



RAVI URBAN DEVELOPMENT AUTHORITY (RUDA)

**CONSTRUCTION OF BRIDGE-III ON RIVER RAVI
AND ACCESS ROADS FROM CB-01 TO RIVER
BANK-TOPAZ AND CONNECTING ROAD FROM
CB-01 TO CB-02**



**ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
REPORT**

April, 2025



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ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT
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LIST OF ABBREVIATIONS

| | |
|----------|--|
| BCP | Buildig Code of Pakistan |
| CDM | Clean Development Mechanism |
| 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 Assessment |
| EMP | Environmental Management Plan |
| EMMM | Environmental Mitigation and Management Matrix |
| EPA | Environmental Protection Agency |
| EP&CCD | Environment Protection and Cliamte Change Department |
| FGDs | Focused Group Discussions |
| GHG | Green house gases |
| GoP | Government of Pakistan |
| GoPb | Government of the 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 |
| POPs | Persistent Organic Pollutants |
| PPE | Personnel Protective Equipment |
| PAPs | Project Affected Persons |
| PEPA | Punjab Environmental Protection Agency |
| QMP | Quarry Management Plan |
| R & D | Research and Development |
| RUDA | Ravi Urban Development Authority |
| RRUDP | River Ravi Urban Development Project |
| SDGs | Sustainable Development Goals |
| STDs | Sexually-Transmitted Diseases |
| SSEMP | Site Specific EMP |
| SOPs | 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 the 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 Bridge 3 and Access Road from CB-01 to River Bank and Connecting Roads from CB-01 to CB-02, Ravi City.

ES-2 LEGAL AND ADMINISTRATIVE 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 Sheikhpura and Lahore, Punjab. The proposed roads are new alignment which includes a 27.5 km long road and a 1 km long bridge. Right of Way (RoW) of the road is 300 ft. No. of Lanes on the road is 4 lanes dual carriageway. The proposed project is expected to be completed within eighteen (18) months. The estimated cost of the construction works of proposed access roads is Rs. 30 Billion.

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 Sheikhpura 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.

The climate of the district Sheikhpura is subjected to extreme variations. From middle of December to middle of March, the air is very damp, cold and receive light to moderate rain fall at intervals. The winter rain is followed by a spell of pleasant weather. In April, the temperature rises fast and the two successive months are very hot. Towards the end of June, Monsoon appears. The average rainfall in the district is about 635 mm.

The River Ravi forms southern boundary of District Sheikhpura. Apart of this major surface water body i.e., River Ravi, Shahdhara Distributary also exist near the proposed access road along Kalakhatai – Narang Mandi Road. The proposed access road crosses this distributary. The groundwater resources are in abundance. The drainage system of the District consists of natural drains.

Ecological Environment:

The access roads are situated in semi-arid region. The landowners 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 aureus*), Squirrel (*Funambulus*), Fox (*Vulpus vulpus*), Rats (*Mus musculus*) and Mongoose (*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.

Agriculture in the study area is predominantly irrigated agriculture through tube wells. The project area depends upon canal system and mostly tube wells, installed in the area for its irrigation, as canal water is not available for all the potential land here. As a result of ground water availability, lush green crops of wheat, sugarcane, maize, fodder and vegetables give a substantial yield. Vegetables grown in the project area and the study area include, Tomato, sweet pepper, Brinjal, Cucumber, Okra, Bitter Gourd, Potato, Turmeric, Ginger, Cabbage, Carrot, Potato, Onion, Radish, Turnip, Peas, Spinach, etc.



Socio-Economic Environment:

The project area falls in District Sheikhpura and Lahore. The population of Sheikhpura District is 3,460,426 with the average annual growth rate of 2.22%. The overall gender ratio is 107.16 indicating approximately 107 males for 100 females. Proportionally 50.5 percent are male while 49.5 percent are females. Total area of Sheikhpura District is 3,030 Sq. Km with population density 1,100 per Sq. Km.

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 million¹, 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 public project will involve procurement of land and will use acquired land too.
- 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 include use of Quieter Equipment, Modification of Existing Old Equipment, Barrier Protection, change in Work Activity Schedule and Maintenance of vehicle/equipment;
- Wastewater will be generated at the construction camps and from construction activities. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as 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);

¹ Pakistan Bureau of Statistics



- 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. 132.15 Million , 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. 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 the 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-III and Access Roads to establish a vital transportation link between the Ravi Riverbank, Chaharbagh Phase-I and Chaharbagh Phase-II, enhancing connectivity between key areas, improving accessibility and supporting future urban development in the region. This document presents the findings of Environmental Impact Assessment (EIA) of Bridge 3 and Access Roads, Ravi City, Lahore.

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.

1.3 NATURE, SIZE AND LOCATION OF THE PROJECT

The proposed Project comprises of a major road spanning 27.5 km in length along with a bridge. The proposed Project falls in administrative jurisdiction of District Lahore and District Sheikhupura of Punjab Province. **Figure 1.1** shows the location map of the proposed project.

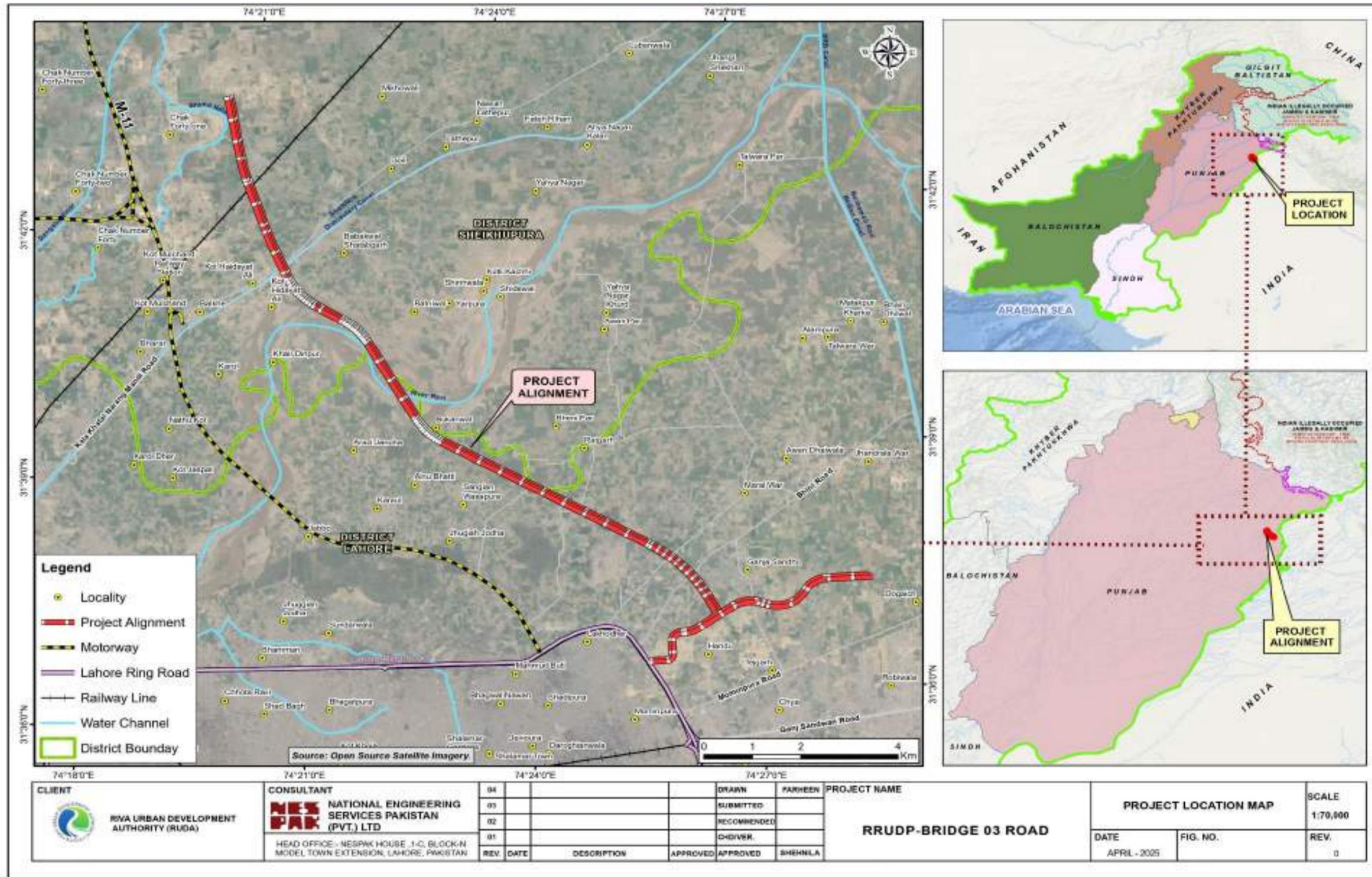


Figure 1.1: Location Map of the Proposed Project



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

Executive Director (Engineering)
Ravi Urban Development Authority (RUDA)
Government of the Punjab
5-C New Muslim Town Facing Canal Road Lahore, Punjab
Tel: +92 42 99233229

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. | Ms. Uzma Iqbal | Acting Head ERSD Section/ Quality Assurance |
| 2. | Ms. Ramla Siddique | Senior Environmental Scientist |



| Sr. No. | Name of Expert | Designation |
|---------|---------------------|--------------------------------|
| 3. | Ms. Shehnila Hanif | Senior Environmental Scientist |
| 4. | Mr. Muhammad Sajjad | Senior Sociologist |
| 5. | Mr. Ibadullah Khan | Senior Ecologist |
| 6. | Ms. Haleema Ayaz | Environmental Scientist |

1.8 APPROACH AND METHODOLOGY

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

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.

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;
- Analysis of Maps and Plans;
- Public Consultations; and
- Environmental Sampling, Testing and Analysis.

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.

Delineation of Corridor of Impact (Col)

Col includes the area in the surroundings of the proposed project receiving direct impacts of project activities. The Col delineated for the proposed project is 50 m each side of the proposed road. Col map is shown as **Figure 1.2**.

Survey of COI

A team of Environmentalists, Ecologist and Sociologist carried out the environmental and social survey of the Col in in December 2024 and January 2025 and 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 Aol was observed. Map showing Aol has been attached as **Figure 1-2**.

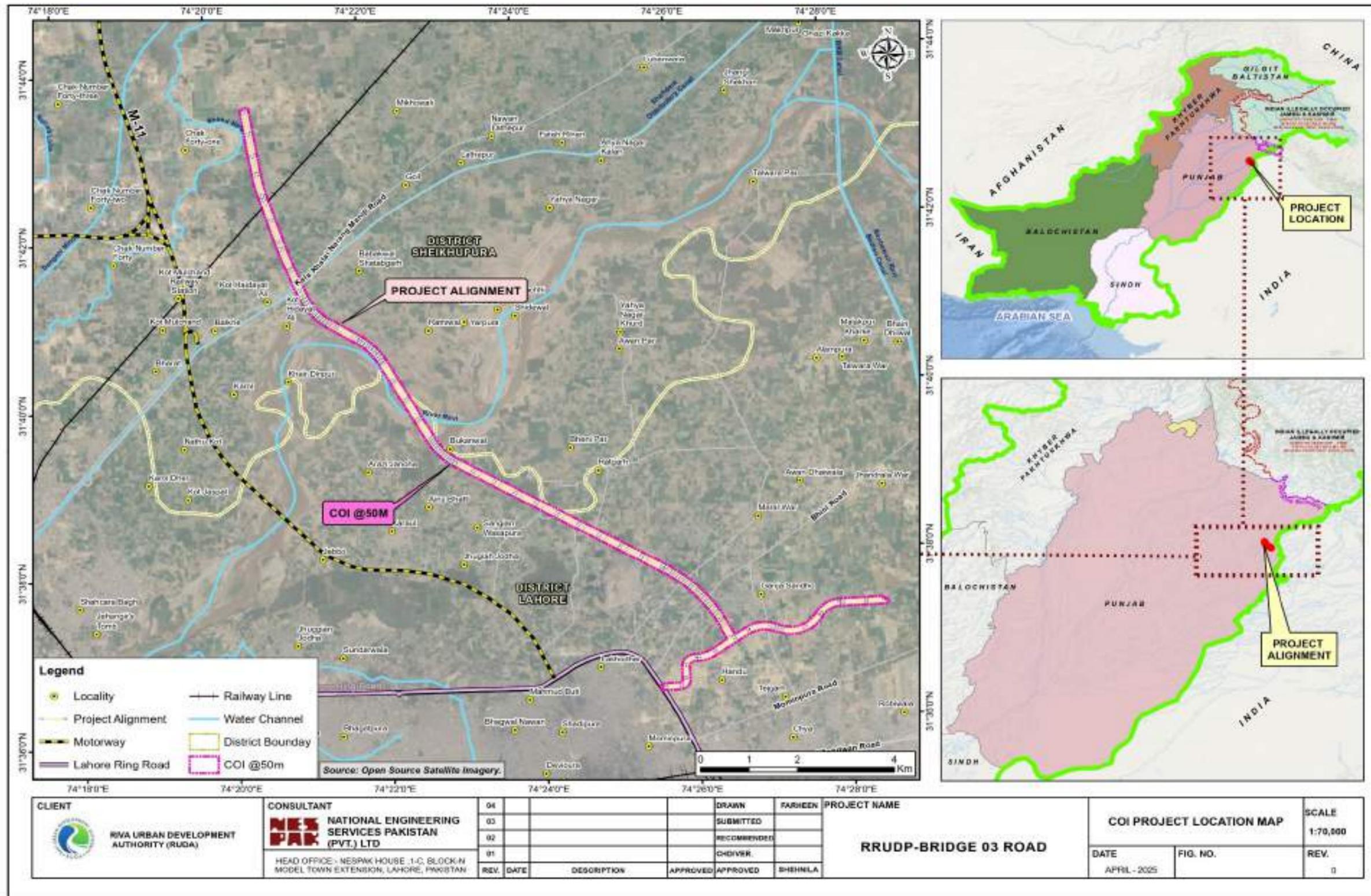


Figure 1.2: Aol Map of the Proposed Project



Environmental Baseline Survey of the Project

Detailed environmental and social survey was carried out within the Aol 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.

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.

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 Project affectees, relevant departments including Punjab Environmental Protection & Climate Change Department (EP&CCD), Punjab Forest and Wildlife Department, Irrigation Department Punjab, Revenue Department, Agricultural Department, Fisheries Department and Parks & Horticulture Authority 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.

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.



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 | <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> | <p>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.</p> <p>This policy and action plan will accelerate due to the possible emissions from the construction machinery and equipment.</p> |
| 4 | National Drinking Water Policy, 2009 | <p>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.</p> | <p>This policy is applicable for the proposed project during construction phase in terms of regular water quality monitoring.</p> |
| 5 | National Water Policy, 2018 | <p>The National Water Policy aims at efficient management and conservation of existing water resources, optimal development of potential water resources, steps to minimize</p> | <p>The core areas that are relevant in the context of the proposed project are drinking water</p> |



| Sr. No. | Policy/Strategy | Brief Coverage | Relevance to Project |
|---------|------------------------------|--|--|
| | | <p>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.</p> | <p>demand, sewage disposal, handling of wastewater.</p> |
| 6 | National Forest Policy, 2015 | <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 | <p>The proposed Project does not involve any national forests, natural habitats and watersheds within its RoW other than the River bed area of Ravi River. Moreover, urban forestry triggers the Policy due to presence of riverside plantation.</p> |



| Sr. No. | Policy/Strategy | Brief Coverage | Relevance to Project |
|---------|---|---|---|
| | | <p>areas, wetlands and wildlife habitats to reduce fragmentation;</p> <ul style="list-style-type: none"> • 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 | <p>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:</p> <ul style="list-style-type: none"> • Legal Framework; • Advocacy: rights of workers and employers; • Skill development and employment; and • Manpower export. | <p>The labour force will be employed for construction of the proposed project. The provision of policy will apply to all the employed laborers.</p> |
| 8 | National Resettlement Policy, 2002 | <p>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).</p> | <p>There are no resettlement issues.</p> |
| 9 | National Disaster Risk Reduction Policy, 2013 | <p>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.</p> <p>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.</p> | <p>This policy will be elicited if any unforeseen natural and man-made disaster occurs during construction and operational phase.</p> |
| 10 | National Action Plan for COVID-19 Pakistan | <p>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-</p> | <p>This Action Plan for COVID-19 is applicable to the proposed project due to COVID outbreak during project</p> |



| Sr. No. | Policy/Strategy | Brief Coverage | Relevance to Project |
|---------|--|---|---|
| | | <p>content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf.</p> <p>The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/.</p> <p>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.</p> | implementation. |
| 11 | Punjab Climate Change Policy (Draft), 2017 | <p>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.</p> <p>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.</p> <p>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.</p> <p>The PCCP also stresses the need for financial resources, technology transfer, and capacity building to achieve its objectives. It recommends creating a</p> | <p>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.</p> <p>This policy will accelerate due to the possible emissions from the construction machinery and equipment.</p> |



| 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) | <p>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:</p> <ul style="list-style-type: none"> • 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 | <p>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. 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.</p> |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|---|---|---|
| | | <p>issue notices and enforce them to protect the environment.</p> <p>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.</p> <p>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.</p> | |
| 2 | Punjab Environmental Protection Agency, (Review of IEE and EIA) Regulations, 2022 | <p>These regulations set out:</p> <ul style="list-style-type: none"> • 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; | <p>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.</p> |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|--|---|---|
| | | <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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 |
|---------|---|--|---|
| | | <p>Reports, Pakistan Environmental Protection Agency, 1997;</p> <ul style="list-style-type: none"> • 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 | <p>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 <i>ibid</i>.</p> <p>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.</p> | 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 | Land Acquisition Act (LAA), 1894 Including Later Amendments | The Land Acquisition Act, 1894, is a "law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition". The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. The land needed for the construction of development projects will be acquired under normal conditions based on prevailing market prices or negotiated prices between client and the owners of land. Section 17(4) of the LAA will not be used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached. | This Act will anticipate if proposed project involves permanent acquisition of land in the project area. However, the Client already procured land on negotiated land acquisition model for the proposed Project. |
| 9 | Punjab Wildlife Act, | The Punjab Wildlife Act (1974) is | The proposed project |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|---|--|---|
| | 1974 | developed for the regulation of activities relating to protection, conservation and management of wildlife in Punjab. | involves the cutting of trees where unavoidable, which will be managed through extensive tree plantation, therefore, the provisions of this law will be helpful. |
| 10 | 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. |
| 11 | Pakistan Antiquities Act 1975 & Punjab Antiquities Amendment Act 2012 | <p>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:</p> <ul style="list-style-type: none"> • “Ancient” is any object that is at least 75 years old; • All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology; • The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise; • All new construction within a distance of 200 feet from protected antiquities is forbidden; • No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and • The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage. | <p>The law will be applicable to the project mainly due to its two provisions:</p> <p>According to the law, any construction activity within 61 m or 200 ft. of protected antiquities, are prohibited.</p> <p>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.</p> |
| 12 | The Punjab Special Premises | The Punjab Special Premises (Preservation), Ordinance (1985) | The provision of the ordinance is applicable for |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|--|---|---|
| | (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. | 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. |
| 13 | Labour Laws as part of Constitution of Pakistan 1973 | <p>The Constitution of Pakistan contains a range of provisions with regards to labour rights, in particular:</p> <ul style="list-style-type: none"> • Article 11 of the Constitution prohibits all forms of slavery, forced labour and child labour; • Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions; • Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and • Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment. <p>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:</p> <ul style="list-style-type: none"> • Contract of Employment; | 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 |
|---------|----------------------------------|---|---|
| | | <ul style="list-style-type: none"> • 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. | |
| 14 | 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. |
| 15 | 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. |
| 16 | Hazardous Substance Rules, 2018 | The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. Inter alia, general safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are described in these rules. Requirements for project waste management plans are also defined. These include a requirement for updating the plan every three years, the need to provide for management of hazardous waste in a manner that will prevent adverse | This rule is applicable to the proposed project which will guide on hazardous waste handling, use and disposal during the construction stage. |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|--|---|---|
| | | environmental impacts and to ensure that hazardous and non-hazardous waste are not mixed. | |
| 17 | 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. |
| 18 | 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. |
| 19 | Punjab Restriction on Employment of Children Act, 2016 | According to the sub-section 11(a) of this Act, an occupier who employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment for a term which may extend to six months, but which shall not be less than seven days, and a mandatory fine between 10,000 and 50,000 rupees. | This Act will restrict the contractor to hire skilled and unskilled labour under age 15. |
| 20 | 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. |
| 21 | Electricity Act, 1910 | The Act provides a legal basis for distribution of Power. It enables a | This Act will restrict the contractor not to cause |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|--|---|---|
| | | 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. | damage during construction of the power facilities. |
| 22 | 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. |
| 23 | 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. |
| 24 | 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. |
| 25 | The Punjab Heritage Foundation Act, 2005 | This act entails preservation, conservation, maintenance and rehabilitation of the Punjab Heritage through various means, including technical or financial assistance and to create awareness among the people for preservation of the Punjab Heritage. | This Act will deal with heritage sites present in and around the proposed project route. There are no heritage sites in the proposed project. |
| 26 | 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 | 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. |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|--|---|--|
| | | 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. | |
| 27 | 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. |
| 28 | 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. |
| 29 | Punjab Irrigation, Drainage and Rivers Act, 2023 | This Act states that all-natural waters in Punjab vest to the Government of Punjab. This Act 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 | This Act is applicable to the proposed Project since there is planned construction along the River Ravi for carrying out the training works of the river and storage of water due to the construction of Barrages/rubber dams and lakes. |



| Sr. No. | Act | Brief Coverage | Relevance to Project |
|---------|--|---|---|
| | | <p>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.</p> | |
| 30 | Punjab Environmental Protection (SMOG Prevention and Control) Rules 2023 | <p>The rules define smog as a type of air pollution caused by the presence of high levels of particulate matter (PM), nitrogen dioxide (NO₂), and ozone (O₃) in the air. The rules identify the main sources of smog, including: Industrial activities, Vehicle emissions, Agricultural burning, 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.</p> | <p>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.</p> |

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; 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 |



| Sr. No | Agreement/Convention | Ratification | Description/Relevance |
|--------|--|---|---|
| | | | 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 11 th December, 1997 at the 3 rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16 th 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 | The UNCCD is a Convention to combat desertification |



| Sr. No | Agreement/Convention | Ratification | Description/Relevance |
|--------|---|---|---|
| | <p>Web Link: https://www.unccd.int/</p> | <p>it on 24 February, 1997</p> | <p>and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.</p> |
| 6 | <p>Stockholm Convention on Persistent Organic Pollutants (POPs), 2004</p> <p>Web Link: https://www.un.org/press/en/2004/unep204.doc.htm</p> | <p>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</p> | <p>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.</p> |
| 7 | <p>Paris Agreement, 2015</p> | <p>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</p> | <p>The implementation of the proposed project will reduce the emission of Greenhouse Gases (GHGs) due to the construction of the proposed project.</p> |



| Sr. No | Agreement/Convention | Ratification | Description/Relevance |
|--------|--------------------------------------|--|--|
| | | finance flows consistent with a low GHG emissions and climate-resilient pathway. | |
| 8 | Sustainable Development Goals (SDGs) | At the Sustainable Development Summit on 25 th September 2015, UN Member States adopted the 2030 Agenda for Sustainable Development, which includes a set of 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030. Pakistan has displayed commendable commitment to the 2030 Agenda for Sustainable Development as it was one of the first countries to endorse it globally in 2015. On 16 th February 2016, the Parliament unanimously approved the Sustainable Development Goals (SDGs) as the national development agenda. | 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 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 |



| Sr. No | Agreement/Convention | Ratification | Description/Relevance |
|--------|----------------------|--------------|-----------------------|
| | | | construction phase. |

2.4 ADMINISTRATIVE FRAMEWORK

2.4.1 RUDA

The implementing Authority 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 project aims to establish a vital transportation link between the Ravi Riverbank and Chahar Bagh Phase-I and Chahar Bagh Phase-II, enhancing connectivity between key areas, improving accessibility and supporting future urban development in the region.

3.3 PROJECT ADMINISTRATIVE JURISDICTION

The proposed Project lies in District Lahore and Sheikhpura, Punjab.

3.4 PROJECT IMPLEMENTATION SCHEDULE

The tentative implementation period for proposed Project is three 18 Months.

3.5 COST OF THE PROJECT

Tentative cost of the proposed Project is about PKR 30 Billion.

3.6 SALIENT FEATURES OF THE PROJECT

The scope of the Project encompasses Four Lane Carriageway Roads with Earthwork & Allied Activities, pedestrian walkways green belts, etc. The Design features of the proposed Project are provided below:

3.7 DESIGN FEATURES

- Length : 27.5 km
- Primary Road RoW : 300 ft
- Proposed RoW : 140 ft
- CB-1 to CB-02 ROW : 220 ft
- Proposed ROW CB-01-02 : 106 ft
- Service Roads : 26 ft
- No. of Bridges : 01

The **typical cross-section** for the **primary road (300 feet RoW)** is designed to accommodate multiple transportation modes efficiently. It features **4-lane carriageways (50**



feet each) for vehicular traffic, flanked by **dedicated Bus Rapid Transit (BRT) lanes** (15 feet each) and a **central green belt (52 feet wide)** housing a mass transit station.

To support local traffic, **26-foot-wide service roads** run parallel to the main carriageways on both sides. Additionally, the design promotes non-motorized transport with **8-foot-wide bicycle lanes** and **6-foot-wide pedestrian walkways** on both sides.

Extensive **green belts (ranging from 6 to 11 feet)** are incorporated. Total length of the road is **22 km**

Each deck consists of multiple 12-foot-wide traffic lanes, including dedicated 15-foot-wide bus lanes to support public transportation. Additionally, 8-foot-wide bicycle lanes and 1'-5" pedestrian walkways on both sides promote non-motorized transport, enhancing accessibility. Shy lanes of varying widths (2' and 3'-1") are also incorporated. Total length of the bridge is 1.8 km. The drainage and sewerage works are also proposed along these roads to cater the need off future trunk infrastructure.

Cross section of Road and bridge is provided as **Figure 3.1** and **Figure 3.2**.

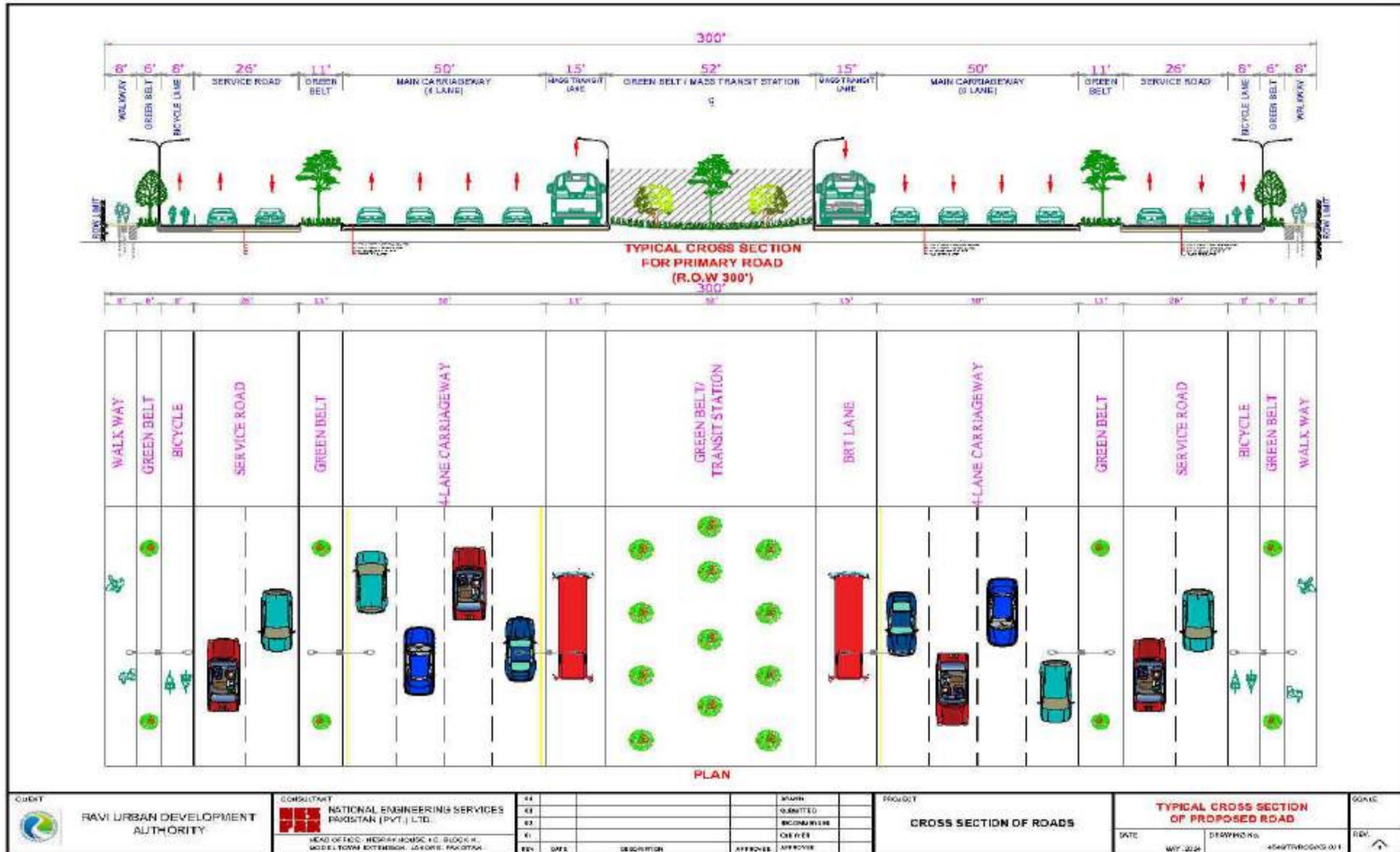


Figure 3.1: Cross section of Primary Road

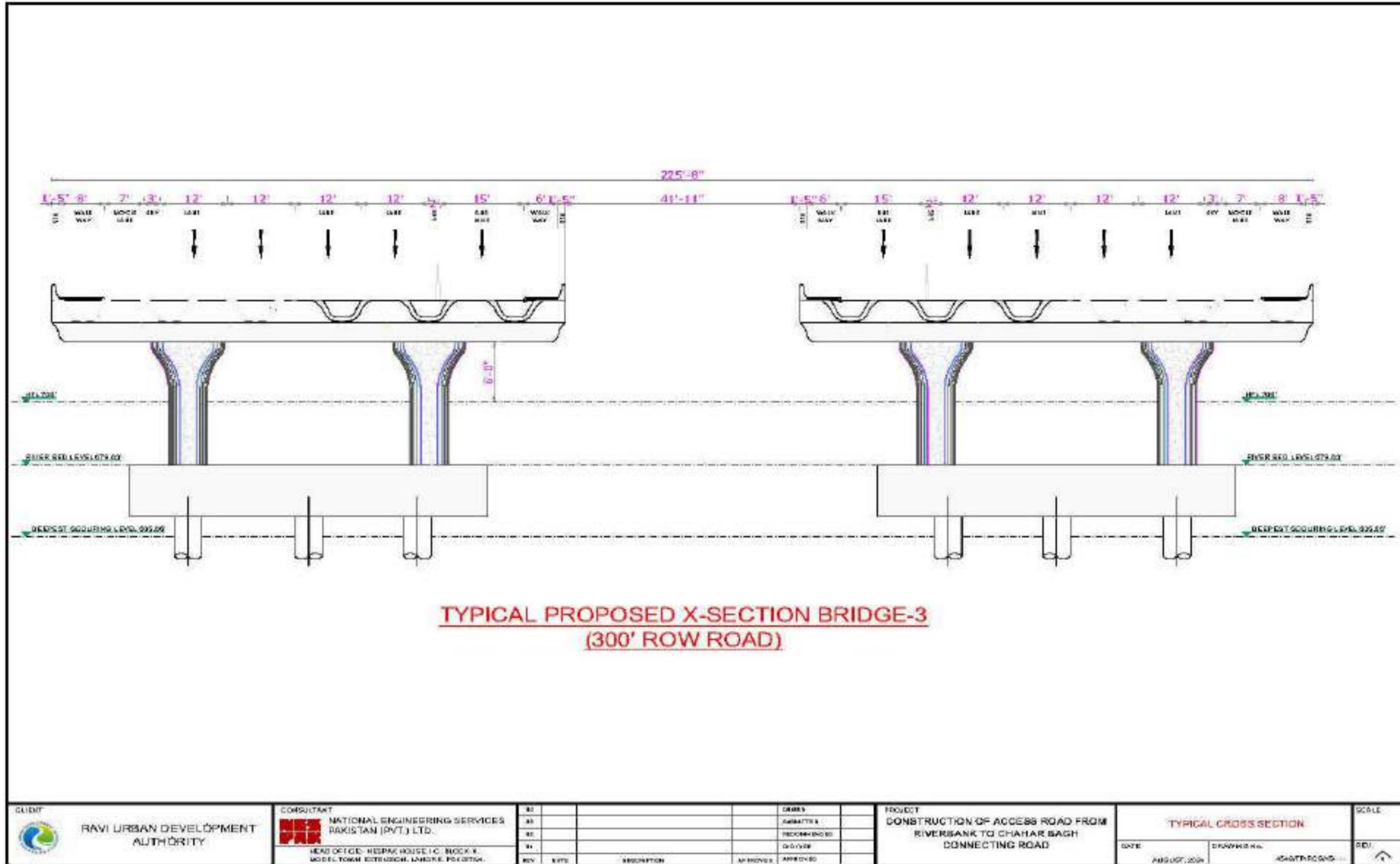


Figure 3.2: Cross section of Bridge-III

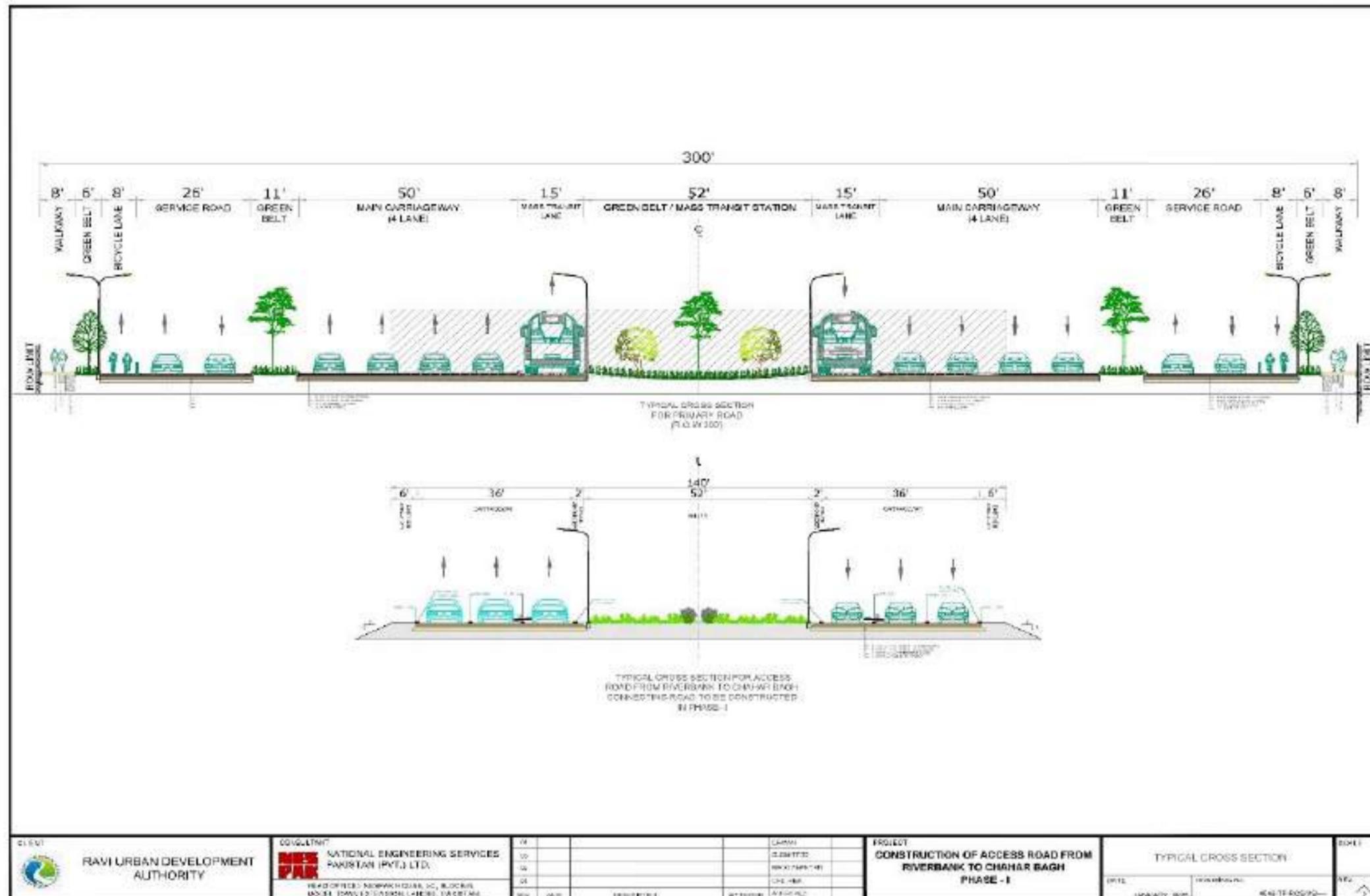


Figure 3.3: Cross section of Riverbank to Chahar bagh connecting Road

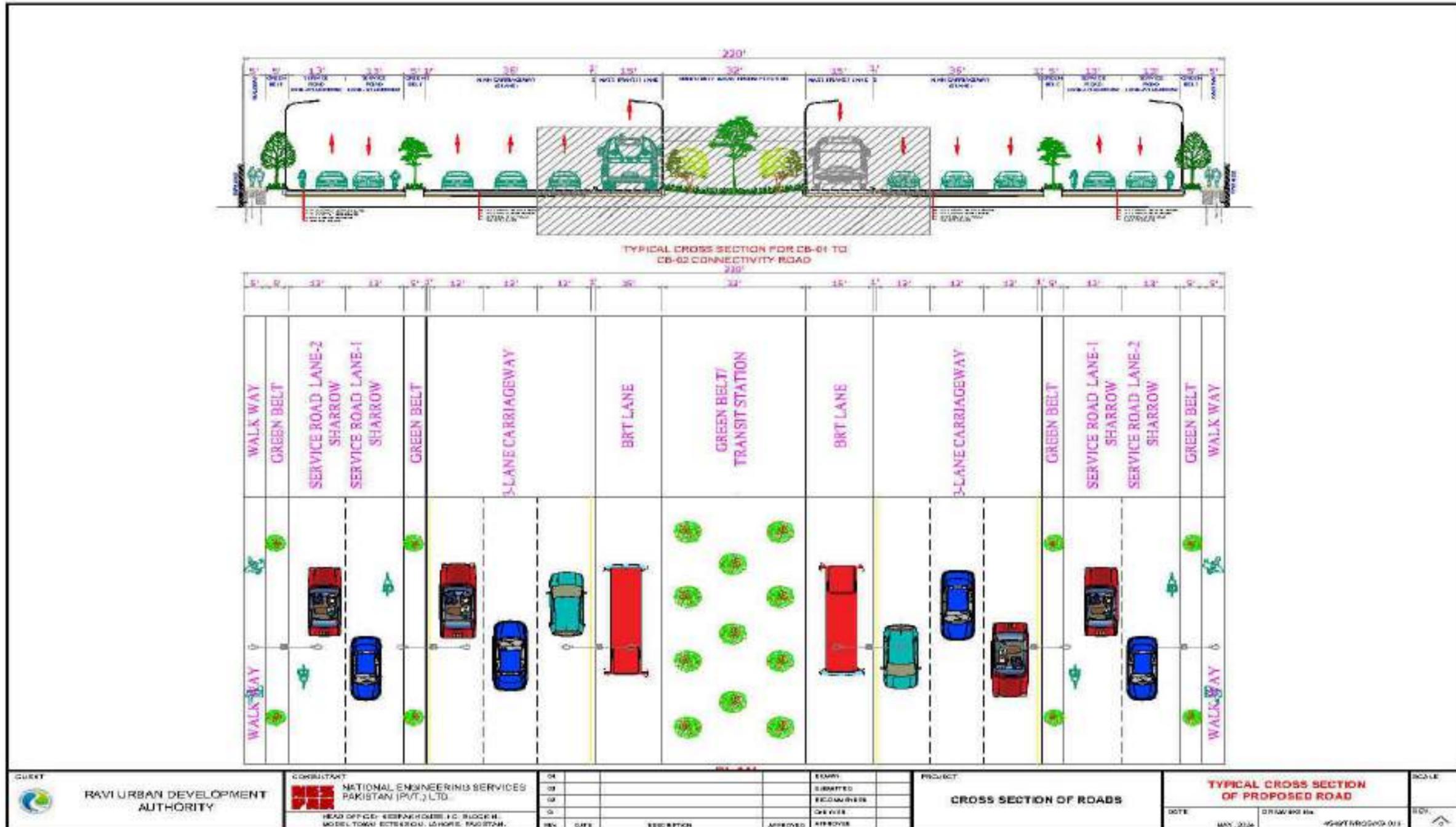


Figure 3.4: Cross section of CB-I to CB-II Road



3.8 CONSTRUCTION ASPECTS

3.9 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.

3.10 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 |

3.11 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.

3.12 WORKFORCE REQUIREMENTS

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

3.13 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.

3.14 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.

3.15 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 Project². Temporary toilets with cesspit will be adequately installed and treated periodically, and after the completion of work, the ground conditions will be restored.

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



3.16 SOLID WASTE

The solid waste generation is estimated to be 60 kg/day for 100 construction workers during construction phase of the proposed Project³.

3.17 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 LESCO.

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

a) Lahore

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.

b) Sheikhpura

District Sheikhpura is located at 35 km from Lahore. The area of the District Sheikhpura is flat and it is a part of Rechna Doab. By topography, the District falls into three main divisions: i) upland or Sandal bar in north-west; ii) the lowland along the River Ravi; iii) The Degh valley in between them. The River Ravi forms southern boundary of the district. The average elevation of the district is 236 m (774 ft) masl. The Topography Map of the Study Area is shown as **Figure 4-1**.

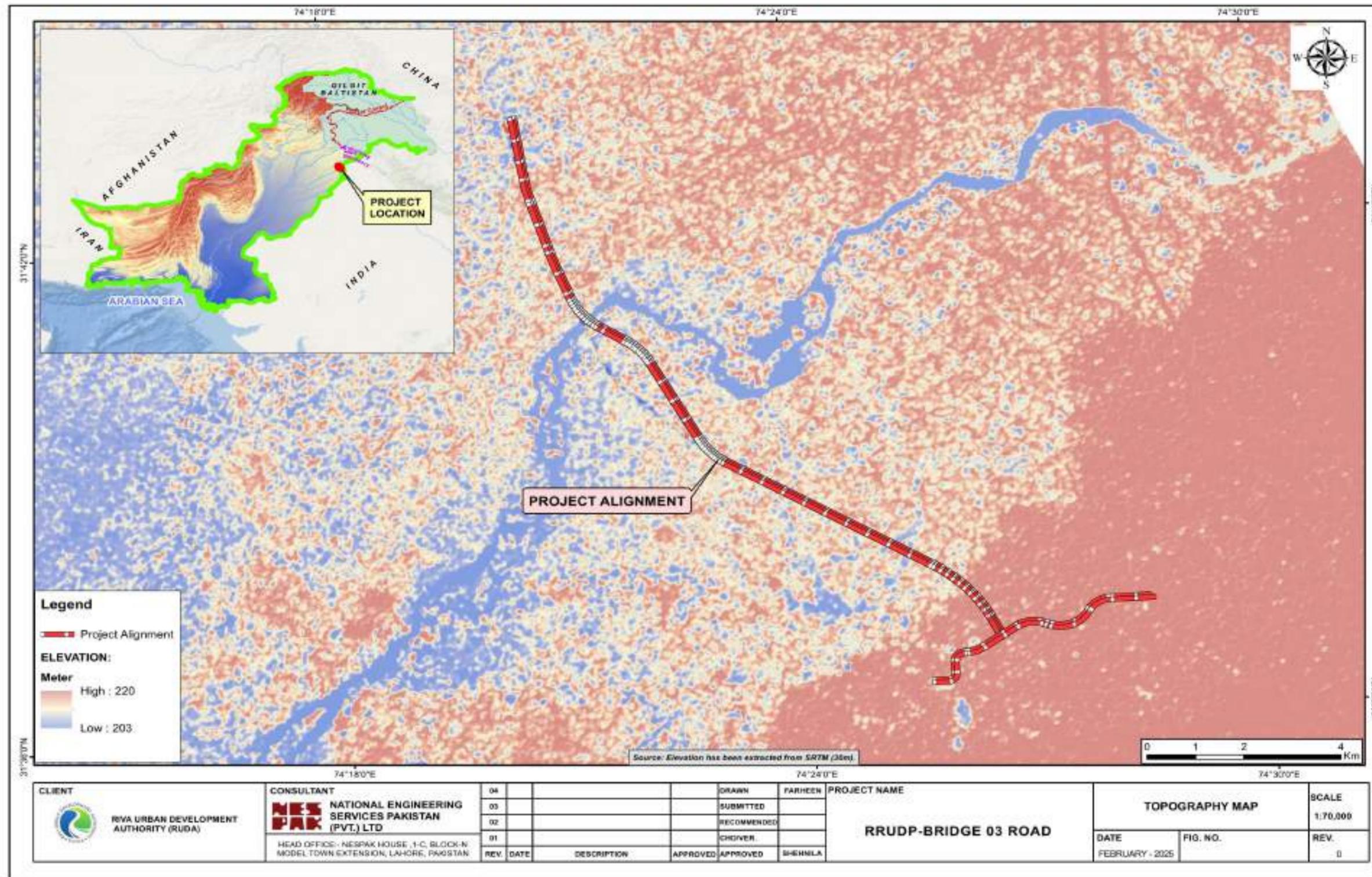


Figure 4.1: Topography Map of the Study Area



4.2.2 Geology

a) Lahore

Lahore city lies on the alluvial plain called Bari Doab⁴. 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 part 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 kankar⁵ 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.

b) Sheikhupura

The project area in District Sheikhupura is located in the upper part of Punjab plain near River Ravi. The area is underlain by thick alluvial deposits consisting of clay, silts and sand deposited by the River Ravi.

The geology of the greater part of the District Sheikhupura is alluvial plain and no rock formation has been found. Sediment deposits are visible in the low velocity area of the river where initial plant colonizers can be seen at the early stages of succession of vegetation. The presence of old channels of Ravi River indicates conformity of the stream oscillation to terrestrial rotation in the deflection of streams. However, abrupt migration indicates period of

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



excessive flooding during which earlier channels were choked with sediments and the streams were forced to create new channels (Kazmi 1964⁶). These alluvial deposits comprise earthy brown to brown silt, clay and sand.

4.2.3 Soil

a) Lahore

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.

b) Shekhupura

The main soil in the Shekhupura District is highly manured artificial soil commonly found around villages. The Rohi is fine dark clay soil. The Dosahi or Missie is fine clay soil. The low land along the River Ravi has light loam. The central portion which is the Deg Valley has stiff soil. Stiff soil is either Rohi or Kallarathi depending on the salt (kallar) contents. There are some old channel levee remnants and old basins filled up with clay materials. The only mineral products of the District are Kankar and Kallar. **Figure 4-3** shows the Soil Map of the Study Area.

⁶ Kazmi, A.H., 1964; *Report on the geology and ground water investigations in Rechna Doab, West Pakistan: Geological Survey of Pakistan, Record 10/3, 26 p.*

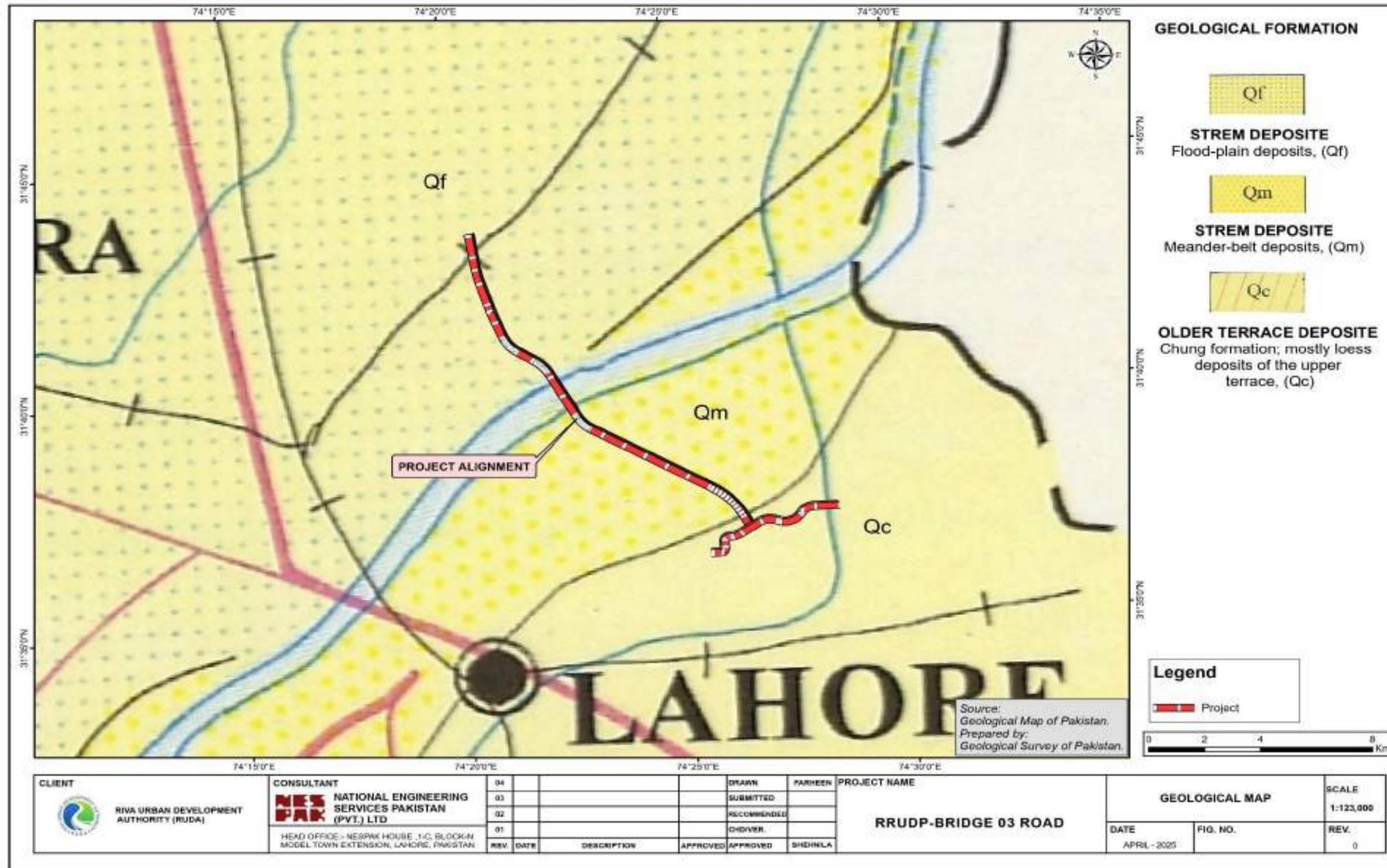


Figure 4.2: Regional Geological Map of the Study Area



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.

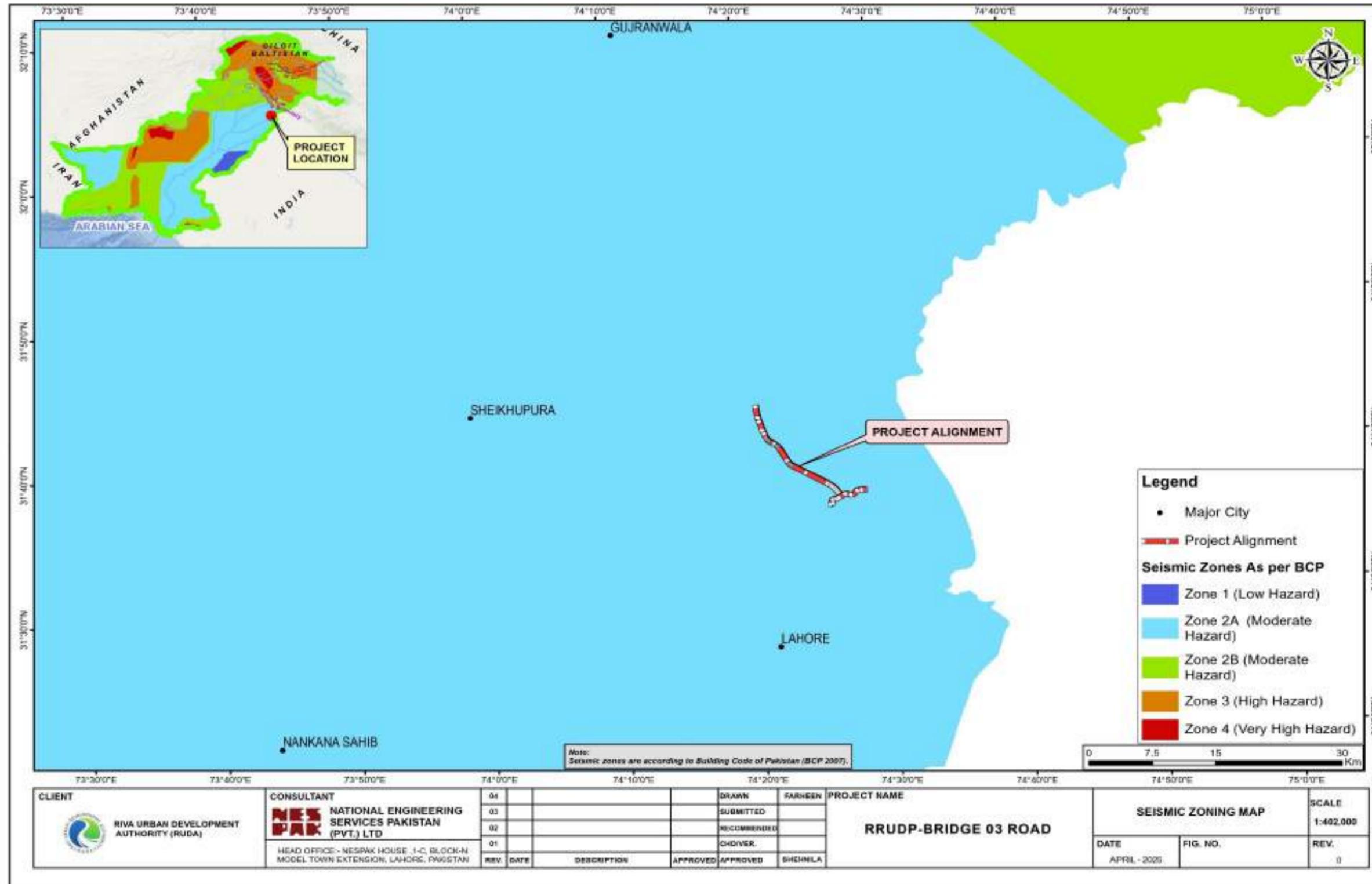


Figure 4.3: Seismic Zone of Project Area

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.

(a) Lahore

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 2010-2024.

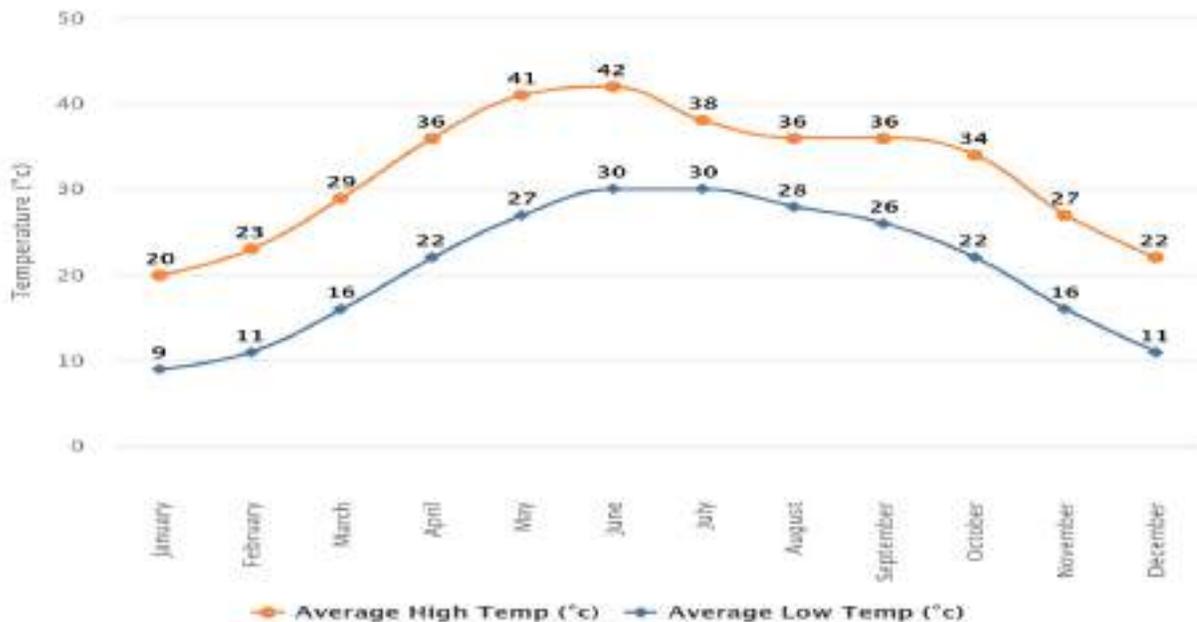


Figure 4.4: Mean Maximum and Minimum Temperature in Lahore (2010-2024)⁷

Precipitation (Rainfall)

Figure 4-5 shows the mean monthly precipitation in the study area for the year 2010-2024.

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

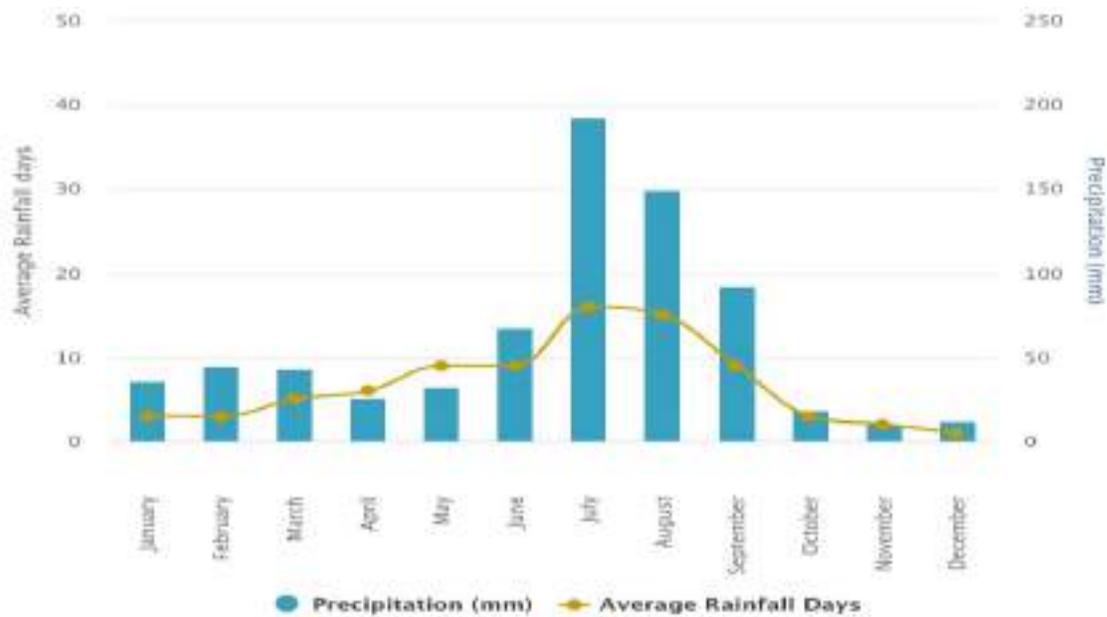


Figure 4.5: Average Rainfall in Lahore (2010-2024)⁸

Relative Humidity

A mean daily data of humidity on a monthly basis from 2010 to 2024 is shown in **Figure 4-6**.

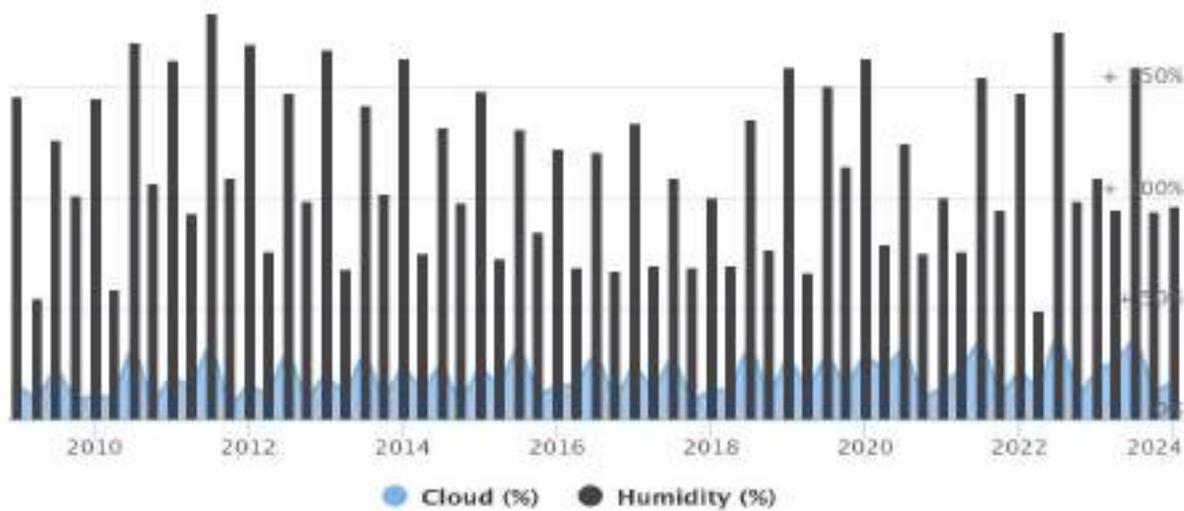


Figure 4.6: Mean Relative Humidity in Lahore (2010-2024)⁹

Wind Speed and Wind Gust

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

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

Figure 4-7 depicts average wind speed on a monthly basis in the study area from year 2010 to 2024.

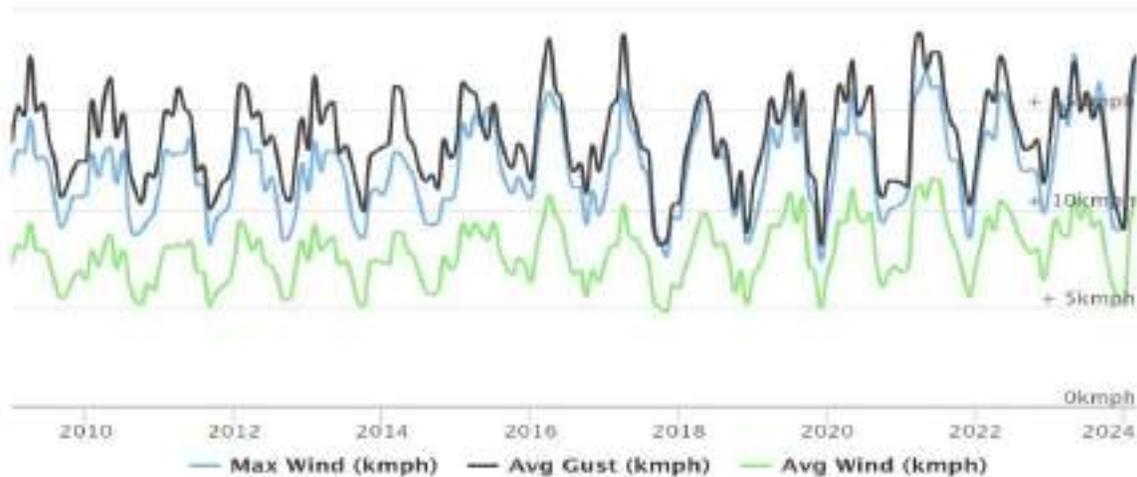


Figure 4.7: Average Wind Speed and Gust in Lahore (2010 to 2024)¹⁰

(b) Sheikhupura

The climate of the district Sheikhupura is subject to extreme variations. It is hot and dry during the summer and moderately cold in the winter. The maximum summer temperature in June is 50 °C, while in winter, during January, the average temperature is 10 °C. From the middle of December to the middle of March, the air is very damp, cold and light to moderate rain falls at intervals. The winter rain is followed by a spell of pleasant weather. The monsoon season usually starts in the middle of July and continues until September. The average rainfall in the district is about 635 mm¹¹. The climatic conditions of district Sheikhupura i.e., Temperature, precipitation, relative humidity and wind speed are shown below.

¹⁰ Source: Lahore Annual Weather Averages - Punjab, PK (worldweatheronline.com)

¹¹ World Weather Online

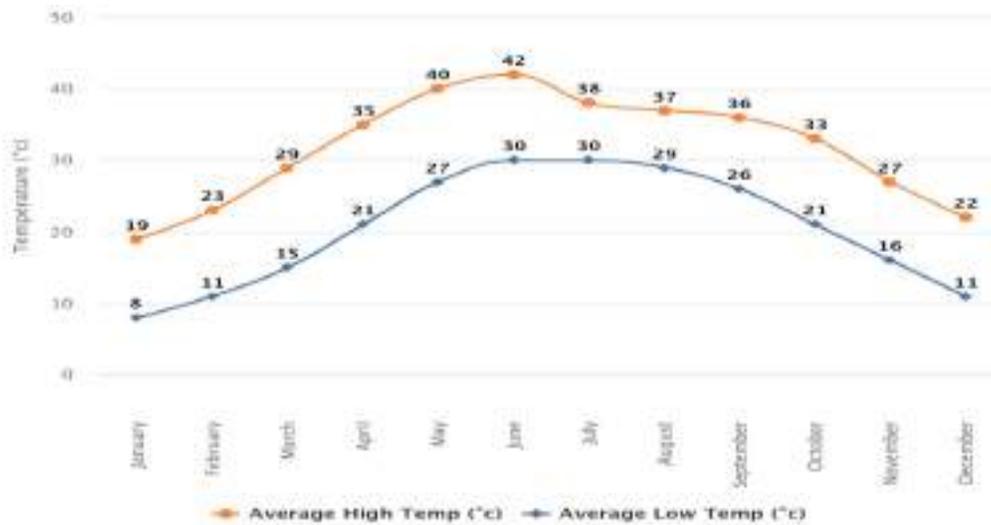


Figure 4.8: Average temperature in Sheikhupura (2010-2024)

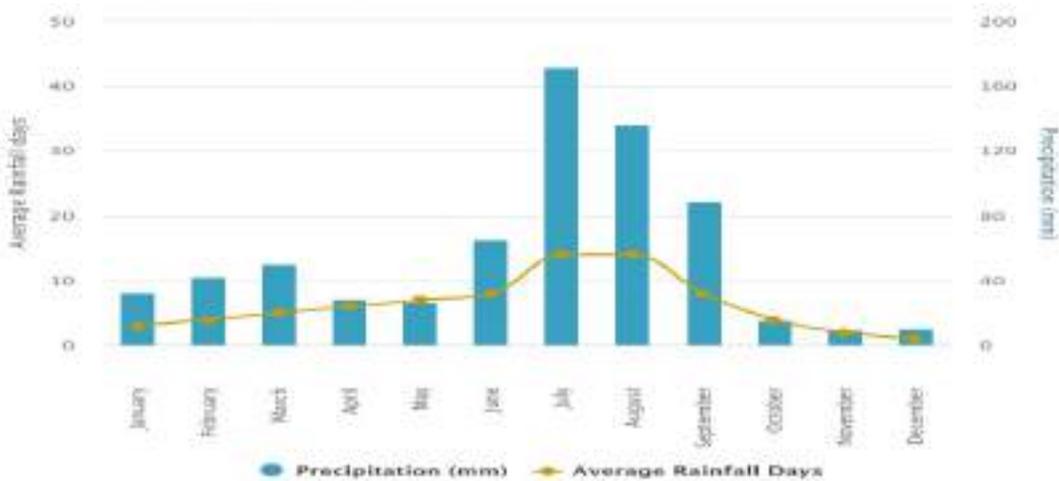


Figure 4.9: Average Rainfall in Sheikhupura (2010-2024)

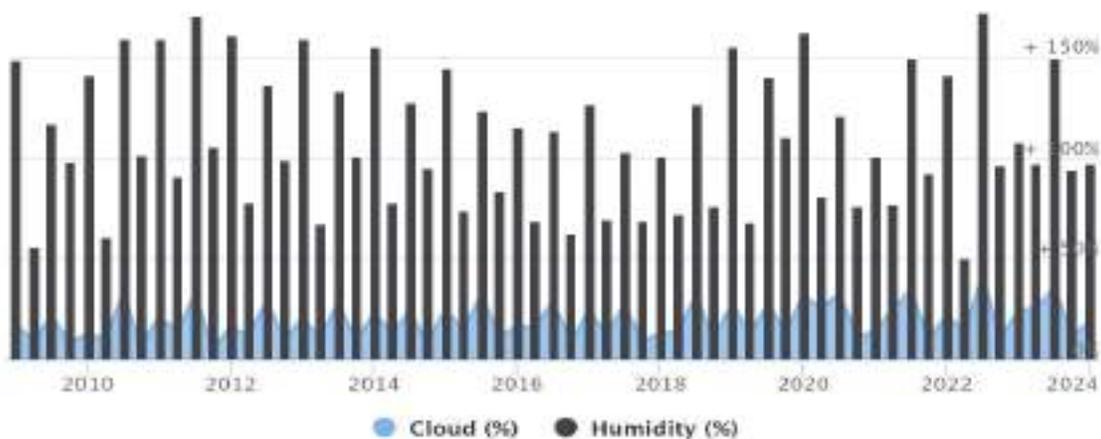


Figure 4.10: Relative Humidity in Sheikhupura (2010-2024)

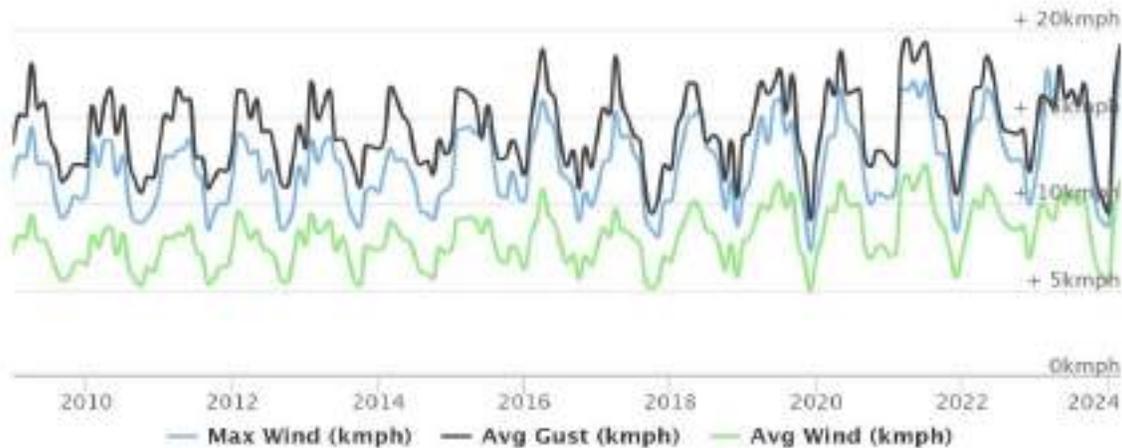


Figure 4.11: Average Wind Speed in Sheikhupura (2010-2024)

4.2.6 Surface Water Hydrology

a) Lahore

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 325¹² respectively.

Lahore Branch Canal

¹² Final Feasibility Study Report on Lahore Water and Wastewater Management Project-February, 2019



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.

b) Sheikhpura

There are two rivers flowing near the district Sheikhpura. The River Ravi forms southern boundary of the Sheikhpura District. Whereas the Chenab River is towards the north western side along the boundary of the district Gujranwala. There is well-established irrigation system in the District. Upper Chenab Canal (UCC) and its distributaries form an irrigation network in the District.

The water body in project area is River Ravi. The slope of the land in planned area is to the south-west, which directs the rivers to flow in this path. Average slope of the area is 0.32 m/km. The most of the discharge that falls in to the River Ravi is of sewage and industrial nature. Due to present conditions, there is high level of contamination in form of organic, inorganic and heavy metals in River Ravi.

Apart from this major surface water body, Shahdara Distributary is also existing along the Kala Khatai – Narang Mandi Road. The surface water hydrology map of the study area is shown in **Figure 4-12**.

4.2.7 Ground Water

a) Lahore

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.¹³

b) Sheikhpura

The groundwater resources in district Sheikhpura are in abundance in the form of groundwater aquifer. Groundwater for drinking purposes is extracted from a depth of 120-200 meters (m). It is pumped for irrigation, domestic, industrial and commercial purposes.

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.

The drainage system of the District Sheikhpura consists of natural drains. Bhed Nullah, Lila Nullah, Degh Nullah, Niki Degh and Chicho Ki Malian Drain are the major natural drains of the district, among them Degh Nullah is the main and the biggest drain.

The Bheed Drain is flowing near the project area in which minor drains falls. **Figure 4-12** shows the major drains in the study area.

¹³ https://wasa.punjab.gov.pk/infodesk_watersupply

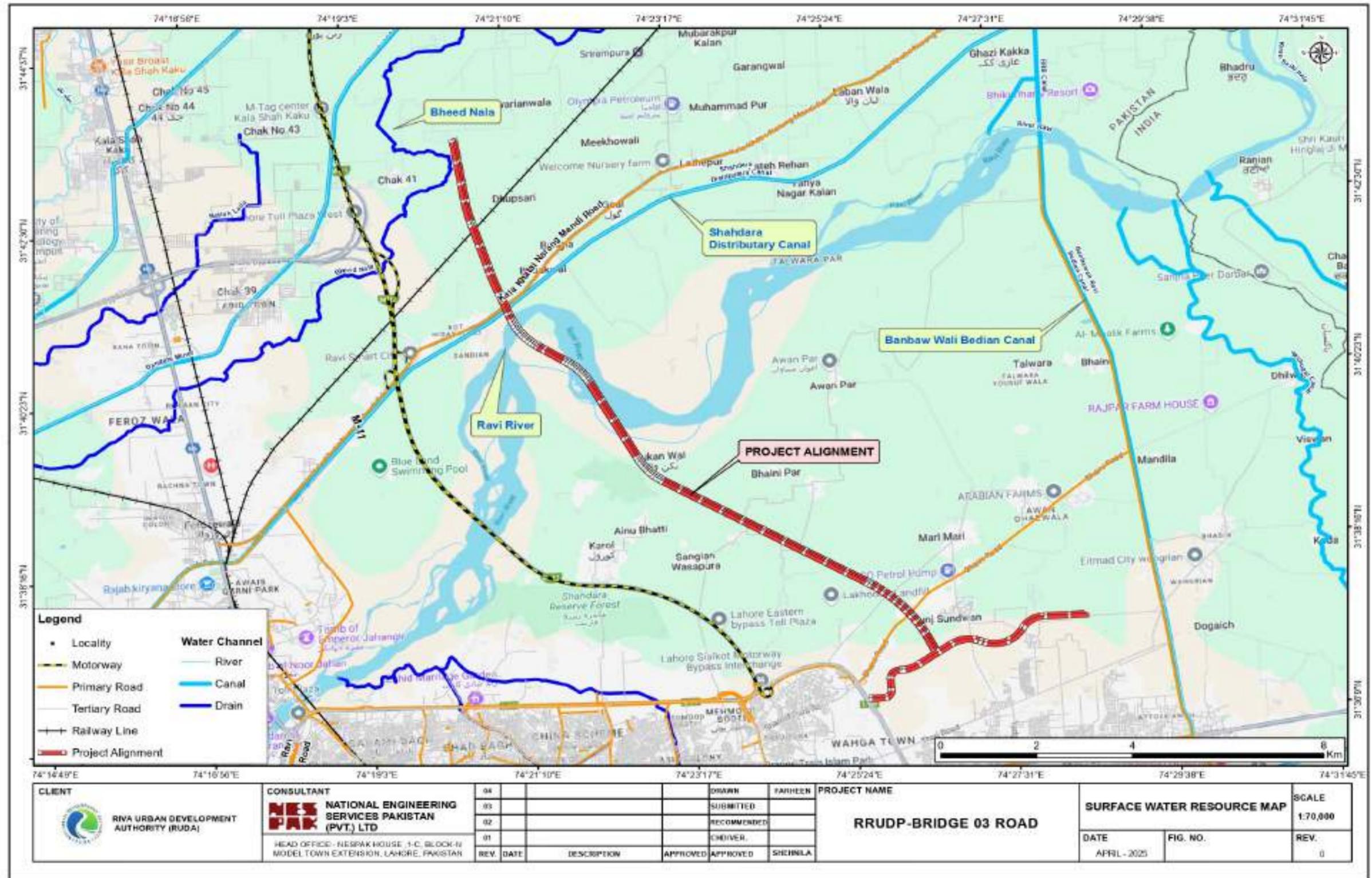


Figure 4.12: Surface Water Resources Map of the Study Area



4.2.9 Floods

Floods in the Lahore and Sheikhpura Districts take place due to heavy rains in the monsoon season causing serious damage to life and property. Recent events were recorded in 2014. A disaster relief control center has also been established to control the emergency situation. The control center remains updated with the latest information regarding the disaster situation of the district and immediately disseminates it to the relief agencies.

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 cumecs¹⁴. 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.

Lahore had been subjected to extreme floods in past due to high discharge in Ravi River during monsoon season. The flood of 1955 is the second highest on record flood for the Ravi River, with peak discharges of 14,932 cumecs at Shahdara. It breached flood embankments of the Bambanwala–Ravi–Bedian–Dipalpur Link Canal, upstream from Ravi Siphon, and at Shahdara Bridge. The Punjab Irrigation Department estimated that flood discharges of 7,334 m³/s passed through the breaches at Ravi Siphon and 8,495 m³/s through the breaches at Shahdara Bridge. The flood of 1988, with magnitude of 16,309 cumecs (575,941 cusecs) at Shahdara, was the worst flood of 20th century to hit Lahore City.

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

a) Lahore

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

¹⁴ '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



- 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/day¹⁵.

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.

b) Sheikhupura

Sheikhupura currently generates about 205 tons of municipal solid waste daily, and is estimated to have a yearly generation of 74,869 tons. Estimated solid waste generation rate in the study area is about 2033 using 0.531 kg/capita/day¹⁶.

The primary collection is accomplished by sanitary workers those carry out sweeping of streets and roads and collect the solid waste from small heaps with the help of brooms, wheel barrows etc. and store at permanent and temporary collection points. 40% of localities in Sheikhupura are fully served, 40% partially served, while 20% are not served. 20% roads in the city are being manually swept daily. Town Municipal Administration (TMA) is responsible for solid waste management in the Districts.

¹⁵ <https://www.lwmc.com.pk/uc-plan.php>

¹⁶ *Situation Analysis Report for Integrated Solid Waste Management (ISWM) In Sheikhupura, (2013).*

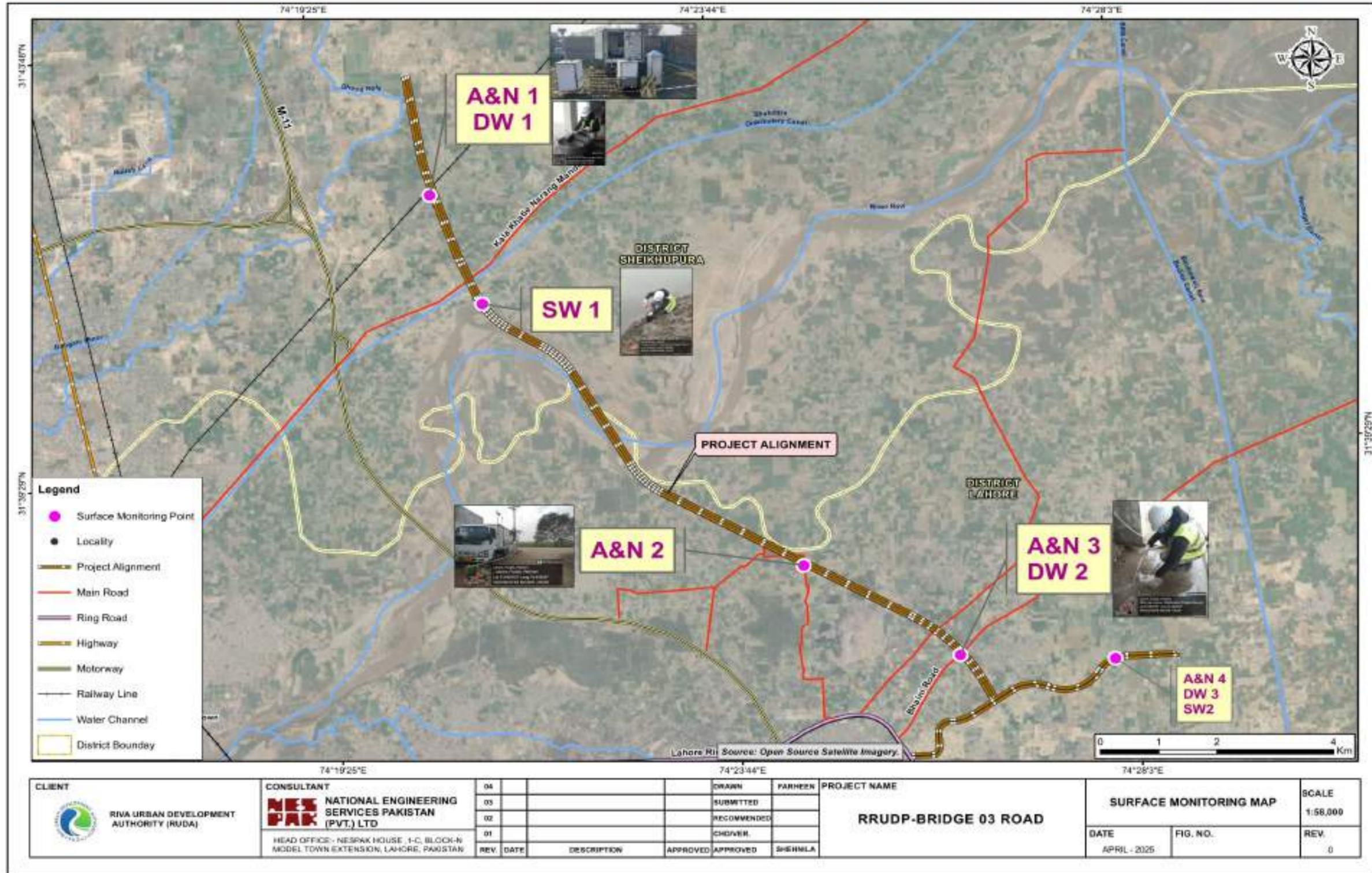


Figure 4.13: Sampling Location Map of Environmental Monitoring



4.2.11 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.

Air Quality

The ambient air quality monitoring for Nitrogen Dioxide (NO₂), Nitrogen Oxide (NO), Sulfur Dioxide (SO₂), Carbon Monoxide (CO), Ozone (O₃), Particulate Matter (PM_{2.5}), Particulate Matter (PM₁₀) and Suspended Particulate Matter (SPM) was carried out at Project Site. The sampling was conducted for 24 hours duration for NO₂, NO, SO₂, PM_{2.5}, PM₁₀ and SPM, 1 hour for O₃ 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 | A&N 3 | A&N 4 | |
| Carbon Monoxide (CO) | 1.7 µg/m ³ | 1.3 mg/m | 2.1 mg/m ³ | 1.12 mg/m ³ | 5mg/m ³ (8 hours) |
| Sulfur Dioxide (SO ₂) | 9.9 µg/m ³ | 8.3 µg/m ³ | 10.4 µg/m ³ | 19.34 µg/m ³ | 120µg/m ³ |
| Ozone (O ₃) | 37.5 µg/m ³ | 39.5 µg/m ³ | 24.9 µg/m ³ | 18.99 µg/m ³ | 130 µg/m ³ (1 Hour) |
| Oxides of Nitrogen as NO | 15.0 µg/m ³ | 13.1 µg/m ³ | 12.3 µg/m ³ | 14.35 µg/m ³ | 40 µg/m ³ |
| Oxides of Nitrogen as NO ₂ | 20.9 µg/m ³ | 23.1 µg/m ³ | 24.5 µg/m ³ | 22.34 µg/m ³ | 80 µg/m ³ |
| Particulate Matter PM _{2.5} * | 234 µg/m³ | 393 µg/m³ | 190 µg/m³ | 30.70 µg/m ³ | 35 µg/m ³ |
| Particulate Matter PM ₁₀ * | 427 µg/m³ | 469 µg/m³ | 375 µg/m³ | 133.46 µg/m ³ | 150 µg/m ³ |
| Suspended Particulate Matter (SPM)* | 786 µg/m³ | 741 µg/m³ | 800 µg/m³ | 199.16 µg/m ³ | 500 µg/m ³ |
| Lead (Pb) | 0.05 µg/m ³ | 0.07 µg/m ³ | 0.03 µg/m ³ | 0.18 µg/m ³ | 1.5 µg/m ³ |

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

The analysis of pollutant concentrations indicates that all parameters, including Carbon Monoxide (CO₂), Sulfur Dioxide (SO₂), Ozone (O₃), Oxides of Nitrogen (NO & NO₂), and Lead (Pb), are within the permissible limits set by PEQS. However, Particulate Matter (PM_{2.5}, PM₁₀, and Suspended Particulate Matter - SPM) significantly exceed the PEQS limits, raising serious concerns about air quality.

Noise Level



Noise level monitoring was carried out in the study area. The average concentrations of noise level are given in **Table 4-3**.

Table 4-2: Average Concentration of Noise Level

| Averaging Time | PEQS | Unit | Average Value in dB (A) | | | |
|----------------|-----------------|--------|-------------------------|-------|-------|-------|
| | Commercial Area | | A&N 1 | A&N 2 | A&N 3 | A&N 4 |
| Day-time | 65 | db (A) | 58 | 68 | 68 | 52.80 |
| Night-time | 55 | | 52 | 57 | 59 | 44.93 |

The above results show that the average noise values at day time are within the permissible limits of PEQS in the Study Area except night time values at Location A&N 2 and A&N 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) | | | PEQS |
|---------|---------------------------------------|------|-----------------------------|------------|------------|---|
| | | | Location 1 | Location 2 | Location 3 | |
| 1. | Total Coliform | - | Detected | ND | ND | Must not be detectable in any 100 mL sample |
| 2. | Fecal Coliform Bacteria | - | Detected | ND | ND | Must not be detectable in any 100 mL Sample |
| 3. | E. Coli | - | ND | ND | ND | Must not be detectable in any 100 mL Sample |
| 4. | Taste | -- | Unacceptable | Acceptable | Acceptable | Non-Objectionable / Acceptable |
| 5. | Odor | -- | Acceptable | Acceptable | Acceptable | Non-Objectionable / Acceptable |
| 6. | pH* | -- | 7.6 | 7.8 | 6.91 | 6.5-8.5 |
| 7. | Turbidity | NTU | 7.8 | 0.6 | <0.1 | <5 NTU |
| 8. | Color | TCU | ND | ND | <1.0 | ≤15 TCU |
| 9. | Total Dissolved Solids (TDS)* | mg/l | 1205 | 567 | 619.0 | <1000 mg/L |
| 10. | Total Hardness as CaCO ₃ * | mg/l | 298 | 196 | 344.0 | <500 mg/L |
| 11. | Residual | mg/l | ND | ND | <0.1 | 0.2-0.5 mg/L |



| Sr. No. | Parameter | Unit | Test Results (Ground Water) | | | PEQS |
|---------|---|------|-----------------------------|------------|------------|-------------|
| | | | Location 1 | Location 2 | Location 3 | |
| | Chlorine | | | | | |
| 12. | Chloride (as Cl ⁻)* | mg/l | 168 | 38 | 9.78 | <250 mg/L |
| 13. | Fluoride (F ⁻)* | mg/l | 0.6 | 0.2 | <0.01 | ≤1.5 mg/L |
| 14. | Cyanide (CN ⁻) | mg/l | ND | ND | | ≤0.05 mg/L |
| 15. | Nitrate (NO ₃ ⁻) | mg/l | 0.5 | ND | 4.8 | ≤50 mg/L |
| 16. | Nitrite (NO ₂ ⁻) | mg/l | ND | ND | <0.01 | ≤3 mg/L |
| 17. | Phenolic Compounds (as Phenols) | mg/l | ND | ND | <0.01 | NGVS |
| 18. | Aluminum (Al) | mg/l | ND | ND | <0.028 | ≤0.2 mg/L |
| 19. | Antimony (Sb) | mg/l | ND | ND | ND | ≤0.005 mg/L |
| 20. | Arsenic (As) | mg/l | ND | ND | <0.01 | ≤0.05 mg/L |
| 21. | Barium (Ba) | mg/l | ND | ND | <0.031 | 0.7 mg/L |
| 22. | Boron (B) | mg/l | ND | ND | <0.1 | 0.3 mg/L |
| 23. | Cadmium (Cd) | mg/l | ND | ND | <0.0028 | 0.01 mg/L |
| 24. | Chromium (Cr) | mg/l | ND | ND | <0.0054 | ≤0.05 mg/L |
| 25. | Copper (Cu) | mg/l | ND | ND | <0.0045 | 2.0 mg/L |
| 26. | Lead (Pb) | mg/l | ND | ND | <0.013 | ≤0.05 mg/L |
| 27. | Manganese (Mn) | mg/l | ND | ND | <0.0016 | ≤0.5 mg/L |
| 28. | Mercury (Hg) | mg/l | ND | ND | <0.0008 | ≤0.001 mg/L |
| 29. | Nickel (Ni) | mg/l | ND | ND | <0.008 | ≤0.02 mg/L |
| 30. | Selenium (Se) | mg/l | ND | ND | ND | 0.01 mg/L |
| 31. | Zinc (Zn) | mg/l | ND | ND | <0.0033 | 5.0 mg/L |

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. However, value of turbidity in sample number DW1 exceeding the permissible limits of PEQS.

Surface Water /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 |
|---------|---|-----------------|-----------------|------|
| | | Location 1 (SW) | Location 2 (WW) | |
| 1. | pH | 8.2 | 7.92 | 6-9 |
| 2. | Biochemical Oxygen Demand (BOD ₅) | <2 mg/l | 71 | 80 |
| 3. | Chemical Oxygen Demand (COD) | <3 mg/l | 204 | 150 |
| 4. | Total Suspended Solids (TSS) | 13 mg/l | 58 | 200 |
| 5. | Total Dissolved Solids (TDS) | 218 mg/l | 1648 | 1000 |
| 6. | Phenolic Compounds (as Phenols) | ND | <0.01 | 0.1 |
| 7. | Grease and Oil | ND | <0.2 | 10 |
| 8. | Chloride (Cl ⁻) | 10 mg/l | 172.28 | 1000 |
| 9. | Fluoride (F ⁻) | 0.3 mg/l | <0.01 | 10 |
| 10. | Cyanide (CN ⁻) | ND | <0.01 | 1.0 |
| 11. | An-ionic Detergents (as MBAs) | ND | - | 20 |
| 12. | Sulfate (SO ₄ ²⁻) | 178 mg/l | 211.56 | 600 |
| 13. | Sulfide (S ²⁻) | ND | <0.2 | 1.0 |
| 14. | Ammonia (NH ₃) | ND | 2.3 | 40 |
| 15. | Cadmium (Cd) | ND | <0.0028 | 0.1 |
| 16. | Chromium (Cr) | ND | 0.03 | 1.0 |
| 17. | Copper (Cu) | ND | <0.0045 | 1.0 |
| 18. | Lead (Pb) | ND | 0.013 | 0.5 |
| 19. | Mercury (Hg) | ND | 0.0008 | 0.01 |
| 20. | Selenium (Se) | ND | ND | 0.5 |
| 21. | Nickel (Ni) | ND | 0.05 | 1.0 |
| 22. | Silver (Ag) | ND | 0.06 | 1.0 |
| 23. | Total Toxic Metals | ND | 0.15 | 2.0 |
| 24. | Zinc (Zn) | ND | 0.078 | 5.0 |
| 25. | Arsenic (As) | ND | <0.01 | 1.0 |
| 26. | Barium (Ba) | ND | <0.031 | 1.5 |
| 27. | Iron (Fe) | 0.4 mg/l | 0.55 | 8.0 |
| 28. | Manganese (Mn) | ND | 0.23 | 1.5 |

| Sr. No. | Parameter | Test Results | | PEQS |
|---------|--------------------------------------|-----------------|-----------------|------|
| | | Location 1 (SW) | Location 2 (WW) | |
| 29. | Boron (B) | ND | <0.1 | 6.0 |
| 30. | Residual Chlorine (Cl ₂) | ND | - | 1.0 |
| 31. | Temperature | 19.2 °C | 1.6 | NGVS |

It is evident from the monitoring results that all the parameters are well within prescribed limits of the PEQS, 2016.

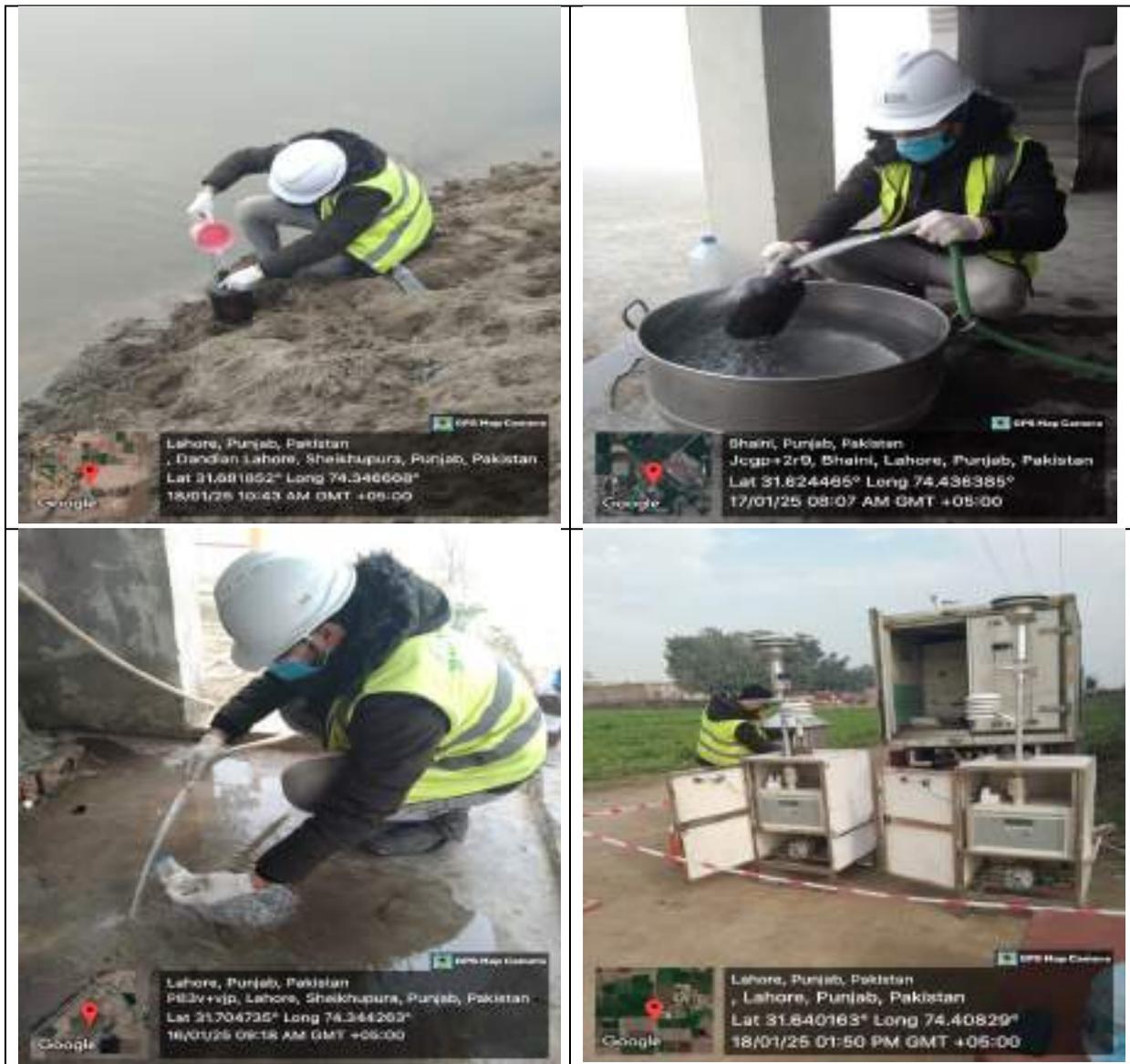




Plate 4-2: A view of Monitoring at Project Site

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

4.2.12 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 4-6**. Pictorial view of land use is given in **Plate 4-2**. Detailed landuse maps have been shown in the **Annex-II**.

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

| Sr. No. | Landuse Type | Area (acres) |
|---------|--------------------------------|--------------|
| 1 | Agriculture | 356.11 |
| 2 | Builtup | 9.03 |
| 3 | Canal | 0.74 |
| 4 | Drain | 3.35 |
| 5 | Forest | 1.25 |
| 6 | Railway Track | 0.75 |
| 7 | River | 47.01 |
| 8 | Road | 5.01 |
| 9 | Vacant/Open Space/ Barren Land | 32.01 |



Bhaini Road



Livestock in near Bhukan Wal



River Ravi



Ainnu Bhatti Forest



Agriculture Field



Railway Track



Fish farm



Islamabad Village

Plate 4-2: Landuse of the Study Area

4.2.13 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 4-16**. Pictorial view of the sensitive receptors is given in **Plate 4-3**.



Mosque on Dera



Ainnu Bhatti Forest



Government Boys High School Babakwal



River Ravi

Plate 4-3: Sensitive Receptors in the Study Area

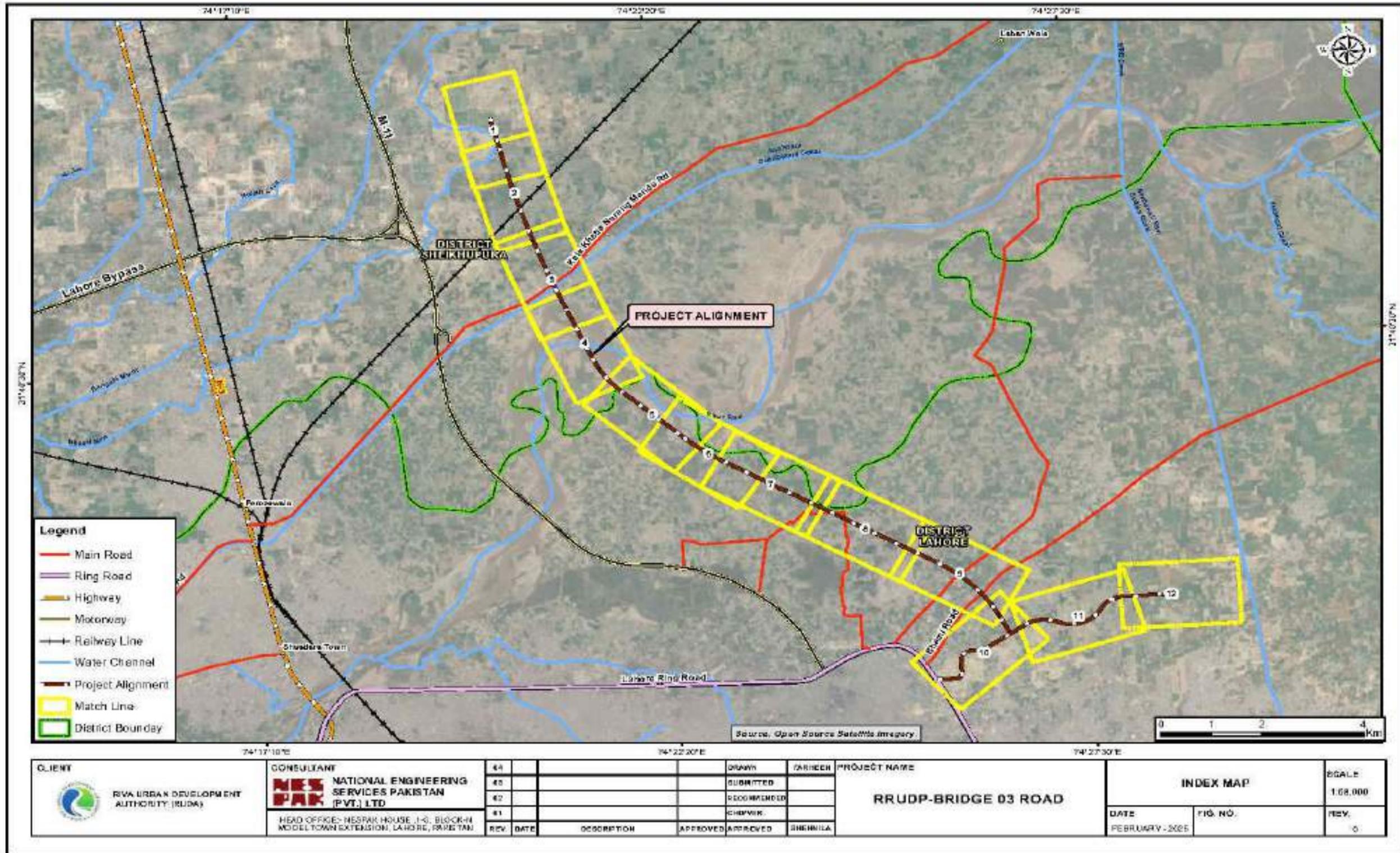


Figure 4.14: Land Use Map of the Study Area



4.3 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.

Flora

The Project area is dominated by barren and agricultural land use, in combination with a few scattered trees, where vegetables are also grown by locals. The soil shows that the vegetation of the Project area shows that it is suitable for the agriculture and plantation of native species along the agricultural fields.

The local farmers have also raised trees like Shisham or Tahli (*Dalbergia sissoo*), Kikar (*Acacia Nilotica*), Jamun(*Syzygium cumini*) Beri (*Zizyphus spp*) Thoot (*Morus alba*), Dherek (*Melia azedarach*), etc. along the boundaries of their agricultural fields. Pipal (*Ficus religiosa*) are grown for shade in their houses or eras

a) Annu Bhatti Protected Forest

Ecologically, the region falls under the Tropical Thorn Forest Zone. These are low, open and pronouncedly xerophytic forests in which thorny leguminous species predominate. This type occupies the whole of the Indus Plain except the driest parts. Vegetation of the area shows that it is suitable for the plantation of native species in forest and along the agriculture fields. Variation in diversity is caused due to climate, heterogeneity, biotic interaction and habitat. In the past, the area was covered with huge amount of ground vegetation/flora now the conditions are at the adverse side because the original or natural habitat has been modified and converted into degraded. This particular area has been accessible to humans for a long time resulting in low diversity and wildlife abundance

There is no considerable number of fruit trees found in the study area but generally, fruit trees are mostly raised at the deras or residences of the local landowners. Common trees found in the area are given in **Table 4-7**.

Table 4-7: Major Tree species in the Study Area

| Sr. No. | Common Name | Scientific Name |
|---------|-------------|---------------------------------------|
| 1. | Eucalyptus | <i>Eucalyptus camaldulensis</i> |
| 2. | Dherek | <i>Melia azedarach</i> |
| 3. | Kikar | <i>Acacia Nilotica</i> |
| 4. | Bairy | <i>zizyphus mauritiana/nummularia</i> |
| 5. | Bhor | <i>Ficus benghalensis</i> |
| 6. | Pipal | <i>Ficus religiosa</i> |

| Sr. No. | Common Name | Scientific Name |
|---------|----------------|--------------------------------|
| 7. | Shisham | <i>Dalbergia sissoo</i> |
| 8. | Paper Mulberry | <i>Broussonetia papyrifera</i> |
| 9. | White Mulberry | <i>Morus alba</i> |
| 10. | Jamun | <i>Syzygium cumini</i> |

b) Shrubs and Herbs

The Project area is not having large variety of the shrubs and herbs but some common species found in the study area are Jawan (*Alhaji maurorum*), Bhakra (*Tribulus terrestris*), Aak (*Calotropis procera*), a list of shrubs and herbs found in the study Area is given in **Table 4-8**.

Table 4-8: Shrubs and Herbs in the Study Area

| Sr. No. | Common Name | Scientific Name |
|---------|-------------|----------------------------|
| 1. | AaK | <i>Calotropis procera</i> |
| 2. | Jawan | <i>Alhaji maurorum</i> |
| 3. | Bhakra | <i>Tribulus terrestris</i> |

c) Grasses

The overall condition of the study area may fall in the modified/degraded habitat category. The original flora of the tract is almost in deteriorated condition and lost its virginity and originality as well. The most common grass of the tract is Khabbal (*Cynodon dactylon*). It is a useful fodder grass. Kana (*Saccharum munja*) and Dib (*Typha angustata*) are found along the water courses or in moist places.

Pictorial views of birds in the project area are provided in **Plate 4.3**.





Plate 4.2: Pictorial Views of Flora in the Project Area

Fauna

a) Mammals

The Study Area falls in barren and agricultural land use and is not very rich in wildlife mammals. However, common mammals (in & around the project area) found are Jackals (*Canis aureus*), Squirrel (*Funambulus*), Rats (*Mus musculus*) and Mongoose (*Herpestes auropunctatus*). Wild Boar (*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. Porcupine (*Hystrix indica*) is also reported in region. The above and the species given in the table, are away from the Project location but are found regionally.

Domestic animals include goats, cows and buffaloes. Another important domestic draught animal of the area is donkey which is used for pulling carts, etc. A list of mammals found in the area is given in below **Table 4-9**.

Table 4-9: Mammals in the Study Area

| Sr. No. | Common Name | Scientific Name |
|---------|-------------|----------------------------|
| 1. | Jackal | <i>Canis aureus</i> |
| 2. | Porcupine | <i>Hystrix indica</i> |
| 3. | Squirrel | <i>Sciuridae</i> |
| 4. | House Mouse | <i>Mus musculus</i> |
| 5. | Mongoose | <i>Herpestes javanicus</i> |
| 6. | Wild Boar | <i>Sus scrofa</i> |

b) Reptiles

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*), Rattle Snakes and Rat Eater Snakes. 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 | <i>Naja naja</i> |

| Sr. No. | Common Name | Scientific Name |
|---------|--------------|---------------------------|
| 2. | Indian Krait | <i>Bungarus caeruleus</i> |

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. These include little and medium sized Egrets and Mallard (*Anas platyrhynchos*). The common bird species found in the tract are the Common Crow, Common Mynah, House Sparrow and Common Teal are abundant in the area and are frequently sighted. Many precious species in the area have been reduced to a minimum quantity due to excessive and illegal hunting.

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 | <i>Acridotheres tristis</i> |
| 2. | House Crow | <i>Corvus splendens</i> |
| 3. | House sparrow | <i>Passer domesticus</i> |
| 4. | Pigeon | <i>Columba livia</i> |
| 5. | Quil | <i>Coturnix coturnix</i> |
| 6. | Little Egret | <i>Egretta garzetta</i> |

d) Endangered Species

No endangered flora and fauna were found on the track.

Pictorial views of fauna in the project area are provided in **Plate 4.3**.



Plate 4.3: Pictorial Views of Fauna in the Project Area

4.4 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.

4.4.1 General Description of the Project Area

The Project Area of proposed project falls in Lahore and Sheikhpura Districts. Study Area included the following major settlements.

- Gunj Sundwan;
- Bhaini Par,
- AINU BHATTI
- Bukan Wal;
- Jhuggian Arazi;
- Babakwal;
- Kot Hidyat ALi
- Chak No. 41UC

4.4.2 Methodology

The socio-economic survey was carried out in the month of January 2025. A sample size of 56 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.

4.4.3 Task Specific Approach

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



4.4.4 Discussion with Officials

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

4.4.5 Data Collection and Field Survey

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

4.4.6 Community/Stakeholders' Participation

Community consultations with different stakeholders, beneficiaries and affected communities of the Project Area were organized to facilitate stakeholders' / peoples' participation in the project activities of the proposed project and their views and feedbacks were incorporated for planning/preparation of the proposed project. Such consultations would strengthen the commitment of a wide cross-section of the affected people, public representatives, government employees and professional groups by giving them an opportunity to participate in key decisions.

4.4.7 Administrative and Political Settings

a) Lahore District

The Mayor of Lahore is the leader of the municipal government of Lahore (Metropolitan Corporation Lahore) in Lahore, Punjab. The mayor is directly-elected in municipal elections every four years alongside nine (09) deputy town mayors. The mayor is responsible for the administration of government services, the composition of councils and committees overseeing Lahore City District Departments and serves as the chairperson for meeting of Lahore Council.

The mayor is responsible for the administration of government services, the composition of councils and committees overseeing Lahore City District departments and serves as the chairperson for meeting of Lahore Council. The mayor also functions to help devise long term development plans in consultation with other stakeholders and bodies to improve the condition, livability and sustainability of urban areas.

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.

b) Sheikhpura District

Deputy Commissioner (DC) is the highest ranked administrator of the district. For the collection of revenue and administration, the district is subdivided into Tehsils. Local governments also administer the area through Union Councils and Tehsils.

4.4.8 Demography of Districts

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

4.4.9 Population and Family Size

a) Lahore

According to Census of 2017, the population of Lahore District is 11,126,285 with an average annual growth rate of 3.0 percent from 1998 to 2017. The male population of Lahore District is more than the female population. Out of the total population, 52.34 percent are males and 47.66 percent are females and the sex ratio of the district is 109.87. According to census report 2017, the average household size for the district is 6.33 persons.

b) Sheikhpura

According to Census of 2017, the population of Sheikhpura District is 3,460,426 with an average annual growth rate of 2.22 percent from 1998 to 2017. The male population of Lahore District is more than the female population. Out of the total population, 51.72 percent are males and 48.28 percent are females and the sex ratio of the district is 107.16. According to census report 2017, the average household size for the district is 6.68 persons.

4.4.10 Agriculture Practice

In the proposed project area, groundwater is being supplied through tube wells, or river water for agriculture purposes which are the main source of irrigation water however, sewerage water is also used for agriculture purpose. Local farmers use traditional methods



for farming (i.e. ploughing, tilling etc.) coupled with use of tractors and modern machinery for cultivation and harvesting. They grow almost all types of vegetables and fodder crops for their domestic animals. Milk selling is one of the major source of livelihood for the local people, hence, they are used to grow fodder crops on major portion of their agricultural land. Moreover, Potatoes, sweet potatoes, tomatoes, sweet potatoes, wheat and rice are also commonly grown. There are no fruit orchards in proposed Project's Aol.

The major agricultural machinery being used was tractors. There has been a consistent increase in the number of privately-owned agricultural machines. The farmers seem to consider increased mechanization of agriculture as they are buying more agricultural machinery, especially tractors. Scythes, sickle-type western hand tools are also being used for cutting of Barseem and other fodder crops. Fertilizers such as Urea and Ammonium Phosphate are used by farmers to increase the crop productivity.

4.4.11 Livestock

Lahore and Sheikhpura Districts are rich in agriculture products. Its lush green lands are a big producer of human food and livestock fodder. Livestock industry provides not only the major food requirements of human use protein but also forms backbone of national income through dairy products. To enhance this productivity, the livestock department of the District is doing a great job. The livestock rearing is made at large-scale in the Project Area. Almost all the households who have their link with the agriculture are keeping the cattle. All the domestic animals like buffalos, bulls, cows, calves, goats and donkeys are reared up in the proposed Project Area. The livestock rearing is made mostly on commercial basis in the proposed Project Area.

4.4.12 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 16% 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 | 47 | 94 |
| 2 | Un-Married | 9 | 16 |
| Total | | 56 | 100 |



ii. Literacy

Educational distribution of the respondents shows that Fifteen (14%) of the respondents were illiterate. 23% were educated up to primary level. However, 21% and 16% 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 | 14 |
| 2 | Primary | 13 | 23 |
| 3 | Middle | 12 | 21 |
| 4 | Matric | 9 | 16 |
| 5 | Intermediate | 8 | 14 |
| 6 | Graduation and above | 6 | 12 |
| Total | | 56 | 100 |

Based on the field survey and discussion with the locals, it is noted that female literacy rate was lower compared to males. Locals give least importance to female education. However, proposed project area falls in Lahore and considered semi urban area. Following are the reasons of low literacy rate among women in the area:

- The major cause of women illiteracy is increase in population, which is playing a negative role in this deprivation of female education. A family having more children and less income will prefer to educate the boys of the family, while the girls will be given embroidery or sewing skills;
- There is also misconception that females have to manage home after marriage whereas males have to earn for livelihood, so education matters only for males and not for females;
- Some families do not like their daughters to study in co-education institutes thus depriving them of higher education;
- The social setup is male dominated and girls restricted to homes and cannot go out freely thus any male of the family has to take responsibility for grocery purchasing etc. This sometimes seems difficult to them. There is also a sharp division between female oriented work and male oriented work. Females are not allowed to work in all sectors therefore their education is not considered valuable; and
- The number of schools and colleges for females are less with compare to males. Girls have to travel a long distance to reach the schools or colleges. For this reason, most parents prefer to give them religious education.

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 ¹⁷ | 10 | 18 |
| 2 | Pacca ¹⁸ | 41 | 73 |
| 3 | kutcha ¹⁹ | 5 | 9 |
| | Total | 56 | 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 (46%) of the respondents were associated with farming. Thirteen (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 agriculture, industrial and general labor for earning their livelihood, while 12% were engaged with private jobs to earn their livelihood. Rest of the 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 | 28 | 50 |
| 2 | Shopkeepers | 5 | 9 |
| 3 | Mechanic | 2 | 4 |
| 4 | Laborers | 8 | 14 |
| 5 | Private Service | 7 | 12 |
| 6 | Business | 4 | 7 |

¹⁷ Constructed using a combination of pacca (strong, high-quality) and kutcha (inferior) materials.

¹⁸ 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.

¹⁹ Constructed of mud and kutcha (inferior) materials



| | | | |
|--------------|---------------|-----------|------------|
| 7 | Govt. Service | 2 | 4 |
| Total | | 56 | 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 | 24 | 43 |
| 3 | 40,001 – 50,000 | 13 | 23 |
| 4 | 50,001-60,000 | 10 | 18 |
| 5 | Above 60,000 | 6 | 11 |
| Total | | 56 | 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 9% of respondents reported their monthly expenditure up to 30,000, and 41% respondents found within the range of 30,000- 40,000 per month. While, 21% 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, 11% 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 | 9 |
| 2 | 30,001 – 40,000 | 23 | 41 |
| 3 | 40,001 – 50,000 | 12 | 21 |



| | | | |
|--------------|---------------|-----------|------------|
| 4 | 50,001-60,000 | 10 | 18 |
| 5 | Above 60,000 | 6 | 11 |
| Total | | 56 | 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 | 47 | 84 |
| 2 | Yes | 9 | 16 |
| | Total | 56 | 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. Agriculture Practice

In the proposed Project Area, groundwater is being supplied through tube wells for agriculture purposes which is the main source of irrigation water. Local farmers use traditional methods for farming (i.e. ploughing, tilling etc.) coupled with use of tractors and modern machinery for cultivation and harvesting. They grow almost all types of vegetables and fodder crops for their domestic animals. Milk selling is one of the major source of livelihood for the local people, hence, they are used to grow fodder crops on major portion of their agricultural land. There were no fruit orchards in proposed Project's Aol.

The major agricultural machinery being used was tractors. There has been a consistent increase in the number of privately-owned agricultural machines. The farmers seem to consider increased mechanization of agriculture as they are buying more agricultural machinery, especially tractors. Scythes, sickle-type western hand tools are also being used for cutting of Barseem and other fodder crops. Fertilizers such as urea and ammonium phosphate are used by farmers to increase the crop productivity.

x. Religion, Ethnic and Minority Groups



The population of the settlements in Aol 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 Aol, local councilors, chairman and deputy chairman are the influential persons.

xi. 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 Aol, 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 Aol, 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).

xii. Family System

Joint family system is the dominant culture in the Aol. It was observed that the family structure in the area was very strong and members played a pivotal 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 Aol 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.

xiii. Decision-making Methods and Conflict Resolutions System

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

People prefer “Panchayat” in the Aol 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.

xiv. Educational Facilities

The educational facilities in the Aol 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.

xv. Health Facilities

Health facilities are generally inadequate in the AOI. Bad sanitary conditions, contaminated underground water, insufficient medical facilities and meagre parental care, all contribute to the prevalence of ill health in the area. To avail health facilities locals, go to Lahore. As per findings of the socioeconomic survey and community consultations, there were no proper health facility for the local people of village Babakwal. Local people are forced to risk their lives in the hands of the traditional practitioners.

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.

xvi. 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.

xvii. 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 and factories.

xviii. 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? | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• 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 Col; and
- To address the most relevant concerns of the stakeholders on project and its activities including the upfront negative impacts.

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.

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, Agriculture Department, Forest Department, Irrigation Department 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

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.

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

Locations of the Public Consultations

The public consultations were conducted with the community members of the following locations;

- Chak No. 41UC,
- Abbass Nagar;
- Babakwal; and
- Different locations along the alignment

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 |

5.6 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 | Livelihood of the locals depending on the agriculture and livestock. Due to loss of arable land livelihood of the local people will be affected. | Impact on the arable land should be minimized | RUDA will ensure compensation where applicable as per law. |
| 2 | Loss of residential and commercial, structures | Resettlement and proper compensation at replacement cost to Project Affected Persons for loss of structures and livelihood. | RUDA will ensure as per law. |
| 3 | Land owners cannot sale and purchase land due to issuance of section-4 of LAA of 1894. | Restriction on sale and purchase of land should be removed. | As per law. |
| 4 | 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 as per plan. |
| 5 | During the construction | Alternate route should be provided to | Possible alternate route |



| Sr. No. | Concerns Raised by Participants | Mitigation Proposed by Participants | Action to be taken by Project Executors |
|---------|---|--|--|
| | period, mobility of the local community will be disturbed. | the local communities for convenience in mobility. | will be provided before the commencement of the civil work on the proposed project |
| 6 | 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. |
| 7 | 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. |
| 7 | 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. |
| 8 | 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. |

5.7 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 | <ul style="list-style-type: none">• Pre-Implementation• During the Project Implementation• At Closure period | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• Pre-Implementation• During the Project Implementation• At Closure period | <ul style="list-style-type: none">• Consultation at different stages, before implementation, periodic meetings during construction phase and at the time of project completion. |
| 3 | NGOs/CBOs | <ul style="list-style-type: none">• Pre-Implementation• During project Implementation• At Closure period | <ul style="list-style-type: none">• 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.

5.8 INFORMATION DISCLOSURE PLAN

After suggesting the possible solutions of the stakeholders' concerns, the solutions will be disclosed once again before the stakeholders and general public in the form of workshop. EIA report will be accessible to interested parties on request and the version of final report



will be available in the project office and RUDA website and its summary will also be available in national language.

List of Participants

| Sr. No. | Name of Participant | Profession |
|--------------------|----------------------|--------------------|
| Abbas Nagar | | |
| 1 | Alisher | Fishing Labour |
| 2 | Shehbaz Ali | Fishing Labour |
| 3 | Toseef Ali | Fishing Labour |
| 4 | Muhammad Arif | Agriculture Labour |
| 5 | Shahid | Agriculture Labour |
| 6 | Sajjad Hussain | Fishing Labour |
| 7 | Tamoor | Fishing Labour |
| 8 | Ali Hyder | Farmer |
| Babakwal | | |
| 1 | Tanweer Hussain | Shopkeeper |
| 2 | Dilawar | Shopkeeper |
| 3 | Muhammad Mateen | Farming |
| 4 | Muhammad Iqbal | Farming |
| 5 | Ismail | Farming |
| 6 | Khalil Ahmed | Farming |
| 7 | Muhammad Rafique | Farming |
| 8 | Ali | Farming |
| 9 | Muhammad Asif | Farming |
| 10 | Awais | Farming |
| 11 | Farooq | Farming |
| 12 | Dawood | Farming |
| 13 | Asghar Ali | Farming |
| 14 | Saad Abdullah | Farming |
| 15 | Asim Ali | Farming |
| 16 | Waleed | Farming |
| Chak No.41 | | |
| 1 | Nasir Abbass | Farmer |
| 2 | Rana Asif | Farmer |
| 3 | Rana Sajjawal | Farmer |
| 4 | Muhammad Tariq | Farmer |
| 5 | Sheroof | Farmer |
| 6 | Muhammad Hafeez | Farmer |
| 7 | Rana Muhammad Ramzan | Farmer |
| 8 | Shakeel Ahmed | Farmer |

5.9 DEPARTMENTAL CONSULTATIONS

The Environment and Social team have conducted the Stakeholder's Consultation with relevant departments/organizations in January, 2025. The consultation was done to get their views/concerns for the proposed Project. **Table 5.4** below presents the details of consultations, including stakeholder's designations/department and their views/concerns regarding the proposed Project.

Table 5.2: Summary of Consultation Meeting at Department Level

| Sr. No. | Department/ Organization | City/ District | Name and Designation / Contact Details | Stakeholder Views/Concerns and Discussions |
|---------|--|----------------|---|--|
| 1 | Punjab Irrigation Department | Lahore | Mr. Muhammad Salman Director (Guages) PMIU | <ul style="list-style-type: none"> The status of the River Ravi and Shahdara Distributary was discussed. It is essential to ensure that a minimum flow is maintained in both the River Ravi and Shahdara Distributary. All relevant Regulations, as outlined on the official website, must be strictly adhered to during the construction phase. Potential impacts arising from construction activities should be effectively managed to minimize disruption and ensure compliance with environmental and safety standards. |
| 2 | Agriculture Department Punjab | Lahore | Mr. Agha Nabeel Akhtar Special Secretary (Agriculture) | <ul style="list-style-type: none"> The official noted that road construction generally facilitates the transportation of agricultural produce to markets. Additionally, the establishment of fruit and vegetable production in the area further enhances the project's overall benefits. |
| 3 | Environmental Protection and Climate Change Department, Punjab | Lahore | Mr. Noor Ahmad Deputy Director (EIA) | <ul style="list-style-type: none"> The project location should be clearly defined in relation to the alignment of the River Training Works and the RUDA master plan. The status of land ownership must be clarified, considering the relevant court orders. Alternatives should be thoroughly evaluated to minimize or avoid impacts on sensitive receptors. |
| 4 | Forest Department | Lahore | Mr. Mehar M. Hafeez (Divisional Forest Officer - Lahore) | Tree cutting will be avoided and compensation plantation will be done. Tree management plan will be prepared. |
| 5 | Railway Department | Lahore | Mr. Mateen Ahmed Khan (XEN Lahore) | <ul style="list-style-type: none"> The status of the railway track was discussed. Design should also be altered to ensure the smooth and safe running of the railway track in the project area. |

Mixed responses received during the consultations. A majority of consulted persons considered the proposed Project will lead to adverse social and environmental issues, i.e. ,population, waste management, consumption of energy, issues of privacy of local residents, traffic management issues and health and safety issues. On the other hand, some consulted people favored the Project and mentioned that it will contribute to the economic and social development in the area.



A View of Socioeconomic Survey



A View of Consultation with Fisher Men and farmers



A View of Socioeconomic Survey



A View of Socioeconomic Survey



Consultation at Hakeem Pura



Consultation at Kunji Sindo



Consultation with EP&CCD



Consultation with Agriculture Department



Consultation with Irrigation Department



Consultation with Forest Department



Consultation with Railway Department

Figure 5.1: Pictorial View of Community and Departmental Consultation Meetings



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.

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**.

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/Crochants | 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 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| Topographic Survey of Bypass | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Geotechnical Investigation | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Temporary Acquisition of Land | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Parmanent Acquisition of Land | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 9 | 9 | 6 | 0 | 6 | 0 | 9 | 6 | 9 | 0 | 0 | 0 | 9 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 0 |
| B. Construction Phase | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RoW / Site Clearance | 9 | 9 | 9 | 8 | 8 | 4 | 6 | 0 | 0 | 4 | 9 | 9 | 0 | 6 | 4 | 3 | 6 | 6 | 0 | 0 | 6 | 0 | 8 | 9 | 4 | 4 | 0 | 6 | 0 | 4 | |
| Earthwork in Filling and Excavation | 9 | 9 | 9 | 8 | 8 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 6 | 9 | 4 | 4 | 0 | 6 | 0 | 4 | |
| Establishment of Construction Camps & Workshop | 2 | 2 | 4 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 4 | 8 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 4 | 4 | 8 | 4 | 0 | 0 | 6 | 6 | 6 | |
| Transportation & Storage of Construction Materials | 4 | 6 | 6 | 2 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 6 | 4 | 0 | 0 | 4 | 0 | 0 | |
| Use of Construction Material and Heavy Machinery | 3 | 8 | 9 | 0 | 4 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 0 | 4 | 0 | 4 | 0 | 0 | |
| Installation and operation of Batching and Asphalt Plants | 4 | 8 | 8 | 2 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 6 | 4 | 0 | 4 | 4 | 0 | 0 | 0 | |
| Spoil Disposal | 3 | 3 | 0 | 6 | 6 | 4 | 6 | 0 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | |
| Structural & Civil Work | 8 | 8 | 8 | 7 | 7 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 6 | 9 | 4 | 4 | 0 | 8 | 0 | 8 | |
| Drainage Work | 6 | 6 | 6 | 7 | 6 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 4 | 9 | 4 | 4 | 0 | 8 | 0 | 8 | |
| Miscellaneous Work (Road Ancillaries, Traffic Signs and Signals etc.) | 0 | 4 | 6 | 4 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 6 | 0 | 6 | | |
| Pavement Work | 2 | 4 | 6 | 2 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 8 | 0 | 0 | 0 | 6 | 0 | 6 | |
| Finishing and Comissioning | 0 | 2 | 4 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 0 | 4 | | |
| C. Operational Phase | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operation of Road | 0 | 2 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 6 | 0 | 0 | 6 | 4 | 8 | 0 | 0 | 6 | 4 | 0 | 0 | 8 | 6 | 8 | 4 | 8 | 6 | 6 | 6 | |
| Inspection & Monitoring | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 4 | 0 | 4 | 0 | 0 | |
| Road Maintenance | 0 | 4 | 4 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 4 | 0 | 0 | 0 | |
| Maintenance of Miscellaneous Work | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 0 | 4 | 0 | |

| 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 MITIGATION 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 (retaining walls, 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 road. 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.

6.6.5 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.

6.6.6 Land Procurement/Award of Land

Land available for the proposed bridge is both awarded land and procured land for proposed project by RUDA. Construction of the proposed project may result in loss of land, infrastructure, commercial activities and disturbance to local people on temporary and permanent basis but will open new avenues of business opportunities.

The loss of agriculture land is a major direct impact. This impact will be permanent.

6.6.7 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.
- All notices will be followed issued by the Government from time to time
- Resource Conservation Plan is attached as **Annex-III**

6.6.8 Change in Hydrologic Regime

The proposed road 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 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.

6.6.9 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.

6.6.10 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.

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.

6.6.11 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.

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;
- 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.

6.6.12 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 Soil Erosion

Construction activities such as clearing of earth, levelling, piling, compaction, carpeting, pavement finishing will affect the existing soil condition in the AOI. The clearing of vegetation can also loosen the soil and make it more susceptible to erosion due to wind and rain. There is also a possibility of silt runoff during rainy season causing soil erosion. During the rain, the eroded soil mix with stagnant water to transform into slush, which can affect movement of vehicles and machinery and construction work as well as limit the movements of local people.

Soil erosion may also occur in the workshop areas as a result of improper drainage system of equipment washing-yards and improper management of construction activities. This impact can be categorized as moderate negative in nature.

Mitigation Measures

Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas and along the shoulders of roads and excavations shall be kept confined to the specified



foundation spots as per the approved engineering drawings. Unnecessary excavations should be avoided.

The provision for vegetation with a fast-growing crops/tree 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 bridge. 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. Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. Site restoration plan for the Project should be strictly followed.

6.7.2 Soil Contamination

The soil contamination occurs at all construction stages: during the design and survey work, and during the work on the construction site. Land may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc. Various types of machinery will be used at the construction sites. This machinery may also contaminate soil due to leaks etc.

The possible contamination of soil by oils and chemicals at camp sites, workshop area and equipment washing-yards may limit the future use of land for agricultural purposes. This impact can be categorized as minor negative in nature.

Mitigation Measures

The following practice will be adopted to minimize the risk of soil contamination:

- 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 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
- Use of modern, well-maintained machinery and vehicles by the contractor to avoid emissions and leakages;
- 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.

6.7.3 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. The operation of an asphalt plant causes the emission of many different pollutants. The most common air pollutants are particulate matter (PM₁₀), sulfur dioxide (SO₂), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxides (CO).

Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site. Dust is a major component of air pollution during road construction. Emissions are generated mainly from the following construction activities:

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

The construction activities will also result in increased air pollution in the area. The overall impact on the quality of air during the construction phase will be moderate negative and limited to the project's implementation phase only.

Mitigation Measures

The impacts associated with the construction phase 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 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 or use of chemical dust suppressants 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 asphalt plants can be controlled efficiently by the installation of cyclone/scrubbers. Diesel operated equipment should be equipped with well-



- maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators;
- Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a pre-set time can reduce emissions, without intervention of the operators;
 - Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather;
 - 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; by providing dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards. Moreover, ensure that the batching and asphalt plants are equipped with emission control devices like scrubbers, electrostatic precipitators or bag filters; and
 - Regular monitoring and compliance of air quality in accordance with PEQS.

6.7.4 Noise/Vibration

The noise and vibration will be produced due to the operation of construction machinery and 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 activities. The machinery is expected to generate noise levels that would be severe in the project area.

The cumulative effects from several machines can be significant and may cause significant nuisances. However, these increased noise levels will prevail only for a short duration during the pre-construction and construction phase.

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; and
- 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.

Though the construction method that has not been determined yet, however it is believed that the adopted method of construction shall produce less noise and vibration if the suggested mitigation measures are adopted.

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

Noise Perimeter Zones (NPZ) are another administrative control to limit exposure to noisy processes or equipment to as few workers as possible. NPZ 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. NPZ can be set up using a sound level meter to find the safe distance from the source (90 dB (A)) and the NPZ 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.

6.7.5 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 |
|---|--|
| <p>Environmental</p> <ul style="list-style-type: none"> ▪ 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 | <p>Environmental</p> <ul style="list-style-type: none"> ▪ 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 impending works to all potential receptors within a 1 km corridor surrounding the RoW via public notices and local news. |
| <p>Social</p> <ul style="list-style-type: none"> ▪ Worker camp site: consultation surrounding potential construction camp sites revealed concerns regarding the location of proposed sites for Worker Camps. | <p>Social</p> <p>State land will be a second preference for worker camp locations, followed by land where there is a willing lessee.</p> <p>Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values.</p> <p>Training will be provided to all staff on camp management rules and overall discipline and cultural awareness. This will include, in appropriate languages:</p> |



| Potential Impact | Proposed Avoidance and Mitigation Measures |
|---|--|
| | <ul style="list-style-type: none"> ▪ 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). <p>The construction contractor is required to develop a Construction Camp Management Plan to address:</p> <ul style="list-style-type: none"> ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases. <p>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.</p> |
| <p>Camp Location The final location will be determined by the construction contractors and agreed with the RUDA.</p> | <p>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.</p> |

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; and
- Compensatory plantation to be scheduled when construction works near end.

6.7.6 Wastewater Generation at Construction Camps

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 river Ravi. apart from soil contamination. The below **Table 7.4** shows estimated quantities of the wastewater to be generated during the course of the construction phase of the project.

Table 6.3: Estimated Wastewater Generated by Workers in Construction Camps

| Sr. No. | No. of Workers* | Estimated Total Water Demand** (liters/day) | Estimated Wastewater Generated (liters/day)*** |
|---------|-----------------|---|--|
| 1 | 100 | 4,000 | 3,200 |

* "Tentative Work Force Requirements Including Client and Contractor Staff"

** = $(100) \times (40) = 4,000$ liters/day

*** = $(4,000) \times (80\%) = 3,200$ liters/day

This impact can be categorized as moderate negative in nature.

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.

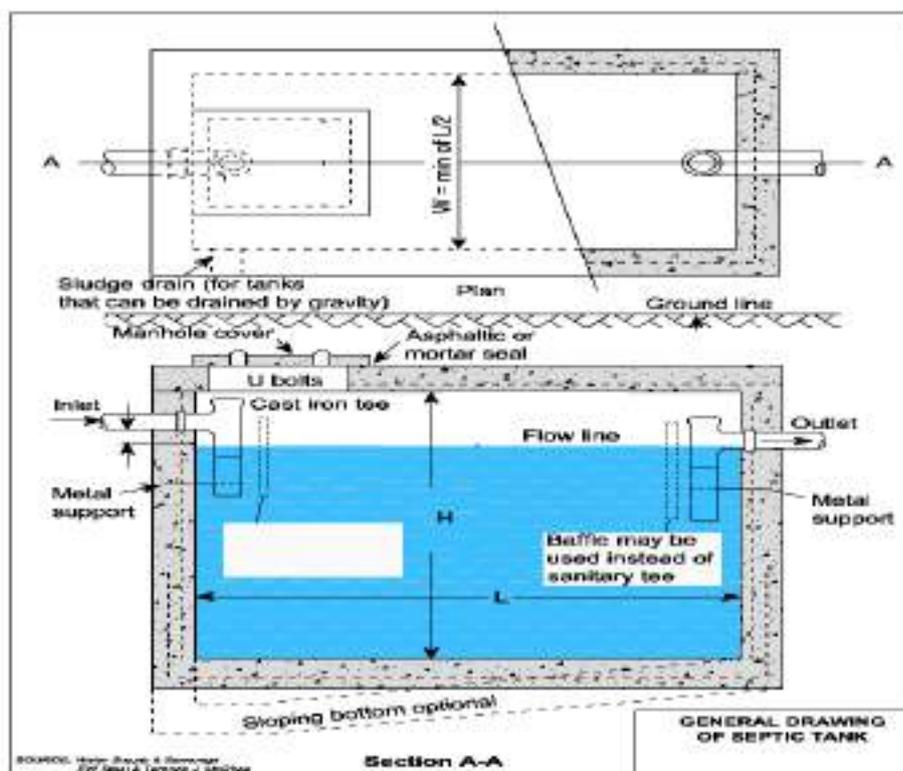


Figure 6.1: General Drawing of Septic Tank

6.7.7 Solid Waste Generation at Construction Camps

Considering the labourers (about 100 in numbers) residing in the construction camp and the locally available labour, an average solid waste generation rate of 0.6 kg/capita/day is adopted for the estimation of solid waste generation. Based on this assumption, a total of



about 60 kg of solid waste will be generated from construction camps on daily basis. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues. 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 moderate 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.

6.7.8 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.

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

Mitigation measures will include:

- Waste Management Plan will be developed to implement an efficient and responsive solid waste management system during construction phase. 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
- 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;
- The site will be restored back to its original conditions after construction completion.

6.7.9 Impact on Water Resources (Surface and Groundwater Contamination)

The proposed project will cross River Ravi and passes near the shahdara distributary and at different locations. These surface water resources 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.

Surface water might get contaminated due to the disposal of construction waste generated due to the Project activities and also result in jeopardizing the health of natives that use this water for various purposes. The impact on these water bodies will be only for the period of construction phase.

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. This impact can be categorized as local, temporary, moderate negative and reversible.

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 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 from 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 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, 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 on to the land it will meet the requirements of the PEQS for disposal of wastewater.

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

6.7.11 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-VI**.
- An emergency management plan must be devised by the contractor in close coordination with the provincial emergency services (Rescue 1122).

6.7.12 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 health 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.

6.7.13 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. Guideline for COVID-19 are attached as **Annex-VII**;



- 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.

6.7.14 Climate Change and Green House Gas (GHG) Abatement

Construction operations of construction equipment generate significant greenhouse gas emissions including carbon emissions and diesel exhaust emissions. The main sources of greenhouse gases (CO₂, CH₄, NO_x etc.) during the construction activities of the proposed 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. Emission of greenhouse gases from project activities will contribute in global warming and other climatic changes on regional and global scale.

Mitigation Measures

- Integration of careful planning on construction equipment activities with appropriate equipment selection could contribute to the reduction of carbon gas emissions as well as savings of construction cost;
- Regular motioning of the equipment and vehicles for engine efficiency;
- Avoid idling of construction vehicles;
- Alternative energy resources shall be considered where possible;
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.

6.7.15 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 (NO_x), volatile organic compounds (VOCs), and particulate matter that will contribute to smog formation in reaction with sunlight and other pollutants in the atmosphere.
- **Incomplete Combustion:** Inefficient combustion of fuels, often used in construction equipment, can release pollutants like sulfur dioxide (SO₂), nitrogen oxides (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.

6.7.16 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.

6.7.17 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**.

6.7.18 Flora

The Project may involve destruction of vegetation cover on construction areas. It is initially examined that approximately 130 number of trees/saplings will be disturbed. The provided number of trees is approximate and tentative provided by GIS. 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 Plan of **1500 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;
- Client shall involve the communities for carrying out plantation;
- 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.



6.7.19 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 involving excavation, blasting, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing livestock of the study area in quest of fodder will leave the directly affected areas due to construction activities and human intervention. 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.

6.7.20 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.

6.7.21 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.

6.7.22 Impacts on Livelihood

The construction activity may disturb the business and livelihoods of the locals in terms of loss of agricultural land 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.

6.7.23 Loss of Income

During the construction activities, people will suffer loss in their annual income due to the loss of crops and trees. This impact can be categorized as moderate adverse in nature.

Mitigation Measures



- Fair, prompt and negotiated compensation for the crops and trees on private land will be provided to the affectees along with the land value; and
- Affectees will be involved in the valuation process of the Project.

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. INSTITUTIONAL ARRANGEMENTS AND 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 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT/ MONITORING PLAN (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.

7.3 INSTITUTIONAL REQUIREMENTS

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

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**.

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.

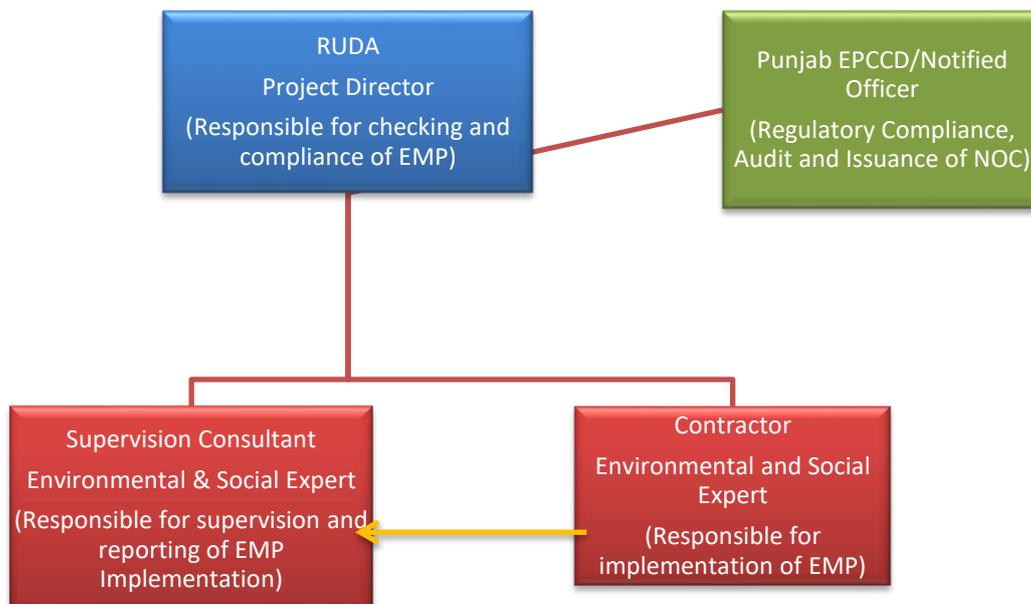


Figure 7.1: Organizational Setup for the Implementation of EMP (Construction Phase)

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.

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 Sheikhpura/ Lahore District to ensure compliance of EMP during operation phase.

7.4 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 the 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. | <p>Technical Design and Layout Planning</p> <p>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.</p> | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Confirmation of design incorporation. Audits and Checks | Design Consultant | Proponent |
| 2. | <p>Topography</p> <p>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.</p> | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Confirmation of design incorporation. Audits and Checks | Design Consultant | Proponent |
| 3. | <p>Storm Water Drainage</p> <p>Improper design of storm water drainage of the proposed Project may result in stagnant water on the road</p> | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Confirmation of design incorporation. Audits and Checks | Design Consultant | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|--|--|-------------------|------------|
| | | | | Implementation | Monitoring |
| 4. | <p>Seismic Hazard and Geo Hazard</p> <p>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.</p> | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Confirmation of design incorporation. Audits and Checks | Design Consultant | Proponent |
| 5. | <p>Resource Conservation</p> <p>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, cementitious materials, reinforced and structural steel etc.</p> <p>Excessive water consumption for</p> | <ul style="list-style-type: none"> Use potable water bowsers for construction works and mineral water bottles/ filtered or treated ground water for drinking purpose; Tested water will be provided. 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 | <ul style="list-style-type: none"> 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. | <p>content should be used to operate construction machinery and equipment;</p> <ul style="list-style-type: none"> • Efficient and well-maintained equipment and machinery should be used; VICS certified. • 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. | | | |
| 6. | <p>Change in Hydrologic Regime</p> <p>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</p> | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Confirmation of design incorporation. • Audits and Checks | Design Consultant | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---|---|--|-------------------|------------|
| | | | | Implementation | Monitoring |
| | communities. | and provision of safety of embankments will be considered during the design of these arrangements. | | | |
| 7. | <p>Utilities</p> <p>Due to the proposed project, public utilities i.e. Electricity Poles, Power/Telephone Lines, etc. will be affected creating disruption of public services and inconvenience to the local residents.</p> | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Confirmation of design incorporation. Audits and Checks | Design Consultant | Proponent |
| 8. | <p>Flora</p> <p>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.</p> | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Audits and Checks | Design Consultant | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---|--|---|-------------------|------------|
| | | | | Implementation | Monitoring |
| | | <ul style="list-style-type: none"> 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. | | | |
| 9. | <p>Fauna</p> <p>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.</p> | <ul style="list-style-type: none"> 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; The construction camp management plan during the planning stage will consider fencing and gating to check the entry of animals in search of | <ul style="list-style-type: none"> Audits and Checks | Design Consultant | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------------------------|---|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>eatable goods; and</p> <ul style="list-style-type: none"> Similarly, waste management plan of the camps will be considered at the planning stage to prevent wild animals and birds. | | | |
| 10. | <p>Socio-economic Environment</p> <p>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.</p> | <ul style="list-style-type: none"> Planning shall involve minimum disturbance to locals and their associated income and livelihood sources. Alternate arrangements for access shall be provided. | <ul style="list-style-type: none"> Audits and Checks | Design Consultant | Proponent |
| Construction Phase | | | | | |
| 11. | <p>Soil Erosion and Contamination</p> <p>The clearing of vegetation can loosen the soil and make it more susceptible to erosion due to wind and rain.</p> <p>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</p> | <ul style="list-style-type: none"> Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in 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 | <ul style="list-style-type: none"> 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 |
| | earth/cutting operations and clearing of vegetation. | <p>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;</p> <ul style="list-style-type: none"> • 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 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 | | | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---|---|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>would be stockpiled for reuse where possible; and</p> <ul style="list-style-type: none"> • 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. | <p>Borrow/ Open Pits</p> <p>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.</p> | <ul style="list-style-type: none"> • 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 • 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. | <ul style="list-style-type: none"> • Visual observation and photographic record • Site restoration and rehabilitation plan implementation | Construction Contractor | Proponent |
| 13. | <p>Deterioration of Ambient Air Quality</p> | <ul style="list-style-type: none"> • All vehicles, machinery, equipment and generators used during | <ul style="list-style-type: none"> • Visual observation • Regular | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|--|--|----------------|------------|
| | | | | Implementation | Monitoring |
| | <p>Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles.</p> <p>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.</p> <p>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.</p> | <p>construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;</p> <ul style="list-style-type: none"> • 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 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; | <p>environmental monitoring, sampling and testing reports</p> <ul style="list-style-type: none"> • Vehicle maintenance records • Water sprinkling records. | | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---|---|-----------------------------------|----------------|------------|
| | | | | Implementation | Monitoring |
| | Similarly, exhausts from generators can also have impacts on air quality in the vicinity. | <ul style="list-style-type: none"> Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators; Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a pre-set time can reduce emissions, without intervention of the operators; PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works; Service roads (used for earthmoving | | | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|---|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>equipment and general transport) should be regularly sprayed with water during dry weather;</p> <ul style="list-style-type: none"> • 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 PEQS. | | | |
| 14. | <p>Noise and Vibration</p> <p>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,</p> | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • Physical observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | 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. | | | | |
| 15. | <p>Construction Camps Sites</p> <p>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.</p> | <p>Environmental</p> <ul style="list-style-type: none"> • Reinstate any temporary facilities to pre-existing conditions in ecologically sensitive areas. • Implement landscaping plan for all facilities in areas where high landscape value and visual vulnerability to the proposed activities warrants site-specific landscape restoration measures. • Operate equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary. • Provide adequate warnings of impending works to all potential receptors within a 1 km corridor surrounding the ROW via public notices and local news. <p>Social</p> | <ul style="list-style-type: none"> • 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 |
| | | <p>State land will be a second preference for worker camp locations, followed by land where there is a willing lessee.</p> <p>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:</p> <ul style="list-style-type: none"> ▪ 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). <p>The construction contractor is required to develop a Construction Camp Management Plan to address:</p> <ul style="list-style-type: none"> ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases. <p>A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan, which provides</p> | | | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>policies and a disciplinary framework with respect to worker behavior.</p> <p>Camp Location</p> <ul style="list-style-type: none"> ▪ 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. | <p>Wastewater Generation at Construction Camps</p> <p>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 ground water apart from soil contamination. The wastewater generation is estimated to be 3,200 liters/day for 100 construction workers.</p> | <ul style="list-style-type: none"> • 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 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. | <ul style="list-style-type: none"> • Visual observation and photographic record. • Waste Management plan implementation | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| 17. | <p>Solid Waste Generation at Construction Camps/s</p> <p>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.</p> | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Visual observation and photographic record. Waste Management plan implementation | Construction Contractor | Proponent |
| 18. | <p>Waste Generation at Construction Site</p> <p>Construction waste will include</p> | <ul style="list-style-type: none"> Construction Waste Management Plan (Annex-IV) will be implemented to ensure safe handling, storage, collection and disposal of construction | <ul style="list-style-type: none"> Visual observation and photographic record. Waste Management | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|------------|---|---|--|--------------------------------|------------------|
| | | | | Implementation | Monitoring |
| | <p>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.</p> <p>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.</p> | <p>wastes and the training of employees who handle waste;</p> <ul style="list-style-type: none"> • 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. | <p>plan implementation</p> | | |
| 19. | <p>Impact on Water Resources (Surface and Groundwater Contamination)</p> <p>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</p> | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Physical observation • Regular environmental monitoring, sampling and testing | <p>Construction Contractor</p> | <p>Proponent</p> |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|---|-----------------------------------|----------------|------------|
| | | | | Implementation | Monitoring |
| | <p>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.</p> <p>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.</p> | <p>a controlled manner. These measures are described below:</p> <ul style="list-style-type: none"> • 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 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 | | | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|------------|--|---|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>areas;</p> <ul style="list-style-type: none"> 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. | <p>Traffic Issues</p> <p>The project area will be approached 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</p> | <ul style="list-style-type: none"> 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; The speed of the vehicles will be controlled (at 30 to 40 km/hr) to | <ul style="list-style-type: none"> Vehicle maintenance record Training record Implementation of TMP Regular visual observations | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|------------|---|---|--|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | 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. | <p>reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission;</p> <ul style="list-style-type: none"> • 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. | | | |
| 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 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. | <ul style="list-style-type: none"> • 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 emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works. | <ul style="list-style-type: none"> • Regular environmental monitoring, sampling and testing reports • Vehicle inspection record • Plantation record | Construction Contractor | Proponent |
| 22. | Natural and Man-Made Disasters Natural disasters (earthquakes) and | <ul style="list-style-type: none"> • An Emergency Response Plan (ERP) for natural and manmade disasters should be developed by contractor in coordination with SC and client should | <ul style="list-style-type: none"> • Trainings, drills, record keeping • ERP implementation | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|------------|--|---|--|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths. | <p>be implemented in close consultation with the RESCUE Services and other concerned departments;</p> <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • Visual observation and photographic record. | | |
| 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 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, | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster management plan in case of natural disaster occurrence | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | <p>falls from height, eye and head injuries etc.</p> <p>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.</p> | <p>and sustained usage;</p> <ul style="list-style-type: none"> 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 contractor in close coordination with the provincial emergency services (Rescue 1122). | | | |
| 24. | <p>Community Health and Safety</p> <p>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</p> | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 |
| | <p>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.</p> | <p>particularly children;</p> <ul style="list-style-type: none"> • 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 health | | | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|------------|--|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>workers in disease treatment; immunization program and providing health service;</p> <ul style="list-style-type: none"> 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. | | | |
| 25. | <p>Communicable Diseases</p> <p>The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the</p> | <ul style="list-style-type: none"> 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; | <ul style="list-style-type: none"> Implementation of HSE Plan Use of PPEs Implementation of COVID-19 Guidelines; | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | <p>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.</p> <p>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.</p> | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • Medical reports of worker | | |
| 26. | Discovery of Heritage Sites/ Structures during Excavation | <ul style="list-style-type: none"> • Chance finds procedure shall be adopted in case of any accidental discover of cultural heritage. | <ul style="list-style-type: none"> • Implementation of chance find procedure | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|--|---|---|------------|
| | | | | Implementation | Monitoring |
| | 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. | | | | |
| 27. | <p>Emergency Response</p> <p>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.</p> | <ul style="list-style-type: none"> An Emergency preparedness and response is attached as Annex-IX should be adopted in case of any emergency. | <ul style="list-style-type: none"> Implementation of chance find procedure | Construction Contractor | Proponent |
| 28. | <p>Flora</p> <p>The Project may involve destruction of vegetation cover on construction areas. It is initially examined that approximately 130 number of trees/saplings will be disturbed. The provided number of trees is approximate and tentative provided by GIS.</p> | <ul style="list-style-type: none"> 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 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 | <ul style="list-style-type: none"> Implementation of Tree Plantation Plan Visual Observations | Construction Contractor in association with Forest Department | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|---------|---|-----------------------------------|----------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>support of concerned Agriculture and Forest Department;</p> <ul style="list-style-type: none"> • As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality; • 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 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 | | | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|--|---|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | shall not be allowed. | | | |
| 29. | <p>Fauna</p> <p>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.</p> <p>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.</p> <p>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.</p> | <ul style="list-style-type: none"> 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 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 | <ul style="list-style-type: none"> Visual Observations | Construction Contractor | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|----------------------|---|--|--|-------------------------|------------|
| | | | | Implementation | Monitoring |
| | | <ul style="list-style-type: none"> 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. | <p>Social/ Cultural Conflicts</p> <p>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.</p> | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Visual Observations | Construction Contractor | Proponent |
| O&M Phase | | | | | |
| 31. | <p>Landscapes</p> <p>After the completion of the proposed Project, the overall environmental conditions of the Project area will greatly improve due to plantation of trees and ornamental plants around the proposed alignment.</p> | <ul style="list-style-type: none"> Proper implementation of the tree plantation plan will improve landscape of the project area. | <ul style="list-style-type: none"> Monitoring of plant maintenance activities records | Proponent | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|---|---|----------------|------------|
| | | | | Implementation | Monitoring |
| 32. | <p>Ambient Air Quality</p> <p>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.</p> | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records | Proponent | |
| 33. | <p>Noise</p> <p>The movement of vehicles and usage of horns will create noise which will be a hazard for the nearby residents/built-up areas.</p> | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Physical observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records | Proponent | |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|---------|--|--|--|----------------|------------|
| | | | | Implementation | Monitoring |
| | | <p>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;</p> <ul style="list-style-type: none"> • 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. | | | |
| 34. | <p>Road Safety and Maintenance</p> <p>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.</p> | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • Physical observation • Road maintenance records | | Proponent |
| 35. | <p>Drainage and Urban Flooding</p> <p>During the operational phase, poor</p> | <ul style="list-style-type: none"> • The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage | <ul style="list-style-type: none"> • Physical observation • Road maintenance records | | Proponent |

| Sr. No. | Impacts | Mitigation Measure | Performance Monitoring Indicators | Responsibility | |
|------------|---|---|---|----------------|--|
| | | | | Implementation | Monitoring |
| | <p>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.</p> | <p>system; and</p> <ul style="list-style-type: none"> • Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain along the road alignment. | | | |
| 36. | <p>Flora and Fauna</p> <p>No adverse impacts are envisaged on flora and fauna of the study area during the operation phase.</p> <p>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:</p> <ul style="list-style-type: none"> ▪ Creates a visual barrier and enhances appearance ▪ Providing a 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 | <ul style="list-style-type: none"> • 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 requirements and necessary | <ul style="list-style-type: none"> • 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 |
| | <p>to protect building structures during intense windstorms and intense rainfall.</p> <p>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.</p> | <p>nutrients by relevant department.</p> <ul style="list-style-type: none"> • 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 include 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. | | | |
| 37. | Social Issues | <p>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.</p> | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • Visual observation • Regular monitoring, • Record keeping | Proponent |

7.5 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 based on recommendations in EMP.

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 an environmental monitoring schedule for construction and operations stages of the proposed project.

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 the construction phase, environmental testing reports will be prepared on a 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, concessionaires will be responsible for conducting 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. The 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 future environmental testing and monitoring.

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 | <p>Physical Parameters: Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids</p> <p>Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform</p> <p>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</p> | 1x2x4= 8 | Quarterly @ Rs. 20,000 per sample | CC and SC | - | 160,000/- |
| Surface Water Quality | <p>Physical Parameters: Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids</p> | 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.) |
|---------------------------------------|---|---|------------------------------------|----------------|----------|------------------|
| | <p>Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli</p> <p>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</p> | | | | | |
| 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 | <p>Physical Parameters: Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids</p> | 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.) |
|-----------------------|--|---|-----------------------------------|----------------|----------|---------------|
| | <p>Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform</p> <p>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</p> | | | | | |
| Surface Water Quality | <p>Physical Parameters: Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids</p> <p>Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli</p> <p>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</p> | 1x2x2 = 4 | Biannually @ Rs. 20,000 per point | RUDA | - | 80,000/- |

7.6 TREE PLANTATION

To minimize the negative impacts arising due to tree cutting (approximately 130 No.), increased vehicular activity on the Access Road and enhanced the landscape of the project area, plantation at available spaces may be carried out especially along sides and at the median.

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

The tentative cost for the plantation is about Rs. **2.898 million**. Detailed Tree Plantation Plan is attached as **Annex-X**.

7.7 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: <ul style="list-style-type: none"> • 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 | Short Seminars and Courses on: | Members of | 3 Days |

| Provided by | Contents | Trainees | Duration |
|--|--|--|----------|
| and Organizations specializing in Social Management and Monitoring, and Occupational Health and Safety | <ul style="list-style-type: none"> • 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. | Environmental Committee, RUDA Staff and Contractor Workers | |
| TA Individuals, Consultants and Organizations specializing in Environmental and Social Management and Monitoring | Short Seminars and Courses on: <ul style="list-style-type: none"> • 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 |

7.8 COMMUNICATION & DOCUMENTATION

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

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.

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.

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 |

Social Complaint Register

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

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.

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.

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.

7.9 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.

7.10 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 <i>Pre-Construction Phase:</i> 100 x 6,000 x 1x4 = 2,400,000 <i>Construction Phase:</i> 100 x 6,000 x 2x4= 4,800,000 | 7,200,000 /- | 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 ten Number of tarpaulins (Rs. 20,000 each) and storage at separate area and installment of barrication. 10x20,000=200,000 Lum sum 300,000 | 500,000/- | 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 50000x18x4 | 3,600,000/- | 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 | 3,600,000/- | Rs. 200,000 per month for 18 months to collect construction waste from all the active sites on daily basis. |
| 5. | Health and Safety of Workers | For 400 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. | 10,612,000 | |
| 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 <i>Construction Phase:</i> 4 x 18 x 175,000 = 12,600,000/- <i>Operational Phase:</i> 4 x 12 x 175,000 = 8,400,000/- | 21,000,000/- | Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase. 1 for Bridge 1 For Road from Bridge R/S bank to Topaz 1 for Road from CB-01 to L/S River Bank 1 for Road from CB-01 to CB-02 |

| | | | | |
|----------------|---|---|-------------|--|
| 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 200,000 = 600,000 | 600,000/- | 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 <i>Operational Phase:</i> 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 130 numbers (based on GIS and field trothing for species identification) of different trees may be cut down during construction phase. Therefore, Compensatory planting trees against each fallen tree of similar floral function should be planned which is approx. 1500 to enhance the landscape of the project area. Plantation at available spaces may be carried out especially at the median. | 82,578,643 | Cost for Tree plantation along both sides of roads. |
| Total = | | | | 132,154,653 |

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 132.15 Million**.

8. CONCLUSION AND RECOMMENDATIONS

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.

Apart from the positive impacts of the Project, the proposed project will also have potential adverse environmental and social impacts during the construction and operational phases. Some significant impacts include removal of agriculture land for road construction, business disturbance and removal of some plants species. Major efforts were made to identify the key 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. Most of these adverse impacts during construction are of a temporary nature.

These potential impacts can be avoided or mitigated by adopting suitable mitigation or remedial measures as mentioned in this report. The plantation of 1500 as part of tree plantation plan provided in the EMP must be implemented as Lahore is already facing the environmental issue of high Air Quality Index (AQI) causing severe smog episodes. Moreover, the construction process should be strictly monitored by enforcing all the environmental mitigations provided in the EMP as it can cause nuisance to the surrounding settlements in terms of noise, dust, traffic management, privacy and waste.

The EMP, its mitigation and monitoring programs, contained herewith should be included within the Bidding documents for project works for all Project components. The Bidding documents state that the Contractor will be responsible for the implementation of the requirements of the EMP through his own site specific EMP which will adopt all of the conditions of the EMP. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

The EMP and all its requirements will then be added to the Contractors Contract, thereby making implementation of the EMP a legal requirement according to the Contract. The Contractor will then prepare a site specific EMP which will be approved and monitored by the Engineer. The Engineer will note any non-conformance with the site specific EMP (and the EMP) the Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the site specific EMP the Contractor should employ Environmental and Social experts to monitor and report Project activities throughout the Project Construction Phase.

The implementation of these steps will ensure that the project is executed in an environmentally sustainable manner.

ANNEXURES

ANNEX-I
ENVIRONMENTAL MONITORING REPORT



ENVIRONMENTAL MONITORING REPORT JANUARY - 2025

NATIONAL ENGINEERING SERVICES PAKISTAN (Pvt) Ltd

Project: Construction of Bridge-3 RUDA

Prepared by: Environmental Services

Pakistan Pvt Ltd (ESPAK)

Web: www.espak.com.pk

Email: info@espak.com.pk

DISCLAIMER

This report is produced in compliance with the client request National Engineering Services Pakistan (Pvt) Limited, for Construction of Bridge-3 RUDA. The information contained in this report was collected and produced from site visit, monitoring and analysis data. The information provided and contained in this report is to the best of our knowledge, correct and up to date. Environmental Services Pakistan (ESPAK) accepts no responsibility for changes made to this document by any third party once report is submitted to the client.

Signature: _____

Chief Chemist: Muhammad Arfan

Dated: February 7, 2025

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ABBREVIATIONS

| | |
|-----------------------|--|
| AA | Ambient Air |
| APHA | American Public Health Administration |
| CO₂ | Carbon Dioxide |
| CO | Carbon Monoxide |
| EPA | Environmental Protection Agency |
| NO | Nitrogen Oxide |
| NO₂ | Nitrogen Dioxide |
| NO_x | Oxides of Nitrogen |
| O₃ | Ozone |
| PEQS | Punjab Environmental Quality Standards |
| DW-PEQS | Drinking Water-Punjab Environmental Quality Standards |
| NL | Noise Level |
| PEPA | Pakistan Environmental Protection Act 1997(Amended 2012) |
| SPM | Suspended Particulate Matter |
| PM | Particulate Matter |
| SO₂ | Sulphur Dioxide |
| USEPA: | United states Environmental Protection Agency |
| ESPAK | Environmental Services Pakistan |

UNITS

| | |
|---------------------------|----------------------------------|
| M: | Meter |
| °C: | Degree Celsius |
| Sec: | Seconds |
| Ppm: | Parts per Million |
| Mg/l: | Milligram per Litre |
| Mg/Nm³: | Milligram per Normal cubic meter |
| µg/m³: | Microgram per cubic meter |
| Mg.kg-1 | Milligram per Kilogram |

CHAPTER# 1. INTRODUCTION

The Ravi Urban Development Authority (RUDA), an urban development authority of Punjab Government, is at the forefront of developing a sustainable and eco-friendly city along with the Ravi River of Lahore. In line with their mission to enhance flood control measures and construct a resilient riverfront, work is underway River Training Works (RTW) and Barrages.

1.1 Objectives

The environmental monitoring is required for the constructional activities in accordance with EPA regulation and environmental management plan. M/S National Engineering Services Pakistan (NESPAK) (Pvt) Ltd hired the services of M/s Environmental Services Pakistan for environmental monitoring of the following sites.

The objective of this study is to:

- Comply with the regulatory requirements of the project;
- To Assess the current environmental conditions in surrounding areas
- Assessing the impact of plant operations on surrounding areas
- Monitor ambient air, noise level in study area/survey area;
- Analyze water quality.

1.2 Scope of Services

The environmental monitoring / sampling was conducted at advised locations for following environmental parameters.

- Ambient Air Quality Monitoring
- Noise Level Monitoring
- Waste Water
- Ground Water

| Sr. No. | Required Testing/ Parameters | Sampling Duration | Quantity |
|---------|--------------------------------|--------------------------------|----------|
| 1. | Ambient Air Quality Monitoring | Averaging Period 24 Hours | 03 |
| 2. | Noise Level Monitoring | 24 Hours Continuous Monitoring | 03 |
| 3. | Ground Water Sampling | Grab Sampling | 01 |
| 4. | Surface Water Sampling | Grab Sampling | 01 |

1.3 Monitoring Duration

The environmental monitoring of project was carried out from 15/01/2025 to 18/01/2025 conducted through EPA Certified Environmental Laboratory; Environmental Services Pakistan (ESPAK).

1.4 Monitoring Team

| Sr. No. | Name | Designation | Qualification | Experience |
|---------|-----------------|---------------|----------------------------|------------|
| 1. | Zain-ul-Abideen | Field Analyst | B.s Environmental Sciences | 01 Year |

1.5 Project Locations

Locations for sampling and monitoring of required environmental parameters were identified by client.

Table 1-1: List of Ambient Air & Noise Monitoring Locations

| Sr. No. | Monitoring Locations | Latitude | Longitude |
|---------|--|-------------|-------------|
| I. | Babakwal Govt Boys High School, Lahore | 31.70520°N | 74.34399°E |
| II. | Bhaini Road, Lahore | 31.624285°N | 74.436202°E |
| III. | Near Sangian Wasapur, Lahore | 31.640163°N | 74.40829°E |

Table 1-2: List of Ground Water Sampling Locations

| Sr. No. | Monitoring Locations | Latitude | Longitude |
|---------|--------------------------------|----------|-----------|
| I. | Bhaini Road, Lahore | | |
| II. | Babakwal Govt Boys High School | | |

Table 1-3: List of Surface Water Sampling Locations

| Sr. No. | Monitoring Locations | Latitude | Longitude |
|---------|------------------------------|----------|-----------|
| I. | Ravi River at Pandia Village | | |

CHAPTER# 2. METHODOLOGY

Following is the brief description of methodology adopted for this environmental monitoring:

2.1 Survey Planning

The project started with a planning of project activities with a management of the National Engineering Services (NESPAC) (Pvt) Ltd.

2.1.1 Identification of Monitoring Locations

NESPAC Pvt Ltd provided location map of proposed project sites. Following criterion was used to finalize the sampling locations on the given site.

- Area where there will be project activities;
- Present environmental conditions at the site.

2.2 Sampling and Analysis Methods

The sampling and testing methods are given in following sections of the report.

2.3 Ambient Air Quality Monitoring

Ambient air quality monitoring was conducted at advised sampling locations to assess the concentration of pollutants (Carbon monoxide, Oxides of Nitrogen (NO, NO₂), Sulphur dioxide (SO₂), Ozone, PM_{2.5} and PM₁₀, SPM). Selection of monitoring locations was based on the environmental factors including wind direction on the particular day and amount of turbulence in the air etc.

Reference method used for the measurements are included as Table 2.1 while the description is provided in subsequent sections.

Table 2-1: Methodology of Ambient Air Quality Monitoring

| Air Pollutant | Monitoring Technique | Instrument Used | Reference Method | Sampling Duration |
|-----------------------------------|---|--|---------------------------------|-------------------|
| Carbon monoxide (CO) | Non-Dispersive Infrared Absorption (NDIR) | Environment S.A CO Analyzer | 40 CFR Part 50, App. C (US-EPA) | 8 hours |
| Sulfur Dioxide (SO ₂) | UV fluorescence (UVF) | Environment S.A SO ₂ Analyzer | EQSA-0197-114 (US-EPA) | 24hours |
| Oxides of Nitrogen | Reduced Pressure Chemiluminescence (CLD) | Environment S.A NO _x Analyzer | 40 CFR Part 50, App F (US-EPA) | 24 hours |

| Air Pollutant | Monitoring Technique | Instrument Used | Reference Method | Sampling Duration |
|--|-------------------------------------|---|--------------------------------|-------------------|
| Particulate Matter (PM ₁₀ , PM _{2.5}) | Beta Ray Absorption Method | Metone BAM | 40 CFR Part 50, App J (US-EPA) | 24 hours |
| Particulate Matter (SPM) | Gravimetric Method | High Volume Air Sampler | 40 CFR Part 50, App J (US-EPA) | 24 Hours |
| Ozone O ₃ | Non-Dispersive UV Absorption (NDIR) | Environment S.A O ₃ Analyzer | 40 CFR Part 53 | 1 Hour |

2.3.1 Carbon monoxide (CO)

Carbon monoxide (CO) was monitored using Environment S.A CO Analyzer. The Environment S.A CO Analyzer measures CO concentration using a non-dispersive infrared (NDIR) absorption method that is based on the nature of CO in that it absorbs special infrared light. Continuous data was recorded for 24 hr.

2.3.2 Oxides of Nitrogen

Oxides of Nitrogen (NO_x) were monitored using Environment S.A NO_x Analyzer. The analyzer measures NO, NO₂ and NO_x using chemiluminescence (CLD) method with the help of chemical reaction between NO₂ and O₃. Continuous data was recorded for 24 hr.

2.3.3 Sulphur Dioxide (SO₂)

SO₂ Sulphur dioxide was monitored using Environment S.A SO₂ Analyzer. The Environment S.A SO₂ Analyzer measures SO₂ using UV fluorescence method that operates on the principle that when the SO₂ molecules contained in the sample gas are excited by ultraviolet radiation they emit a characteristic fluorescence in the range of 220- 240 nm. This fluorescence is measured and the SO₂ concentration is obtained from changes in the intensity of the fluorescence. Continuous data was recorded for 24 hr.

2.3.4 Particulate Matter (PM₁₀ and PM_{2.5})

Particulate matter concentration in terms of PM₁₀ and PM_{2.5} was monitored in the ambient air with the help of High-Volume Air Sampler. PM₁₀ and PM_{2.5} sampling was conducted for period of 24 hour at identified sampling locations with the help of fiberglass filters. The filters were properly stored and placed in the vacuum zipper bag in order to avoid moisture and transported to ESPAK Laboratory for detection of PM₁₀.

Suspended Particulate Matter (SPM) was measured through gravimetric sampling method by using of high-volume air sampler. The sampling continues for 24 hours at identified sampling

locations. For this purpose, fiber glass filters were used to collect the SPM. The filters were stored and transported to ESPAK Laboratory for further analysis.

2.3.5 Ozone (O₃)

Ozone was monitored using Environment S.A O₃ Analyzer. Sampling was conducted for period of 1 hour at identified sampling locations. The analyzer automatically measures and records ozone concentration levels (in milligrams or micrograms per cubic meter) using the industry-proven principle of non-dispersive UV absorption.

2.4 Noise Level

Noise level monitoring was conducted at identified locations using BENTECH Sound Meter. All noise monitoring was conducted in accordance with the guidance set out in BS 7445:2003. Measurements were made using 1/1 Octave in accordance with IEC61260-1:2014 and ANSI S1.11-2004. Meters were calibrated and checked before and after each measurement period by using sound level calibrator.

2.5 Water Sampling

Following methodology was adopted for water sampling and analysis:

2.5.1 Sample Collection

The water samples were collected from identified sampling points. The sampling was carried out in accordance to the Standard Operating Procedures (SOP) based on the recognized methods of United State Environmental Protection Agency (USEPA), World Health Organization (WHO) and American Public Health Administration (APHA) for water sampling and analysis.

2.5.2 Measurement of Field Parameters

Parameters that quickly degrade after they are sampled must be tested in the field. Following parameters were measured in field that can significantly change during storage and transportation. These includes: -

✓ pH (Measured at site)

✓ Temperature

2.5.3 Preservation

Preservation is important in order to minimize the changes in the sample. The collected water samples were preserved in appropriate containers as per APHA Guidelines.

2.5.4 Sample Identification and Chain of Custody

The collected samples were labeled and assigned a unique sample identification number, sampling date and time of collection to collected samples. All the relevant information (sample

location, time of collection, sample identification, temperature, pH, collected by, preservation techniques etc.) was recorded immediately on the Chain of Custody form signed by ESPAK field Analyst.

2.5.5 Transportation

A shipping container (Ice box with eutectic cold packs instead of ice) with maintained temperature of $4^{\circ}\text{C} \pm 5^{\circ}\text{C}$ was used for transporting the sample from the collection site to the environmental laboratory.

2.5.6 Parameters

Parameters provided in the scope of work for the testing include following:

- Ground Water
- Surface Water

The samples of waste water were collected from identified sampling points. The collected samples were given to laboratory for analysis of parameters that are listed in table 2.2.

2.5.7 Methods of Analysis

Drinking Water:

Table 2-2: Parameters and Methods Used for Testing of Drinking Water

| S. No | Parameters | Method / Equipment Used | Reference |
|-------|-------------------------------------|----------------------------|---------------------------|
| 1 | Total Coliforms | Multiple Tube Fermentation | SMWW 9221 B |
| 2 | Fecal Coliform Bacteria | Multiple Tube Fermentation | SMWW 9221 F |
| 3 | E. Coli | Multiple Tube Fermentation | SMWW 9221 F |
| 4 | Color | Spectrophotometer | SMWW 2120 C |
| 5 | Taste | Organoleptic | Organoleptic |
| 6 | Odor | Organoleptic | Organoleptic |
| 7 | Turbidity | Nephelometer | SMWW 2130B |
| 8 | Total Hardness as CaCO_3^* | Titration | SMWW 2340C |
| 9 | Total Dissolved Solids (TDS)* | Gravimetric | SMWW 2540C |
| 10 | pH* | Electrometric | SMWW 4500H*B |
| 11 | Aluminum (Al) | ICP-AES | SMWW 3111 |
| 12 | Antimony (Sb) | ICP-AES | SMWW 3111 |
| 13 | Arsenic (As) | ICP-AES | SMWW 3114 B |
| 14 | Barium (Ba) | ICP-AES | SMWW 3111 |
| 15 | Boron (B) | ICP-AES | SMWW 4500-B B |
| 16 | Cadmium (Cd) | ICP-AES | SMWW 3111 |
| 17 | Chloride (as Cl^-) * | ICP-AES | SMWW 3111 |
| 18 | Chromium (Cr) | ICP-AES | SMWW 3111 |
| 19 | Copper (Cu) | ICP-AES | SMWW 3111 |
| 20 | Cyanide (CN^-) | Ion Selective Electrode | SMWW 4500 CN^- F |
| 21 | Fluoride (F^-) * | Ion Selective Electrode | U.S. EPA 9214 |
| 22 | Lead (Pb) | ICP-AES | SMWW 3111 |
| 23 | Manganese (Mn) | ICP-AES | SMWW 3111 |
| 24 | Mercury (Hg) | ICP-AES | SMWW 3112 |
| 25 | Nickel (Ni) | ICP-AES | SMWW 3111 |

| S. No | Parameters | Method / Equipment Used | Reference |
|-------|---|---------------------------|---|
| 26 | Nitrate (NO ₃ ⁻) | UV Spectrophotometer | SMWW 4500NO ₃ ⁻ B |
| 27 | Nitrite (NO ₂ ⁻) | Spectrophotometer | SMWW 4500NO ₂ ⁻ B |
| 28 | Selenium (Se) | ICP-AES | SMWW 3114 B |
| 29 | Residual Chlorine | DPD Colorimetric | SMWW 4500-Cl B |
| 30 | Zinc (Zn) | ICP-AES | SMWW 3111 |
| 31 | Phenolic Compounds (as Phenols) | Spectrophotometer | SMWW 5530 C |
| 32 | Total Suspended Solids (TSS)* | Gravimetric | SMWW 2540 D |
| 33 | Biochemical Oxygen Demand (BOD ₅) | Respirometer | SMWW 5210B |
| 34 | Chemical Oxygen Demand (COD)* | Closed Reflux Photometric | U.S. EPA 1664 B |
| 35 | Grease and Oil (as n-HEM) | Extraction Gravimetric | SMWW 4500-O G |
| 36 | Dissolved Oxygen (DO) | Titrimetric | Calculated Value |
| 37 | Total Toxic Metals | Calculation | SMWW 3111 |
| 38 | An-ionic detergents (as MBAS) | Spectrophotometer | SMWW 4500 SO ₄ ²⁻ C |
| 39 | Sulfate (SO ₄) | Gravimetric | SMWW 4500 - S ²⁻ F |
| 40 | Sulfide (S ²⁻) | Titrimetric | SMWW 4500-NH ₃ - D |
| 41 | Ammonia (NH ₃) | Ion Selective Electrode | SMWW 4500-Cl B |
| 43 | Pesticides | Screening | U.S.EPA-200.7 |
| 44 | Iron (Fe) | ICP-AES | Thermometer |
| 45 | Temperature | Thermometer | U.S. EPA-200.7 |

Table 2-2: Parameters and Methods Used for Testing of Surface Water

| S. No | Parameters | Method / Equipment Used | Reference |
|-------|--|---------------------------------|---|
| 1 | pH value (H ⁺) * | By pH meter | SMWW 4500H ⁺ B |
| 2 | Biochemical Oxygen Demand (BOD ₅) at 20 °C | Incubator, Titration | SMWW 5210 B |
| 3 | Chemical Oxygen Demand (COD)* | Digester & Photometer | SMWW 5220 D |
| 4 | Total Suspended Solids (TSS)* | Gravimetric method | SMWW 2540 D |
| 5 | Total Dissolved Solids (TDS)* | Gravimetric method | SMWW 2540 C |
| 6 | Phenolic Compounds (as Phenol) | 4-Aminoantipyrine Method | SMWW 5530 C |
| 7 | Grease and Oil (as n-HEM) | Pyrex Glassware | U.S.EPA 1664 B |
| 8 | Chloride (as Cl ⁻) * | Argentometry Titration | SMWW 4500Cl ⁻ -B |
| 9 | Fluoride (as F ⁻) * | Ion Selective Electrode | U.S. EPA 9214 |
| 10 | Cyanide (as CN ⁻) | Ion Selective Electrode | SMWW 4500 CN- F |
| 11 | An-ionic detergents (as MBAS) | Spectrophotometer | SMWW 5540 C |
| 12 | Sulfate (SO ₄ ²⁻) * | Gravimetric method | SMWW 4500 - SO ₄ ²⁻ C |
| 13 | Sulfide (S ²⁻) | Titration Method | SMWW 4500 - S ²⁻ F |
| 14 | Ammonia (NH ₃) | Ion Selective Electrode & Meter | SMWW 4500-NH ₃ - D |
| 15 | Chlorine (Cl) | DPD Method | SMWW 4500-Cl B |
| 16 | Cadmium (Cd) | ICP-AES | SMWW 3111 |
| 17 | Chromium (Trivalent and Hexavalent) | ICP-AES | SMWW 3111 |
| 18 | Copper (Cu) | ICP-AES | SMWW 3111 |
| 19 | Iron (Fe) | ICP-AES | SMWW 3111 |

| S. No | Parameters | Method / Equipment Used | Reference |
|-------|--------------------|-------------------------|------------------------------|
| 20 | Lead (Pb) | ICP-AES | SMWW 3111 |
| 21 | Manganese (Mn) | ICP-AES | SMWW 3111 |
| 22 | Mercury (Hg) | ICP-AES | SMWW 3112 |
| 23 | Selenium (Se) | ICP-AES | SMWW 3114 B |
| 24 | Nickel (Ni) | ICP-AES | SMWW 3111 |
| 25 | Silver (Ag) | ICP-AES | SMWW 3111 |
| 26 | Zinc (Zn) | ICP-AES | SMWW 3111 |
| 27 | Arsenic (As) | ICP-AES | SMWW 3114 B |
| 28 | Barium (Ba) | ICP-AES | SMWW 3111 |
| 29 | Boron (B) | ICP-AES | SMWW 4500-B B |
| 30 | Total Toxic Metals | --- | Calculated Value |
| 31 | Pesticides | --- | SMWW 4500-P J |
| 32 | Temperature | Thermometer | SMWW 4500-NO ₃ -D |

Note: SMWW = Standard Method for the Examination of Water and Wastewater, 23rd Edition (2017)

USEPA: United States Environmental Protection Agency

CHAPTER# 3. RESULTS AND DISCUSSION

3.1 Ambient Air Results

This section of the report presents the testing results of Ambient Air {CO, NO_x, SO₂, Ozone (O₃), PM₁₀, PM_{2.5}, SPM} and Ambient Noise. Concentration of all the below mentioned parameters were measured at Identified sampling location to get an overview of the air quality. The detail results of measure concentration at each sampling location are given in **Annexure-A**.

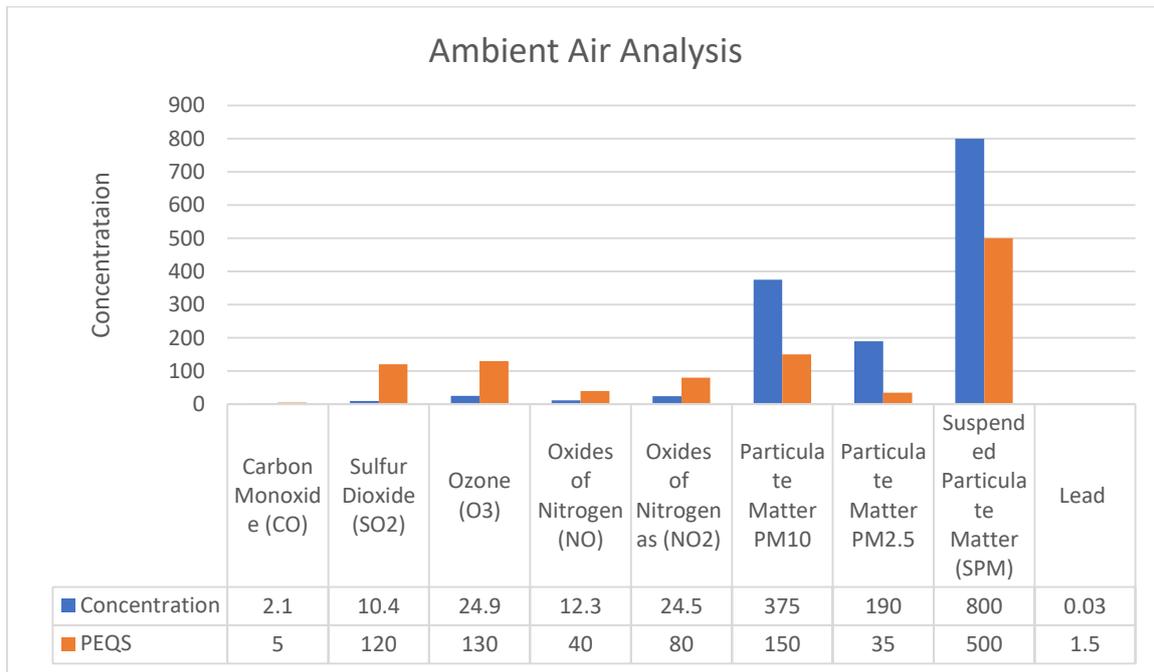


Figure 3-1: Comparison of Measured Concentrations at Babakwal Govt Boys High School

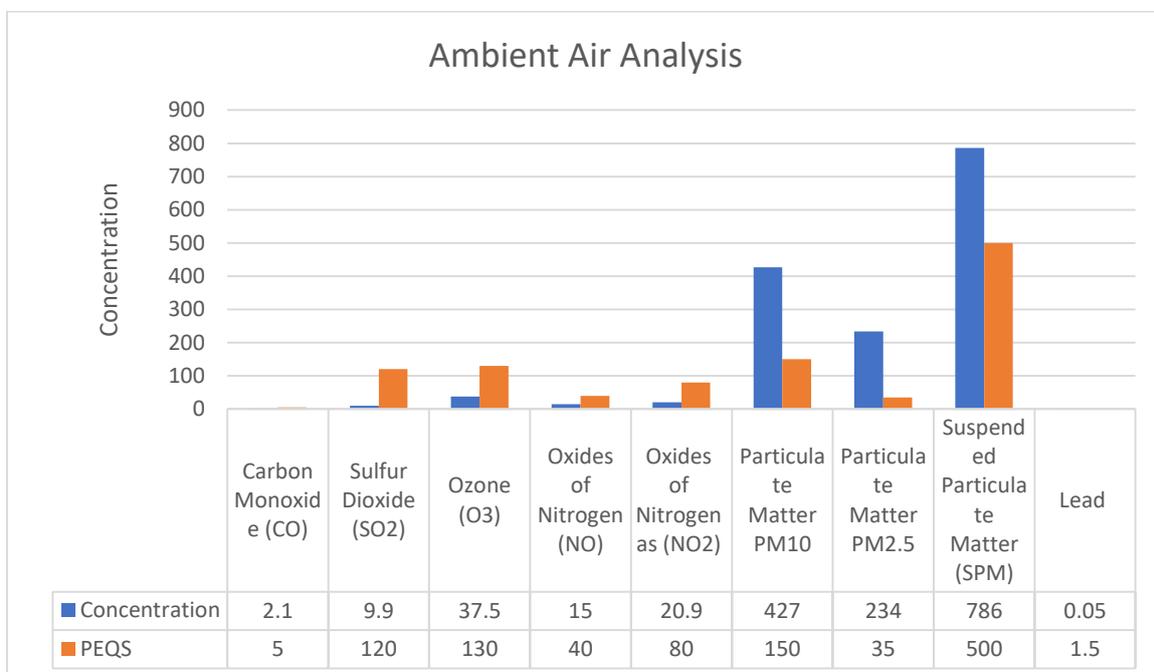


Figure 3-2: Comparison of Measured Concentrations at Bhaini Road, Lahore

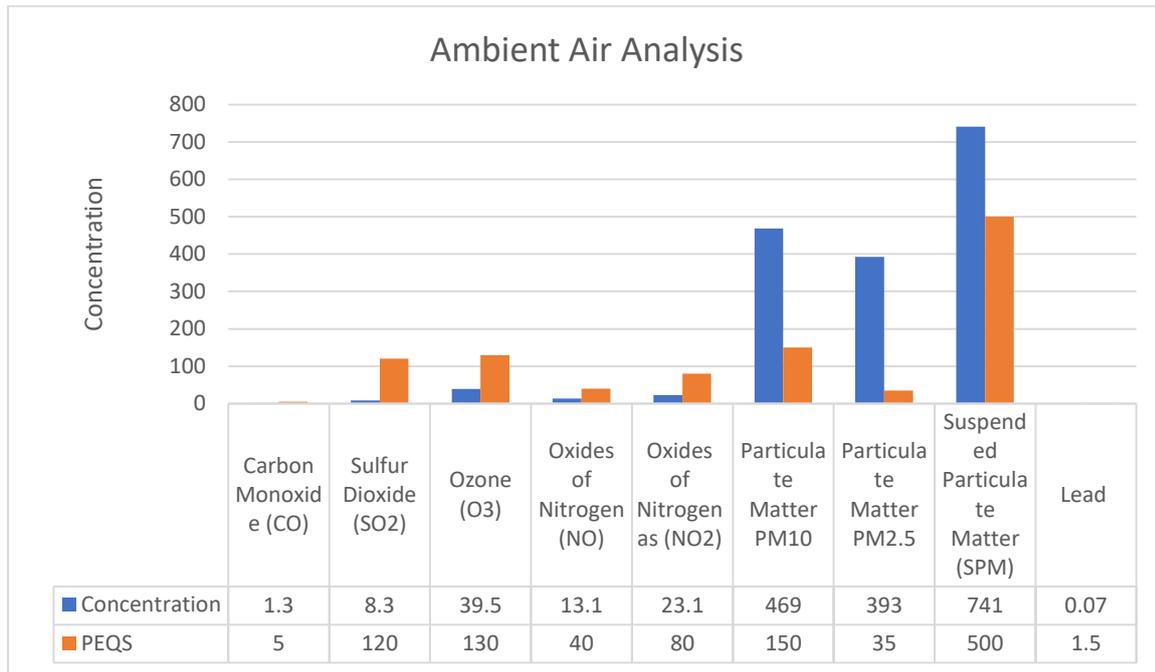


Figure 3-3: Ambient Air Monitoring Near Sagian Wasapur

Discussion:

The ambient air monitoring was carried at the time when the surrounding operations were in full function. The 24 hours duration provides enough time to analyze ambient air during periods of service throughout the daily work routine. Analysis of ambient air revealed that concentration of particulate matter including PM₁₀, PM_{2.5} & SPM were found exceeding to the limits (PEQS). If possible, the working process should be improved during the day and night and ensure the use of protective equipment for the labor.

Graphical representation of all parameters with comparison of PEQS limits are shown above Figure 3-1. Detailed monitoring reports are attached as **Annexure-A**.

Mitigations:

Due to the elevated concentrations of PM₁₀, PM_{2.5}, and SPM, it is recommended to implement air pollution control measures, such as water sprinklers, to effectively manage dust in areas prone to dust generation. In-addition to that, the use of PPEs should be ensured to combat toxic concentrations of particulate matter particularly.

3.2 Noise Level Monitoring Results

Noise is an important environmental stressor and is essential part of environmental studies for projects. Noise has become a very important "stress factor" in the environment of human. The term "noise pollution" has been recently used to signify the hazard of sounds which are consequence of modern-day development, leading to health hazards of different type. Noise is described as an unwanted sound emitted from un-avoidable sources of anthropogenic activities.

The noise monitoring activity was carried out at the project site and the surrounding areas of project site. Detailed environmental monitoring reports are attached as **Annexure-B**.

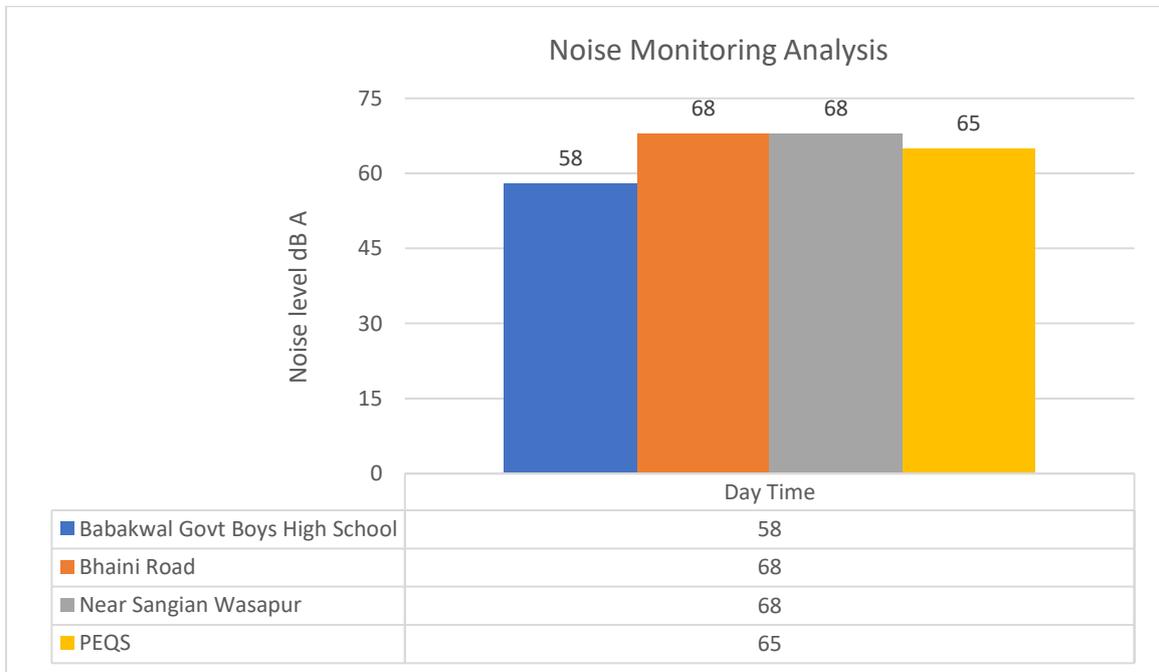


Figure 3-4: Comparison of Background Noise Levels with PEQS During Day Time

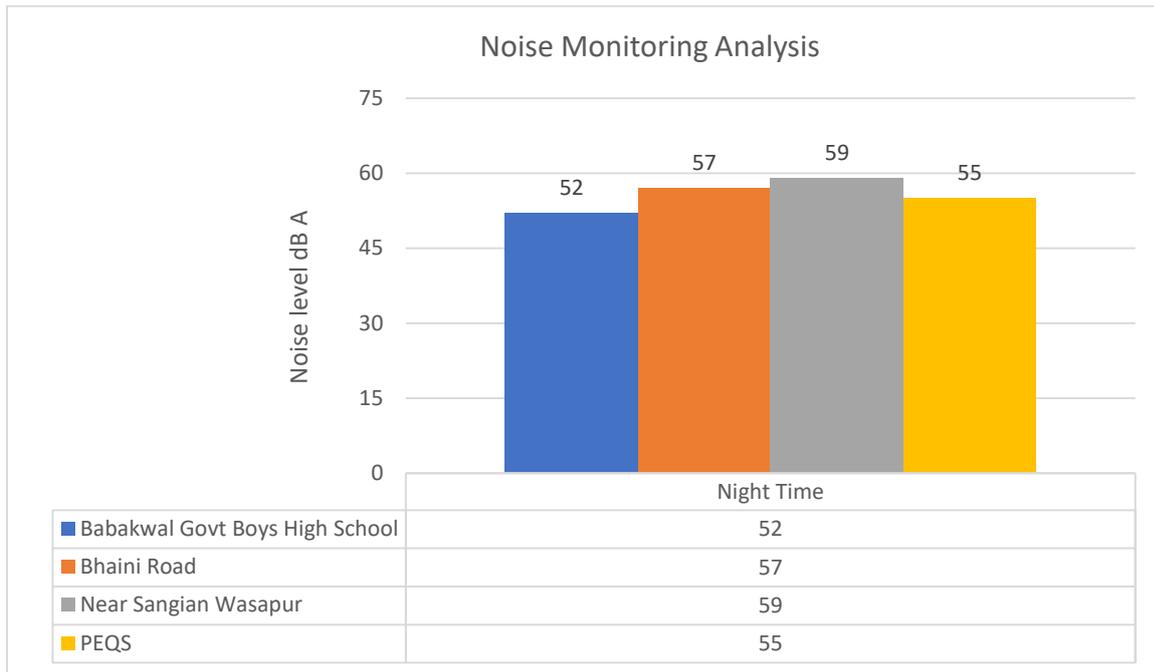


Figure 3-5: Comparison of Background Noise Levels with PEQS During Night Time

Discussion:

Noise levels were monitored at three different sites for 24 hours using Bentech sound meter. According to the monitoring results noise intensities at two spots were found to be exceeding the limits prescribed by PEQS. The graph shows the highest noise level recorded during daytime at two sites i.e. Bhaini Road and Near Sagian Wasapur respectively. Likewise, same spots are found to have the highest noise level during the night time A graphical representation of the measurement results is presented separately (day and night time) in Figure 3-4 and 3-5 above. Detailed monitoring reports are attached as **Annexure-B**.

Mitigation Measure:

Necessary measures should be carried out to reduce the noise levels at the sampling spots. Administrative controls such as the usage of high noise producing machinery like excavators should be ensured after the school time. Moreover, the utilization of protective equipment like ear plugs or ear muffs should be used by labor while working.

3.3 Ground Water Analysis

An essential element for livelihood, domestic, industrial and agricultural activities, all the terrestrials living on this earth planet have to entirely depend upon water. Water, one of the abundant commodities found in nature, is covering approximately three fourths of the surface of the earth.

Over 97% of the total quantity of water is in the oceans and other saline bodies of water and is not readily available for any use. Over 2% is tied up in polar ice caps and glaciers and in atmosphere and as soil moisture, which is inaccessible. Only 0.62% of water found in fresh water lakes, rivers and groundwater supplies, irregularly and non-uniformly distributed over the vast area of the global earth.

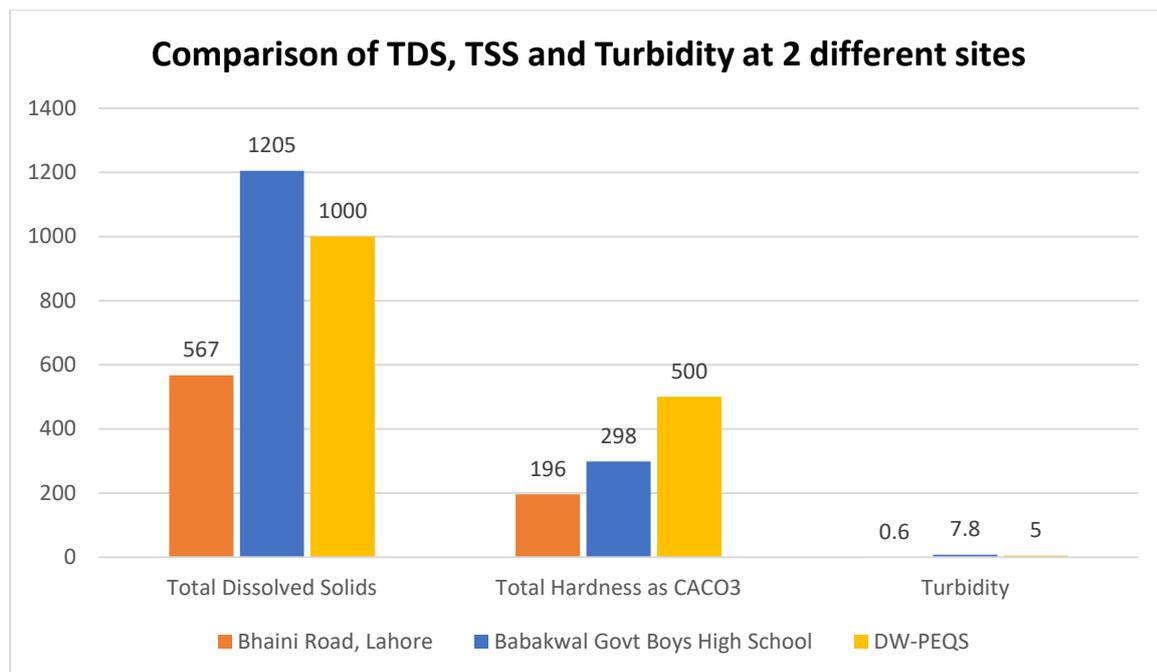


Figure 3-6: Comparison of Concentrations with DW-PEQS

Discussion

Ground water samples were collected from two spots i.e. Babakwal Govt Boys High School and Bhaini Road respectively. According to sampling protocol defined in APHA 1060 B. The samples were preserved as per APHA 1060 C. Sample for microbiological testing were collected in according to APHA 9060 A and preserved as per APHA 9060 B and afterwards, transported to ESPAK Laboratory for the analysis.

The majority of the parameters in the groundwater sample taken from Babakwal Govt Boys High School exceed the prescribed limits outlined in the DW-PEQS standards. On the contrary, all the parameters in the sample taken from Bhaini road are found to be in compliance

with the prescribed DW-PEQS standards. These variations indicate the distinct characteristics of the water in the area. The detailed monitoring reports are attached as **Annexure-C**.

Mitigations:

In order to reduce the contamination, the use of advanced groundwater treatment technologies like RO filtration systems for school and communities should be ensured. Moreover, regulatory framework should be strengthened to minimize and identify the issue at the source. .

3.4 Surface Water Analysis

Surface waters are always exposed to atmospheric environment on the surface of earth in the form of mobile and immobile situation including snow masked mountains, Ice-caps, Glaciers, rivers, non-river streams, rain, sleet, wetlands, watersheds and oceans. These waters are potable or toxic would depend on environment of adjoining area. Surface Water are type of water which all the time exposed to the atmospheric environment and can be the target of any anthropogenic or non-anthropogenic activities at any moment of time. Surface resourced chemical and biological pollution and thus are not used for sensitive applications such as drinking directly, unless it is pretreated.

Graphical representation of major parameters for surface water samples described below and detailed reports are attached as **Annexure-D**.

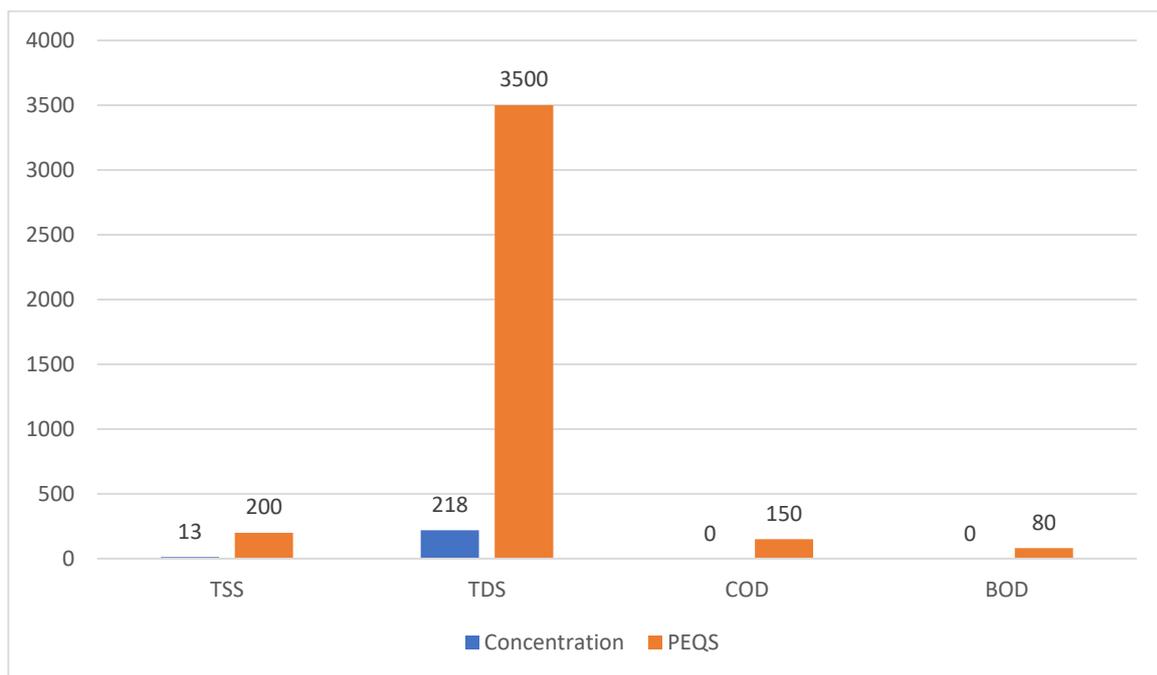


Figure 3-7: Graphical representation of the major parameters in SW from Ravi River at Pandia Village

Discussion

The sample of surface water was collected from River Ravi at Pandia Village According to sampling protocol defined in APHA 1060 B. The sample was preserved as per APHA 1060 C. According to laboratory results, all the parameters were found in compliance to permissible limits (PEQS).

Mitigations:

No specific mitigations are suggested

CHAPTER# 4. CONCLUSION

The ambient air monitoring was carried at three (3) different locations throughout the whole day (24 Hours). Analysis of ambient air revealed the concentration of highly important parameters like PM₁₀, PM_{2.5} & SPM at all 3 sites are found surpassing the prescribed PEQS limits. Specific mitigations measures are required and the working process should be improved during the day and night. In-addition to that, the use of protective equipment for the labor and students must be ensured.

Noise levels were monitored 24 hours using Bentech sound meter. According to the monitoring results, out of all three (3) sites, two of the sites were found to be exceeding the prescribed PEQS limit for noise both during day and night time. In order to reduce the noise levels the use of ear plugs or ear muffs by the labor must be ensured. Moreover, usage of high noise producing machinery like excavators should be ensured after the school time.

Two (2) Ground water samples were collected from identified sampling points according to sampling protocol defined in APHA 1060 B. According to the test results, most of the parameters in the sample taken from Babakwal Govt High School were not in compliance with the prescribed DW-PEQS. Strict regulations and the introduction of advanced technologies like RO filtration systems should be ensured.

The sample of surface water was collected from River Ravi at Pandia Village according to sampling protocol defined in APHA 1060 B. The sample was preserved as per APHA 1060 C. According to laboratory results, all the parameters were found in compliance to permissible limits (PEQS). So, no specific mitigations are suggested.

ANNEXURE – A

Ambient Air Results

CHEMICAL ANALYSIS TEST REPORT (AMBIENT AIR)



Reference Number: ESPAK/00043P/25/AA/00758/00100 Date: 27/01/2025

Name of Industry/Client: National Engineering Services Pakistan (Pvt) Limited

Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore

Project Name: Construction of Bridge-3 RUDA

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Ambient Air Monitoring Location: Babakwal Govt Boys High School, Lahore (GPS: 31.70520°N, 74.34399°E)

Date of Sample Collection: 15/01/2025

Sample Collected/Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK Grab / Composite: Continuous - 24 Hours

Date of Completion of Analysis: 16/01/2025

| S. No | Parameters | Limit Values (PEQS-24 Hours) | Concentration | Method / Equipment Used | Remarks |
|-------|---------------------------------------|--------------------------------|------------------------|---|-----------------------------|
| 1 | Carbon Monoxide (CO) | 5 mg/m ³ (8 Hours) | 2.1 mg/m ³ | Non Dispersive Infrared Absorption (NDIR) | Within Prescribed Limits |
| 2 | Sulfur Dioxide (SO ₂) | 120 µg/m ³ | 10.4 µg/m ³ | UV Fluorescence (UVF) | Within Prescribed Limits |
| 3 | Ozone (O ₃) | 130 µg/m ³ (1 Hour) | 24.9 µg/m ³ | Non Dispersive UV Absorption | Within Prescribed Limits |
| 4 | Oxides of Nitrogen as NO | 40 µg/m ³ | 12.3 µg/m ³ | Chemiluminescence Detection | Within Prescribed Limits |
| 5 | Oxides of Nitrogen as NO ₂ | 80 µg/m ³ | 24.5 µg/m ³ | Chemiluminescence Detection | Within Prescribed Limits |
| 6 | Particulate Matter PM _{2.5} | 35 µg/m ³ | 190 µg/m ³ | Particulate Sensor | Exceeding Prescribed Limits |
| 7 | Particulate Matter PM ₁₀ | 150 µg/m ³ | 375 µg/m ³ | Particulate Sensor | Exceeding Prescribed Limits |
| 8 | Suspended Particulate Matter (SPM) | 500 µg/m ³ | 800 µg/m ³ | High Volume Sampler (HVS) | Exceeding Prescribed Limits |
| 9 | Lead (Pb) | 1.5 µg/m ³ | 0.03 µg/m ³ | ASS after Sampling by HVS | Within Prescribed Limits |

PEQS: Punjab Environmental Quality Standards for Ambient Air, 2016

Note:

- The report should be reproduced as a whole and not in parts.
- The responsibility of the ethical use of this report lies with the client.
- The values represent sample conditions when monitoring/testing was carried out.
- The report data is not intended to be used legally by the client.

1. Sample Analyzed By: Zain-ul-Abideen Nageen Arshad
Analyst (Field) Analyst (Chemical)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
General Manager
Date: 27/01/2025



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

Page 1 of 1

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 **Peshawar Office**
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Dean's Trade Center
Sadar Cantt,
Peshawar, Pakistan.
Tel: +92 312 0849999



| | |
|--------------------------|--|
| Reference Number | ESPAK/00043P/25/AA/00758/00100 |
| Name of Industry/ Client | National Engineering Services Pakistan (Pvt) Limited |
| Address | NESPAK House, 1-C, Block-N, Model Town Extension, Lahore |
| Project Name: | Construction of Bridge-3 RUDA |
| Monitoring Location | Babakwal Govt Boys High School, Lahore |
| GPS Coordinates | 31.70520°N, 74.34399°E |
| Monitoring Date | 15/01/2025 to 16/01/2025 |

| Date - Time | CO | SO ₂ | O ₃ | NO | NO ₂ | PM _{2.5} | PM ₁₀ | TSP | Temp. | RH | Wind Speed | Wind Direction |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------|-----|------------|----------------|
| | mg/m ³ | ug/m ³ | °C | % | m/s | |
| 15-01-25 21:00 | 2.7 | 10.1 | 24.9 | 12.1 | 19.1 | 147.0 | 385 | 800 | 9 | 94 | 0.9 | CALM |
| 15-01-25 22:00 | 2.2 | 10.2 | | 10.5 | 19.2 | 142.0 | 287 | | 8 | 93 | 0.0 | CALM |
| 15-01-25 23:00 | 2.9 | 8.2 | | 13.1 | 19.8 | 174.0 | 584 | | 8 | 93 | 0.0 | CALM |
| 15-01-25 0:00 | 2.6 | 9.7 | | 10.8 | 20.1 | 150.0 | 431 | | 8 | 93 | 0.6 | CALM |
| 16-01-25 1:00 | 2.1 | 11.4 | | 11.2 | 20.4 | 147.0 | 273 | | 8 | 93 | 0.0 | CALM |
| 16-01-25 2:00 | 1.1 | 8.7 | | 14.6 | 19.1 | 105.0 | 514 | | 8 | 91 | 0.6 | CALM |
| 16-01-25 3:00 | 1.7 | 10.6 | | 11.0 | 20.3 | 275.0 | 501 | | 8 | 93 | 0.6 | CALM |
| 16-01-25 4:00 | 1.8 | 11.7 | | 11.2 | 23.4 | 95.0 | 287 | | 8 | 90 | 0.0 | CALM |
| 16-01-25 5:00 | | 13.1 | | 10.1 | 24.9 | 87.0 | 364 | | 8 | 91 | 0.6 | CALM |
| 16-01-25 6:00 | | 13.8 | | 10.8 | 24.7 | 157.0 | 704 | | 7 | 92 | 0.0 | CALM |
| 16-01-25 7:00 | | 14.8 | | 14.6 | 24.2 | 115.0 | 796 | | 8 | 90 | 0.0 | CALM |
| 16-01-25 8:00 | | 10.8 | | 14.3 | 26.5 | 975.0 | 364 | | 7 | 93 | 0.4 | N |
| 16-01-25 9:00 | | 9.9 | | 14.9 | 27.0 | 254.0 | 217 | | 7 | 92 | 0.0 | NW |
| 16-01-25 10:00 | | 11.2 | | 15.4 | 26.7 | 214.0 | 195 | | 7 | 93 | 0.4 | NNE |
| 16-01-25 11:00 | | 9.2 | | 13.9 | 25.5 | 367.0 | 284 | | 7 | 93 | 0.4 | NW |
| 16-01-25 12:00 | | 8.3 | | 10.7 | 22.7 | 168.0 | 177 | | 8 | 93 | 0.5 | NNW |
| 16-01-25 13:00 | | 11.4 | | 10.5 | 23.7 | 113.0 | 252 | | 7 | 93 | 0.4 | N |
| 16-01-25 14:00 | | 8.7 | | 14.6 | 23.9 | 112.0 | 366 | | 8 | 93 | 1.2 | NNW |
| 16-01-25 15:00 | | 9.5 | | 13.7 | 22.6 | 101.0 | 281 | | 8 | 93 | 0.5 | WNW |
| 16-01-25 16:00 | | 11.6 | | 10.5 | 28.6 | 117.0 | 293 | | 7 | 94 | 1.2 | NNE |
| 16-01-25 17:00 | | 9.7 | | 12.4 | 30.5 | 133.0 | 398 | 8 | 93 | 1.2 | SSW | |
| 16-01-25 18:00 | | 7.6 | | 14.6 | 35.2 | 162.0 | 414 | 7 | 94 | 0.5 | CALM | |
| 16-01-25 19:00 | | 8.9 | | 8.8 | 27.8 | 145.0 | 254 | 7 | 94 | 1.2 | CALM | |
| 16-01-25 20:00 | | 9.4 | | 10.5 | 31.7 | 95.0 | 374 | 6 | 95 | 0.0 | CALM | |

| | | | | | | | | |
|---------|-----|------|------|------|------|------|-----|-----|
| Average | 2.1 | 10.4 | 24.9 | 12.3 | 24.5 | 190 | 375 | 800 |
| Maximum | 2.9 | 14.8 | 24.9 | 15.4 | 35.2 | 975 | 796 | 800 |
| Minimum | 1.1 | 7.6 | 24.9 | 8.8 | 19.1 | 87.0 | 177 | 800 |

Monitored By: Zain-ul-Abideen

Zha

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Sadar Cantt,
Peshawar, Pakistan.
Tel: +92 312 0849999



CHEMICAL ANALYSIS TEST REPORT (AMBIENT AIR)



Reference Number: ESPAK/00043P/25/AA/00759/00101 Date: 27/01/2025

Name of Industry/Client: National Engineering Services Pakistan (Pvt) Limited

Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore

Project Name: Construction of Bridge-3 RUDA

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Ambient Air Monitoring Location: Bhaini Road, Lahore
(GPS: 31.624285°N, 74.436202°E)

Date of Sample Collection: 16/01/2025

Sample Collected/Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK Grab / Composite: Continuous - 24 Hours

Date of Completion of Analysis: 17/01/2025

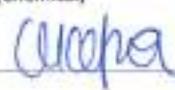
| S. No | Parameters | Limit Values (PEQS-24 Hours) | Concentration | Method / Equipment Used | Remarks |
|-------|---------------------------------------|--------------------------------|------------------------|---|-----------------------------|
| 1 | Carbon Monoxide (CO) | 5 mg/m ³ (8 Hours) | 1.7 mg/m ³ | Non Dispersive Infrared Absorption (NDIR) | Within Prescribed Limits |
| 2 | Sulfur Dioxide (SO ₂) | 120 µg/m ³ | 9.9 µg/m ³ | UV Fluorescence (UVF) | Within Prescribed Limits |
| 3 | Ozone (O ₃) | 130 µg/m ³ (1 Hour) | 37.5 µg/m ³ | Non Dispersive UV Absorption | Within Prescribed Limits |
| 4 | Oxides of Nitrogen as NO | 40 µg/m ³ | 15.0 µg/m ³ | Chemiluminescence Detection | Within Prescribed Limits |
| 5 | Oxides of Nitrogen as NO _x | 80 µg/m ³ | 20.9 µg/m ³ | Chemiluminescence Detection | Within Prescribed Limits |
| 6 | Particulate Matter PM _{2.5} | 35 µg/m ³ | 234 µg/m ³ | Particulate Sensor | Exceeding Prescribed Limits |
| 7 | Particulate Matter PM ₁₀ | 150 µg/m ³ | 427 µg/m ³ | Particulate Sensor | Exceeding Prescribed Limits |
| 8 | Suspended Particulate Matter (SPM) | 500 µg/m ³ | 786 µg/m ³ | High Volume Sampler (HVS) | Exceeding Prescribed Limits |
| 9 | Lead (Pb) | 1.5 µg/m ³ | 0.05 µg/m ³ | ASS after Sampling by HVS | Within Prescribed Limits |

PEQS: Punjab Environmental Quality Standards for Ambient Air, 2016

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- The values represent sample conditions when monitoring/testing was carried out.
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1. Sample Analyzed By: Zain-ul-Abideen Nageen Arshad
Analyst (Field) Analyst (Chemical)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
General Manager
Date: 27/01/2025



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

| | |
|--------------------------|--|
| Reference Number | ESPAK/00043P/25/AA/00759/00101 |
| Name of Industry/ Client | National Engineering Services Pakistan (Pvt) Limited |
| Address | NESPAK House, 1-C, Block-N, Model Town Extension, Lahore |
| Project Name: | Construction of Bridge-3 RUDA |
| Monitoring Location | Bhaini Road, Lahore |
| GPS Coordinates | 31.624285°N ,74.436202°E |
| Monitoring Date | 16/01/2025 to 17/01/2025 |

| Date - Time | CO | SO ₂ | O ₃ | NO | NO ₂ | PM _{2.5} | PM ₁₀ | TSP | Temp. | RH | Wind Speed | Wind Direction |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------|----|------------|----------------|
| | mg/m ³ | ug/m ³ | °C | % | m/s | |
| 16-01-25 21:30 | 2.6 | 10.2 | 37.5 | 14.5 | 16.5 | 515.0 | 437 | 786 | 9 | 91 | 3.4 | CALM |
| 16-01-25 22:30 | 2.1 | 9.6 | | 14.3 | 16.7 | 561.0 | 339 | | 9 | 91 | 1.9 | CALM |
| 16-01-25 23:30 | 2.0 | 10.2 | | 13.2 | 17.2 | 330.0 | 636 | | 9 | 91 | 2.7 | NNW |
| 16-01-25 0:30 | 1.8 | 10.0 | | 13.1 | 17.8 | 180.0 | 483 | | 9 | 90 | 2.6 | CALM |
| 17-01-25 1:30 | 1.3 | 15.0 | | 13.7 | 24.0 | 169.0 | 325 | | 9 | 91 | 2.2 | CALM |
| 17-01-25 2:30 | 1.1 | 12.4 | | 16.2 | 21.5 | 128.0 | 566 | | 8 | 88 | 2.3 | CALM |
| 17-01-25 3:30 | 1.7 | 13.1 | | 13.6 | 21.3 | 125.0 | 553 | | 9 | 90 | 2.7 | CALM |
| 17-01-25 4:30 | 0.9 | 13.8 | | 12.5 | 22.8 | 145.0 | 339 | | 8 | 88 | 2.2 | CALM |
| 17-01-25 5:30 | | 13.6 | | 14.1 | 24.4 | 137.0 | 416 | | 8 | 88 | 2.2 | CALM |
| 17-01-25 6:30 | | 10.1 | | 13.8 | 24.1 | 158.0 | 756 | | 8 | 89 | 2.3 | CALM |
| 17-01-25 7:30 | | 9.4 | | 16.3 | 21.7 | 150.0 | 848 | | 8 | 88 | 2.7 | CALM |
| 17-01-25 8:30 | | 9.2 | | 17.7 | 23.0 | 172.0 | 416 | | 8 | 90 | 1.8 | CALM |
| 17-01-25 9:30 | | 10.4 | | 17.5 | 24.9 | 251.0 | 269 | | 8 | 89 | 2.2 | CALM |
| 17-01-25 10:30 | | 8.9 | | 15.5 | 25.2 | 220.0 | 247 | | 8 | 91 | 1.7 | CALM |
| 17-01-25 11:30 | | 8.2 | | 19.6 | 22.0 | 138.0 | 336 | | 8 | 90 | 2.4 | S |
| 17-01-25 12:30 | | 9.5 | | 15.5 | 23.3 | 130.0 | 229 | | 7 | 91 | 0.9 | SSE |
| 17-01-25 13:30 | | 8.1 | | 14.6 | 21.2 | 146.0 | 304 | | 8 | 91 | 1.6 | N |
| 17-01-25 14:30 | | 6.0 | | 16.4 | 19.2 | 136.0 | 418 | | 7 | 91 | 1.2 | SE |
| 17-01-25 15:30 | | 6.5 | | 17.4 | 20.7 | 160.0 | 333 | | 7 | 91 | 1.3 | NE |
| 17-01-25 16:30 | | 8.5 | | 13.8 | 21.1 | 191.0 | 345 | | 7 | 91 | 1.9 | ESE |
| 17-01-25 17:30 | | 7.6 | | 12.2 | 18.5 | 365.0 | 450 | | 7 | 91 | 0.9 | ESE |
| 17-01-25 18:30 | | 8.1 | | 13.1 | 18.9 | 336.0 | 466 | | 7 | 92 | 1.8 | NE |
| 17-01-25 19:30 | | 8.1 | | 15.6 | 19.1 | 305.0 | 306 | | 7 | 91 | 1.2 | CALM |
| 17-01-25 20:30 | | 10.9 | | 16.3 | 15.7 | 467.0 | 426 | | 7 | 92 | 1.5 | SE |

| | | | | | | | | |
|---------|-----|------|------|------|------|-----|-----|-----|
| Average | 1.7 | 9.9 | 37.5 | 15.0 | 20.9 | 234 | 427 | 786 |
| Maximum | 2.6 | 15.0 | 37.5 | 19.6 | 25.2 | 561 | 848 | 786 |
| Minimum | 0.9 | 6.0 | 37.5 | 12.2 | 15.7 | 125 | 229 | 786 |

Monitored By: Zain-ul-Abideen

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CHEMICAL ANALYSIS TEST REPORT (AMBIENT AIR)



Reference Number: ESPAK/00043P/25/AA/00760/00102 Date: 27/01/2025

Name of Industry/Client: National Engineering Services Pakistan (Pvt) Limited

Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore

Project Name: Construction of Bridge-3 RUDA

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Ambient Air Monitoring Location: Near Sanglan Wasapur, Lahore (GPS: 31.640163°N, 74.40829°E)

Date of Sample Collection: 17/01/2025

Sample Collected/Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK Grab / Composite: Continuous - 24 Hours

Date of Completion of Analysis: 18/01/2025

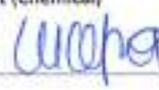
| S. No | Parameters | Limit Values (PEQS-24 Hours) | Concentration | Method / Equipment Used | Remarks |
|-------|---------------------------------------|--------------------------------|------------------------|---|-----------------------------|
| 1 | Carbon Monoxide (CO) | 5 mg/m ³ (8 Hours) | 1.3 mg/m ³ | Non Dispersive Infrared Absorption (NDIR) | Within Prescribed Limits |
| 2 | Sulfur Dioxide (SO ₂) | 120 µg/m ³ | 8.3 µg/m ³ | UV Fluorescence (UVF) | Within Prescribed Limits |
| 3 | Ozone (O ₃) | 130 µg/m ³ (1 Hour) | 39.5 µg/m ³ | Non Dispersive UV Absorption | Within Prescribed Limits |
| 4 | Oxides of Nitrogen as NO | 40 µg/m ³ | 13.1 µg/m ³ | Chemiluminescence Detection | Within Prescribed Limits |
| 5 | Oxides of Nitrogen as NO ₂ | 80 µg/m ³ | 23.1 µg/m ³ | Chemiluminescence Detection | Within Prescribed Limits |
| 6 | Particulate Matter PM _{2.5} | 35 µg/m ³ | 393 µg/m ³ | Particulate Sensor | Exceeding Prescribed Limits |
| 7 | Particulate Matter PM ₁₀ | 150 µg/m ³ | 469 µg/m ³ | Particulate Sensor | Exceeding Prescribed Limits |
| 8 | Suspended Particulate Matter (SPM) | 500 µg/m ³ | 741 µg/m ³ | High Volume Sampler (HVS) | Exceeding Prescribed Limits |
| 9 | Lead (Pb) | 1.5 µg/m ³ | 0.07 µg/m ³ | ASS after Sampling by HVS | Within Prescribed Limits |

PEQS: Punjab Environmental Quality Standards for Ambient Air, 2016

Note:

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- The values represent sample conditions when monitoring/testing was carried out.
- The report data is not intended to be used legally by the client.

1. Sample Analyzed By: Zain-ul-Abideen Nageen Arshad
Analyst (Field) Analyst (Chemical)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
General Manager
Date: 27/01/2025



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

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| | |
|--------------------------|--|
| Reference Number | ESPAK/00043P/25/AA/00760/00102 |
| Name of Industry/ Client | National Engineering Services Pakistan (Pvt) Limited |
| Address | NESPAK House, 1-C, Block-N, Model Town Extension, Lahore |
| Project Name: | Construction of Bridge-3 RUDA |
| Monitoring Location | Near Sangian Wasapur, Lahore |
| GPS Coordinates | 31.640163°N, 74.40829°E |
| Monitoring Date | 17/01/2025 to 18/01/2025 |

| Date - Time | CO | SO ₂ | O ₃ | NO | NO ₂ | PM _{2.5} | PM ₁₀ | TSP | Temp. | RH | Wind Speed | Wind Direction |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------|----|------------|----------------|
| | mg/m ³ | ug/m ³ | °C | % | m/s | |
| 17-01-25 11:35 | 0.9 | 9.4 | 39.5 | 10.9 | 18.0 | 636.0 | 479 | 741 | 10 | 89 | 3.4 | N |
| 18-01-25 12:35 | 1.0 | 8.4 | 39.5 | 12.7 | 21.6 | 515.0 | 381 | | 10 | 88 | 1.9 | NNW |
| 18-01-25 1:35 | 1.2 | 8.5 | | 14.5 | 19.1 | 985.0 | 678 | | 10 | 89 | 2.7 | NNW |
| 18-01-25 2:35 | 1.8 | 7.3 | | 12.6 | 21.5 | 450.0 | 525 | | 10 | 88 | 2.6 | N |
| 18-01-25 3:35 | 1.9 | 9.0 | | 10.2 | 19.6 | 443.0 | 367 | | 10 | 88 | 2.2 | NNW |
| 18-01-25 4:35 | 1.9 | 8.5 | | 14.6 | 18.4 | 352.0 | 608 | | 9 | 86 | 2.3 | NNW |
| 18-01-25 5:35 | 0.9 | 8.0 | | 14.6 | 18.5 | 409.0 | 595 | | 10 | 88 | 2.7 | NW |
| 18-01-25 6:35 | 1.0 | 6.6 | | 11.5 | 18.6 | 396.0 | 381 | | 9 | 86 | 2.2 | N |
| 18-01-25 7:35 | | 8.1 | | 12.4 | 24.5 | 425.0 | 458 | | 10 | 86 | 2.2 | W |
| 18-01-25 8:35 | | 9.7 | | 10.5 | 25.3 | 235.0 | 798 | | 9 | 87 | 2.3 | W |
| 18-01-25 9:35 | | 9.6 | | 11.9 | 25.8 | 190.0 | 890 | | 9 | 86 | 2.7 | SE |
| 18-01-25 10:35 | | 10.8 | | 14.3 | 23.3 | 140.0 | 458 | | 9 | 88 | 1.8 | NW |
| 18-01-25 11:35 | | 11.5 | | 14.2 | 25.7 | 936.0 | 311 | | 9 | 87 | 2.2 | NW |
| 18-01-25 12:35 | | 10.1 | | 14.4 | 26.6 | 335.0 | 289 | | 9 | 85 | 1.7 | N |
| 18-01-25 13:35 | | 11.7 | | 15.3 | 27.2 | 264.0 | 378 | | 9 | 83 | 2.4 | NW |
| 18-01-25 14:35 | | 8.7 | | 16.9 | 27.9 | 183.0 | 271 | | 9 | 88 | 0.9 | W |
| 18-01-25 15:35 | | 6.0 | | 14.3 | 24.4 | 439.0 | 346 | | 9 | 88 | 1.6 | N |
| 18-01-25 16:35 | | 6.5 | | 15.0 | 26.4 | 121.0 | 460 | | 9 | 88 | 1.2 | WNW |
| 18-01-25 17:35 | | 7.1 | | 13.9 | 26.1 | 549.0 | 375 | | 9 | 88 | 1.3 | W |
| 18-01-25 18:35 | | 7.6 | | 14.5 | 26.0 | 374.0 | 387 | | 8 | 89 | 1.9 | CALM |
| 18-01-25 19:35 | | 8.1 | | 14.9 | 21.5 | 273.0 | 492 | | 9 | 88 | 0.9 | WSW |
| 18-01-25 20:35 | | 6.1 | | 13.1 | 23.7 | 189.0 | 508 | | 8 | 89 | 1.8 | NNW |
| 18-01-25 21:35 | | 7.0 | | 8.8 | 23.8 | 200.0 | 348 | | 9 | 89 | 1.2 | W |
| 18-01-25 22:35 | | 5.7 | | 9.7 | 21.8 | 395.0 | 468 | | 8 | 90 | 1.5 | NNW |

| | | | | | | | | |
|---------|-----|------|------|------|------|-----|-----|-----|
| Average | 1.3 | 8.3 | 39.5 | 13.1 | 23.1 | 393 | 469 | 741 |
| Maximum | 1.9 | 11.7 | 39.5 | 16.9 | 27.9 | 985 | 890 | 741 |
| Minimum | 0.9 | 5.7 | 39.5 | 8.8 | 18.0 | 121 | 271 | 741 |

Monitored By: Zain-ul-Abideen



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ANNEXURE – B

Background Noise Levels

NOISE MONITORING REPORT



Reference Number: ESPAK/00043P/25/N/00761/00087 Date: 27/01/2025

Name of Industry/Client: National Engineering Services Pakistan (Pvt) Limited

Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Noise Project Name: Construction of Bridge-3 RUDA

Date of Sample Collection: 15/01/2025 Grab / Composite: Continuous - 24 Hours

Sample Collected/Sent By: Date Zain-ul-Abideen, Analyst (Field), ESPAK

of Completion of Analysis: 16/01/2025

Method/Equipment Used: Sound Level Meter

| S. No | Measurement Point | Limit Values (PEQS) | Noise Level dB(A) Leq | Remarks |
|-------|--|---------------------|-----------------------|--------------------------|
| 1 | Babakwal, Govt Boys High School, Lahore (GPS: 31.70520°N, 74.34399°E) - Day time | 65 dB(A) | 58 dB(A) | Within Prescribed Limits |
| 2 | Babakwal, Govt Boys High School, Lahore (GPS: 31.70520°N, 74.34399°E) - Night time | 55 dB(A) | 52 dB(A) | Within Prescribed Limits |

PEQS: Punjab Environmental Quality Standards for Noise in Commercial Area, 2016 Day Time Hours (6:00 am to 10:00 pm) Night Time Hours (10:00 pm to 6:00 am).

Note:

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1. Sample Analyzed By: Zain-ul-Abideen
Analyst (Field)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
General Manager
Date: 27/01/2025



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

| Report Reference | ESPAK/00043P/25/N/00761/00087 | |
|---------------------------|--|---------------------|
| Client Name | National Engineering Services Pakistan (Pvt) Limited | |
| Address | NESPAK House, 1-C, Block-N, Model Town Extension, | |
| Project Name: | Construction of Bridge-3 RUDA | |
| Monitoring Location | Babakwal Govt Boys High School, Lahore | |
| GPS Coordinates | 31.70520°N, 74.34399°E | |
| Monitoring Date | 15/01/2025 to 16/01/2025 | |
| Day/Night | Date & Ending Hour | Noise dB (A) Leq |
| Day Time | 15-01-25 21:00 | 66.1 |
| | 15-01-25 22:00 | 53.1 |
| | 16-01-25 7:00 | 63.3 |
| | 16-01-25 8:00 | 52.1 |
| | 16-01-25 9:00 | 63.2 |
| | 16-01-25 10:00 | 51.8 |
| | 16-01-25 11:00 | 62.3 |
| | 16-01-25 12:00 | 52.4 |
| | 16-01-25 13:00 | 61.4 |
| | 16-01-25 14:00 | 53.1 |
| | 16-01-25 15:00 | 60.4 |
| | 16-01-25 16:00 | 53.8 |
| | 16-01-25 17:00 | 59.7 |
| | 16-01-25 18:00 | 54.3 |
| 16-01-25 19:00 | 58.9 | |
| 16-01-25 20:00 | 54.9 | |
| Average Day time | | 58 |
| Night Time | 16-01-25 0:00 | 46.1 |
| | 16-01-25 1:00 | 57.8 |
| | 16-01-25 2:00 | 45.6 |
| | 16-01-25 3:00 | 57.4 |
| | 16-01-25 4:00 | 45.6 |
| | 16-01-25 5:00 | 57.0 |
| | 16-01-25 6:00 | 45.6 |
| | 18-01-25 6:35 | 62.9 |
| Average Night time | | 52 |
| Monitored By: | Zain-ul-Abideen | |

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NOISE MONITORING REPORT



Reference Number: ESPAK/00043P/25/N/00762/00088 Date: 27/01/2025
 Name of Industry/Client: National Engineering Services Pakistan (Pvt) Limited
 Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore
 Validation Officer: Muhammad Nadeem, Research Officer
 Nature of Sample: Noise Project Name: Construction of Bridge-3 RUDA
 Date of Sample Collection: 16/01/2025 Grab / Composite: Continuous - 24 Hours
 Sample Collected/Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK
 of Completion of Analysis: 17/01/2025
 Method/Equipment Used: Sound Level Meter

| S. No | Measurement Point | Limit Values (PEQS) | Noise Level dB(A) Leq | Remarks |
|-------|---|---------------------|-----------------------|-----------------------------|
| 1 | Bhaini Road, Lahore (GPS: 31.624285°N, 74.436202°E) - Day time | 65 dB(A) | 68 dB(A) | Exceeding Prescribed Limits |
| 2 | Bhaini Road, Lahore (GPS: 31.624285°N, 74.436202°E) - Night time | 55 dB(A) | 57 dB(A) | Exceeding Prescribed Limits |

PEQS: Punjab Environmental Quality Standards for Noise in Commercial Area, 2016 Day Time Hours (6:00 am to 10:00 pm) Night Time Hours (10:00 pm to 6:00 am).
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1. Sample Analyzed By: Zain-ul-Abideen
Analyst (Field)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
General Manager
 Date: 27/01/2025



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

| Report Reference | | ESPAK/00043P/25/N/00762/00088 |
|----------------------------|--------------------|--|
| Client Name | | National Engineering Services Pakistan (Pvt) Limited |
| Address | | NESPAK House, 1-C, Block-N, Model Town Extension, |
| Project Name: | | Construction of Bridge-3 RUDA |
| Monitoring Location | | Bhaini Road, Lahore |
| GPS Coordinates | | 31.624285°N ,74.436202°E |
| Monitoring Date | | 16/01/2025 to 17/01/2025 |
| Day/Night | Date & Ending Hour | Noise dB (A) Leq |
| Day Time | 16-01-25 21:30 | 68.7 |
| | 16-01-25 22:30 | 69.4 |
| | 17-01-25 7:30 | 68.5 |
| | 17-01-25 8:30 | 67.3 |
| | 17-01-25 9:30 | 68.3 |
| | 17-01-25 10:30 | 68.9 |
| | 17-01-25 11:30 | 66.4 |
| | 17-01-25 12:30 | 69.4 |
| | 17-01-25 13:30 | 68.8 |
| | 17-01-25 14:30 | 65.7 |
| | 17-01-25 15:30 | 69.7 |
| | 17-01-25 16:30 | 68.7 |
| | 17-01-25 17:30 | 65.1 |
| | 17-01-25 18:30 | 70.0 |
| | 17-01-25 19:30 | 68.4 |
| 17-01-25 20:30 | 64.4 | |
| Average Day time | | 68 |
| Night Time | 16-01-25 23:30 | 58.0 |
| | 16-01-25 0:30 | 56.3 |
| | 17-01-25 1:30 | 57.7 |
| | 17-01-25 2:30 | 55.7 |
| | 17-01-25 3:30 | 56.4 |
| | 17-01-25 4:30 | 57.0 |
| | 17-01-25 5:30 | 56.2 |
| 17-01-25 6:30 | 56.6 | |
| Average Night time | | 57 |
| Monitored By: | | Zain-ul-Abideen |

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NOISE MONITORING REPORT



Reference Number: ESPAK/00043P/25/N/00763/00089 Date: 27/01/2025
 Name of Industry/Client: National Engineering Services Pakistan (Pvt) Limited
 Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore
 Validation Officer: Muhammad Nadeem, Research Officer
 Nature of Sample: Noise Project Name: Construction of Bridge-3 RUDA
 Date of Sample Collection: 17/01/2025 Grab / Composite: Continuous - 24 Hours
 Sample Collected/Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK
 of Completion of Analysis: 18/01/2025
 Method/Equipment Used: Sound Level Meter

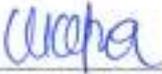
| S. No | Measurement Point | Limit Values (PEQS) | Noise Level dB(A) Leq | Remarks |
|-------|--|---------------------|-----------------------|-----------------------------|
| 1 | Near Sangian Wasapur, Lahore (GPS: 31.640163°N, 74.40829°E) - Day time | 65 dB(A) | 68 dB(A) | Exceeding Prescribed Limits |
| 2 | Near Sangian Wasapur, Lahore (GPS: 31.640163°N, 74.40829°E) - Night time | 55 dB(A) | 59 dB(A) | Exceeding Prescribed Limits |

PEQS: Punjab Environmental Quality Standards for Noise in Commercial Area, 2016 Day Time Hours (6:00 am to 10:00 pm) Night Time Hours (10:00 pm to 6:00 am).

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- The report data is not intended to be used legally by the client.

1. Sample Analyzed By: Zain-ul-Abideen
Analyst (Field)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
General Manager
Date: 27/01/2025



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

| Report Reference | | ESPAK/00043P/25/N/00763/00089 |
|---------------------|--------------------|--|
| Client Name | | National Engineering Services Pakistan (Pvt) Limited |
| Address | | NESPAK House, 1-C, Block-N, Model Town Extension, |
| Project Name: | | Construction of Bridge-3 RUDA |
| Monitoring Location | | Near Sangian Wasapur, Lahore |
| GPS Coordinates | | 31.640163°N, 74.40829°E |
| Monitoring Date | | 17/01/2025 to 18/01/2025 |
| Day/Night | Date & Ending Hour | Noise dB (A) Leq |
| Day Time | 18-01-25 7:35 | 71.1 |
| | 18-01-25 8:35 | 64.6 |
| | 18-01-25 9:35 | 71.3 |
| | 18-01-25 10:35 | 68.9 |
| | 18-01-25 11:35 | 64.0 |
| | 18-01-25 12:35 | 71.5 |
| | 18-01-25 13:35 | 68.6 |
| | 18-01-25 14:35 | 63.5 |
| | 18-01-25 15:35 | 71.4 |
| | 18-01-25 16:35 | 67.9 |
| | 18-01-25 17:35 | 63.6 |
| | 18-01-25 18:35 | 71.3 |
| | 18-01-25 19:35 | 67.1 |
| | 18-01-25 20:35 | 63.7 |
| | 18-01-25 21:35 | 71.3 |
| 18-01-25 22:35 | 66.4 | |
| Average Day time | | 68 |
| Night Time | 17-01-25 11:35 | 61.0 |
| | 18-01-25 12:35 | 55.4 |
| | 18-01-25 1:35 | 61.9 |
| | 18-01-25 2:35 | 60.0 |
| | 18-01-25 3:35 | 55.6 |
| | 18-01-25 4:35 | 61.7 |
| | 18-01-25 5:35 | 59.7 |
| | 18-01-25 6:35 | 56.6 |
| Average Night time | | 59 |
| Monitored By: | | Zain-ul-Abideen |

Zain-ul-Abideen

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ANNEXURE – C

Ground Water Results

CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Reference Number: ESPAK/00043P/25/GW/00350/00106 Date: 25/01/2025

Name of Industry / Client: National Engineering Services Pakistan (Pvt) Limited

Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Ground Water from Babakwal Govt Boys High School

Date Sample Received: 17/01/2025 Project Name: Construction of Bridge-3 RUDA

Date of Sample Collection: 16/01/2025 Grab / Composite: Grab

Sample Collected / Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK

Date of Completion of Analysis: 22/01/2025



| S. No | Parameters | Limit Values (DW-PEQ5) | Concentration | Method / Equipment Used | Remarks |
|-------|---|--|---------------|---|---------------|
| 1 | Total Coliforms | ---- | ND | SMWW 9222 B | ---- |
| 2 | Fecal Coliform Bacteria | Must not be detectable in any 100mL sample | ND | SMWW 9222 H | Within Limits |
| 3 | E. Coli | Must not be detectable in any 100mL Sample | ND | SMWW 9222 H | Within Limits |
| 4 | Taste | Non Objectionable / Acceptable | Acceptable | Organoleptic | Within Limits |
| 5 | Odor | Non Objectionable / Acceptable | Acceptable | Organoleptic | Within Limits |
| 6 | pH* | 6.5-8.5 | 7.8 | SMWW 4500H*B | Within Limits |
| 7 | Turbidity | <5 NTU | 0.6 NTU | SMWW 2130B | Within Limits |
| 8 | Color | ≤15 TCU | ND | SMWW 2120 C | Within Limits |
| 9 | Total Dissolved Solids (TDS)* | <1000 mg/L | 567 mg/L | SMWW 2540C | Within Limits |
| 10 | Total Hardness as CaCO ₃ * | <500 mg/L | 196 mg/L | SMWW 2340C | Within Limits |
| 11 | Residual Chlorine | 0.2-0.5 mg/L | ND | SMWW 4500-Cl B | ---- |
| 12 | Chloride (as Cl ⁻)* | <250 mg/L | 38 mg/L | SMWW 4500Cl ⁻ B | Within Limits |
| 13 | Fluoride (F ⁻)* | ≤1.5 mg/L | 0.2 mg/L | U.S. EPA 9214 | Within Limits |
| 14 | Cyanide (CN ⁻) | ≤0.05 mg/L | ND | SMWW 4500 CN ⁻ F | Within Limits |
| 15 | Nitrate (NO ₃ ⁻) | ≤50 mg/L | ND | SMWW 4500NO ₃ ⁻ B | Within Limits |
| 16 | Nitrite (NO ₂ ⁻) | ≤3 mg/L | ND | SMWW 4500NO ₂ ⁻ B | Within Limits |
| 17 | Phenolic Compounds (as Phenols) | NGVS | ND | SMWW 5530 C | ---- |
| 18 | Aluminum (Al) | ≤0.2 mg/L | ND | SMWW 3111 | Within Limits |
| 19 | Antimony (Sb) | ≤0.005 mg/L | ND | SMWW 3111 | Within Limits |
| 20 | Arsenic (As) | ≤0.05 mg/L | ND | SMWW 3114 B | Within Limits |
| 21 | Barium (Ba) | 0.7 mg/L | ND | SMWW 3111 | Within Limits |
| 22 | Boron (B) | 0.3 mg/L | ND | SMWW 4500-B B | Within Limits |

Page 1 of 2

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CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Reference Number: ESPAK/00043P/25/GW/00350/00106 Date: 25/01/2025
 Name of Industry / Client: National Engineering Services Pakistan (Pvt) Limited



| S. No | Parameters | Limit Values (DW-PEQS) | Concentration | Method / Equipment Used | Remarks |
|-------|----------------|------------------------|---------------|-------------------------|---------------|
| 23 | Cadmium (Cd) | 0.01 mg/L | ND | SMWW 3111 | Within Limits |
| 24 | Chromium (Cr) | ≤0.05 mg/L | ND | SMWW 3111 | Within Limits |
| 25 | Copper (Cu) | 2.0 mg/L | ND | SMWW 3111 | Within Limits |
| 26 | Lead (Pb) | ≤0.05 mg/L | ND | SMWW 3111 | Within Limits |
| 27 | Manganese (Mn) | ≤0.5 mg/L | ND | SMWW 3111 | Within Limits |
| 28 | Mercury (Hg) | ≤0.001 mg/L | ND | SMWW 3112 | Within Limits |
| 29 | Nickel (Ni) | ≤0.02 mg/L | ND | SMWW 3111 | Within Limits |
| 30 | Selenium (Se) | 0.01 mg/L | ND | SMWW 3114 B | Within Limits |
| 31 | Zinc (Zn) | 5.0 mg/L | ND | SMWW 3111 | Within Limits |
| 32 | Pesticides | 0.15 mg/L | ND | Screening Method | Within Limits |

DW-PEQS: Punjab Environmental Quality Standards for Drinking Water Quality, 2016

SMWW: Standard Methods for the Examination of Water and Waste Water, American Public Health Association, American Water Works Association, Water Environment Federation

USEPA: United States Environmental Protection Agency

NGVS: No Guideline Value Set

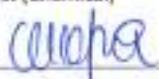
ND: Not Detected

- Laboratory tests and measurements were carried out at 25 ± 5 °C and ≤75 % Relative Humidity conditions unless required otherwise.
- Uncertainty of Measurement (UoM) data will be provided on request, where available. The statement of conformity, if provided in the report, is based on the decision rule of simple acceptance or rejection with equal shared risk due to measurement uncertainty.

Note:

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- The values represent sample conditions when monitoring/testing was carried out.
- The report data is not intended to be used legally by the client.
- Only parameters marked with asterisk (*) are ISO 17025:2017 accredited.

1. Sample Analyzed By: Samahir Khalid Analyst (Chemical) Nageen Arshad Analyst (Chemical) Mahnoor Nasir Analyst (Chemical) Zirwa-tuz-Zahra Analyst (Chemical) Khizra Bano Analyst (Microbiology)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
 General Manager
 Date: 25/01/2025



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

CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)



Reference Number: ESPAK/00043P/25/GW/00351/00107 Date: 25/01/2025

Name of Industry / Client: National Engineering Services Pakistan (Pvt) Limited

Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Ground Water from Bhaini Road, Lahore

Date Sample Received: 17/01/2025 Project Name: Construction of Bridge-3 RUDA

Date of Sample Collection: 16/01/2025 Grab / Composite: Grab

Sample Collected / Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK

Date of Completion of Analysis: 22/01/2025

| S. No | Parameters | Limit Values (DW-PEQS) | Concentration | Method / Equipment Used | Remarks |
|-------|---|--|---------------|-----------------------------|------------------|
| 1 | Total Coliforms | ---- | Detected | SMWW 9222 B | ---- |
| 2 | Fecal Coliform Bacteria | Must not be detectable in any 100mL sample | Detected | SMWW 9222 H | Exceeding Limits |
| 3 | E. Coli | Must not be detectable in any 100mL Sample | ND | SMWW 9222 H | Within Limits |
| 4 | Taste | Non Objectionable / Acceptable | Unacceptable | Organoleptic | Exceeding Limits |
| 5 | Odor | Non Objectionable / Acceptable | Acceptable | Organoleptic | Within Limits |
| 6 | pH* | 6.5-8.5 | 7.6 | SMWW 4500H*B | Within Limits |
| 7 | Turbidity | <5 NTU | 7.8 NTU | SMWW 2130B | Exceeding Limits |
| 8 | Color | ≤15 TCU | ND | SMWW 2120 C | Within Limits |
| 9 | Total Dissolved Solids (TDS)* | <1000 mg/L | 1205 mg/L | SMWW 2540C | Within Limits |
| 10 | Total Hardness as CaCO ₃ * | <500 mg/L | 298 mg/L | SMWW 2340C | Within Limits |
| 11 | Residual Chlorine | 0.2-0.5 mg/L | ND | SMWW 4500-Cl B | ---- |
| 12 | Chloride (as Cl ⁻)* | <250 mg/L | 168 mg/L | SMWW 4500Cl*B | Within Limits |
| 13 | Fluoride (F ⁻)* | ≤1.5 mg/L | 0.6 mg/L | U.S. EPA 9214 | Within Limits |
| 14 | Cyanide (CN ⁻) | ≤0.05 mg/L | ND | SMWW 4500 CN* F | Within Limits |
| 15 | Nitrate (NO ₃ ⁻) | ≤50 mg/L | 0.5 mg/L | SMWW 4500NO ₃ *B | Within Limits |
| 16 | Nitrite (NO ₂ ⁻) | ≤3 mg/L | ND | SMWW 4500NO ₂ *B | Within Limits |
| 17 | Phenolic Compounds (as Phenols) | NGVS | ND | SMWW 5530 C | ---- |
| 18 | Aluminum (Al) | ≤0.2 mg/L | ND | SMWW 3111 | Within Limits |
| 19 | Antimony (Sb) | ≤0.005 mg/L | ND | SMWW 3111 | Within Limits |
| 20 | Arsenic (As) | ≤0.05 mg/L | ND | SMWW 3114 B | Within Limits |
| 21 | Barium (Ba) | 0.7 mg/L | ND | SMWW 3111 | Within Limits |
| 22 | Boron (B) | 0.3 mg/L | ND | SMWW 4500-B B | Within Limits |

Page 1 of 2

 Lahore Office
Office No. 731,
Block - 2, Sector D1,
Shah Jilani Road, Township
Lahore, Pakistan.
Tel: +92 (42) 3515 4015-16

 Islamabad Office
Office No. 314, 3rd
Floor, Gulberg Empire,
Gulberg Greens,
Islamabad, Pakistan.
Tel: +92 (51) 5915060

 Peshawar Office
Unit No. 43-TF,
Dean's Trade Center
Sadar Cantt,
Peshawar, Pakistan.
Tel: +92 312 0849999



CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Reference Number:

ESPAK/00043P/25/GW/00351/00107

Date:

25/01/2025

Name of Industry / Client:

National Engineering Services Pakistan (Pvt) Limited



| S. No | Parameters | Limit Values (DW-PEQS) | Concentration | Method / Equipment Used | Remarks |
|-------|----------------|------------------------|---------------|-------------------------|---------------|
| 23 | Cadmium (Cd) | 0.01 mg/L | ND | SMWW 3111 | Within Limits |
| 24 | Chromium (Cr) | ≤0.05 mg/L | ND | SMWW 3111 | Within Limits |
| 25 | Copper (Cu) | 2.0 mg/L | ND | SMWW 3111 | Within Limits |
| 26 | Lead (Pb) | ≤0.05 mg/L | ND | SMWW 3111 | Within Limits |
| 27 | Manganese (Mn) | ≤0.5 mg/L | ND | SMWW 3111 | Within Limits |
| 28 | Mercury (Hg) | ≤0.001 mg/L | ND | SMWW 3112 | Within Limits |
| 29 | Nickel (Ni) | ≤0.02 mg/L | ND | SMWW 3111 | Within Limits |
| 30 | Selenium (Se) | 0.01 mg/L | ND | SMWW 3114 B | Within Limits |
| 31 | Zinc (Zn) | 5.0 mg/L | ND | SMWW 3111 | Within Limits |
| 32 | Pesticides | 0.15 mg/L | ND | Screening Method | Within Limits |

DW-PEQS: Punjab Environmental Quality Standards for Drinking Water Quality, 2016

SMWW: Standard Methods for the Examination of Water and Waste Water, American Public Health Association, American Water Works Association, Water Environment Federation

USEPA: United States Environmental Protection Agency

NGVS: No Guideline Value Set

ND: Not Detected

- Laboratory tests and measurements were carried out at 25 ± 5 °C and ≤75 % Relative Humidity conditions unless required otherwise.
- Uncertainty of Measurement (UoM) data will be provided on request, where available. The statement of conformity, if provided in the report, is based on the decision rule of simple acceptance or rejection with equal shared risk due to measurement uncertainty.

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- The report data is not intended to be used legally by the client.
- Only parameters marked with asterisk (*) are ISO 17025:2017 accredited.

1. Sample Analyzed By:

Samahir Khalid
Analyst (Chemical)

Nageen Arshad
Analyst (Chemical)

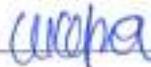
Mahnoor Nasir
Analyst (Chemical)

Zirwa-tuz-Zahra
Analyst (Chemical)

Khizra Bano
Analyst (Microbiology)

2. Name of Chief Analyst with Seal:

Muhammad Arfan



3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
General Manager
Date: 25/01/2025



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

ANNEXURE – D

Surface Water Results

CHEMICAL ANALYSIS TEST REPORT (SURFACE WATER)



Reference Number: ESPAK/00043P/25/SW/00386/00075 Date: 27/01/2025
 Name of Industry / Client: National Engineering Services Pakistan (Pvt) Limited
 Address: NESPAK House, 1-C, Block-N, Model Town Extension, Lahore
 Validation Officer: Muhammad Nadeem, Research Officer
 Nature of Sample: Surface Water from Ravi River at Pandia Village
 Date Sample Received: 20/01/2025 Project Name: Construction of Bridge-3 RUDA
 Date of Sample Collection: 18/01/2025 Grab / Composite: Grab
 Sample Collected / Sent By: Zain-ul-Abideen, Analyst (Field), ESPAK
 Date of Completion of Analysis: 25/01/2025

| S. No | Parameters | Limit Values (WW-PEQS) | Concentration | Method / Equipment Used | Remarks |
|-------|--|------------------------|---------------|---|---------------|
| 1 | pH value (H ⁺)* | 6-9 | 8.2 | SMWW 4500H* B | Within Limits |
| 2 | Total Suspended Solids (TSS)* | 200 mg/L | 13 mg/L | SMWW 2540 D | Within Limits |
| 3 | Total Dissolved Solids (TDS)* | 3500 mg/L | 218 mg/L | SMWW 2540 C | Within Limits |
| 4 | Chlorine (Cl) | 1.0 mg/L | ND | SMWW 4500-Cl B | Within Limits |
| 5 | Chloride (as Cl ⁻)* | 1000 mg/L | 10 mg/L | SMWW 4500Cl ⁻ -B | Within Limits |
| 6 | Fluoride (as F ⁻)* | 10 mg/L | 0.3 mg/L | U.S. EPA 9214 | Within Limits |
| 7 | Cyanide (as CN ⁻) | 1.0 mg/L | ND | SMWW 4500 CN- F | Within Limits |
| 8 | Ammonia (NH ₃) | 40 mg/L | ND | SMWW 4500-NH ₃ - D | Within Limits |
| 9 | Sulfide (S ²⁻) | 1.0 mg/L | ND | SMWW 4500 - S ²⁻ F | Within Limits |
| 10 | Sulfate (SO ₄ ²⁻)* | 600 mg/L | 18 mg/L | SMWW 4500 - SO ₄ ²⁻ C | Within Limits |
| 11 | Chemical Oxygen Demand (COD)* | 150 mg/L | <3 mg/L | SMWW 5220 D | Within Limits |
| 12 | Biochemical Oxygen Demand (BOD ₅) at 20 °C | 80 mg/L | <2 mg/L | SMWW 5210 B | Within Limits |
| 13 | Grease and Oil (as n-HEM) | 10 mg/L | ND | U.S.EPA 1664 B | Within Limits |
| 14 | Phenolic Compounds (as Phenol) | 0.1 mg/L | ND | SMWW 5530 C | Within Limits |
| 15 | An-ionic detergents (as MBAS) | 20 mg/L | ND | SMWW 5540 C | Within Limits |
| 16 | Arsenic (As) | 1.0 mg/L | ND | SMWW 3114 B | Within Limits |
| 17 | Barium (Ba) | 1.5 mg/L | ND | SMWW 3111 | Within Limits |
| 18 | Boron (B) | 6.0 mg/L | ND | SMWW 4500-B B | Within Limits |
| 19 | Cadmium (Cd) | 0.1 mg/L | ND | SMWW 3111 | Within Limits |
| 20 | Chromium (Trivalent and Hexavalent) | 1.0 mg/L | ND | SMWW 3111 | Within Limits |
| 21 | Copper (Cu) | 1.0 mg/L | ND | SMWW 3111 | Within Limits |
| 22 | Iron (Fe) | 8.0 mg/L | 0.4 mg/L | SMWW 3111 | Within Limits |
| 23 | Lead (Pb) | 0.5 mg/L | ND | SMWW 3111 | Within Limits |
| 24 | Manganese (Mn) | 1.5 mg/L | ND | SMWW 3111 | Within Limits |
| 25 | Mercury (Hg) | 0.01 mg/L | ND | SMWW 3112 | Within Limits |
| 26 | Nickel (Ni) | 1.0 mg/L | ND | SMWW 3111 | Within Limits |

CHEMICAL ANALYSIS TEST REPORT (SURFACE WATER)

Reference Number: ESPAK/00043P/25/SW/00386/00075 Date: 27/01/2025
 Name of Industry / Client: National Engineering Services Pakistan (Pvt) Limited



| S. No | Parameters | Limit Values (WW-PEQS) | Concentration | Method / Equipment Used | Remarks |
|-------|--------------------|------------------------|---------------|-------------------------|---------------|
| 27 | Selenium (Se) | 0.5 mg/L | ND | SMWW 3114 B | Within Limits |
| 28 | Silver (Ag) | 1.0 mg/L | ND | SMWW 3111 | Within Limits |
| 29 | Zinc (Zn) | 5.0 mg/L | ND | SMWW 3111 | Within Limits |
| 30 | Total Toxic Metals | 2.0 mg/L | ND | Calculated Value | Within Limits |
| 31 | Temperature | NGVS | 19.2 °C | Thermometer | — |
| 32 | Pesticides | 0.15 mg/L | ND | Screening Method | Within Limits |

WW-PEQS: Punjab Environmental Quality Standards for Municipal & Liquid Industrial Effluents, 2016

SMWW: Standard Methods for the Examination of Water and Waste Water, American Public Health Association, American Water Works Association, Water Environment Federation

USEPA: United States Environmental Protection Agency

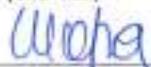
ND: Not Detected

- Laboratory tests and measurements were carried out at 25 ± 5 °C and ≤75 % Relative Humidity conditions unless required otherwise.
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1. Sample Analyzed By: Samahir Khalid Nageen Arshad Mahnour Nasir Zirwa-tuz-Zahra Sumra Manzoor
 Analyst (Chemical) Analyst (Chemical) Analyst (Chemical) Analyst (Chemical) Analyst (Chemical)

2. Name of Chief Analyst with Seal: Muhammad Arfan 

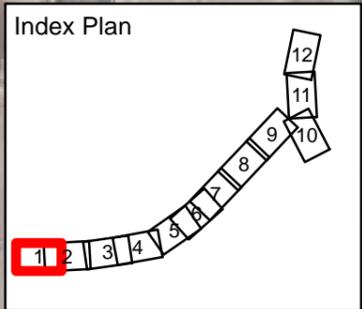
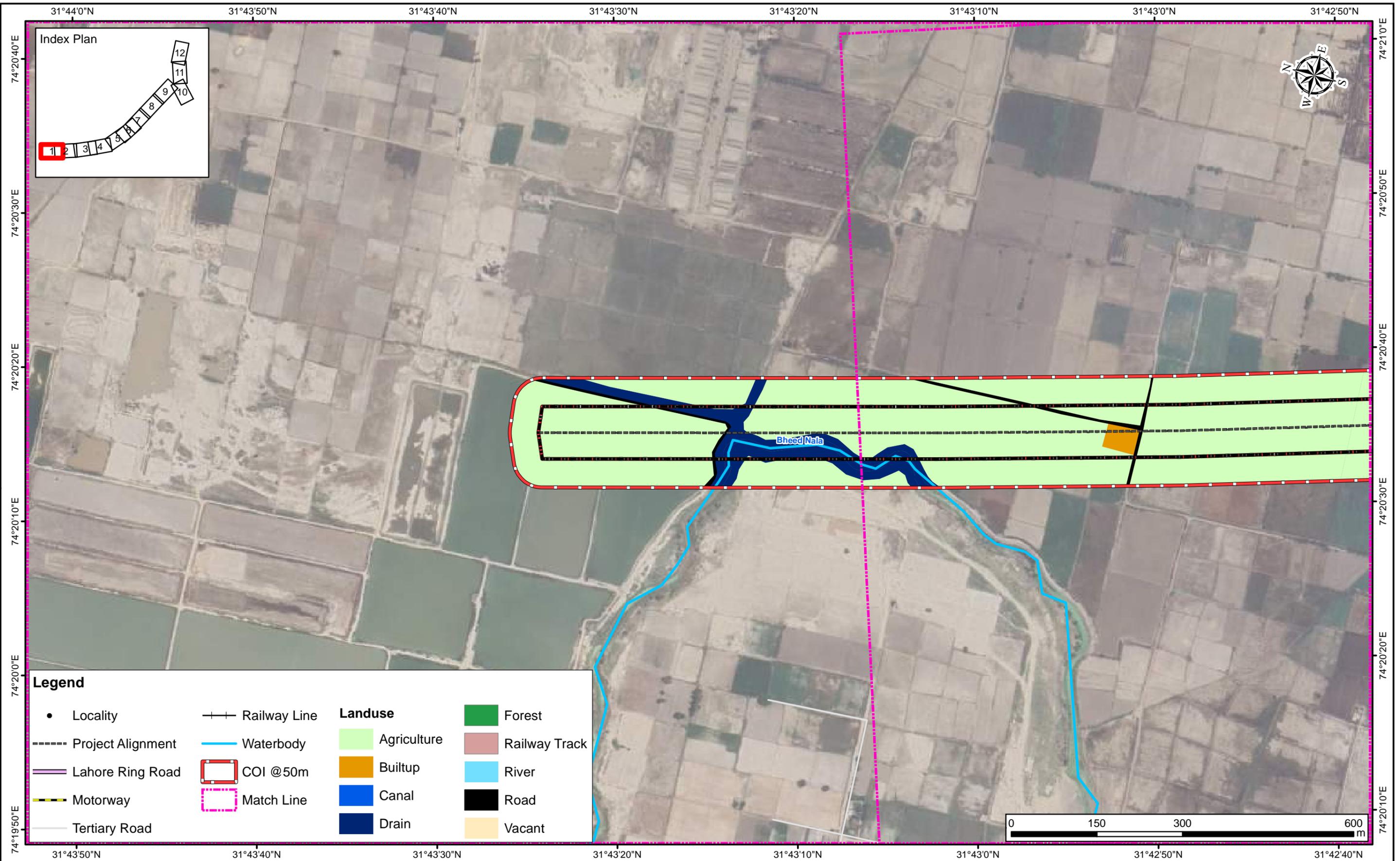
3. Signature of Incharge of the Environmental Laboratory:

Name: Imran Malik
 General Manager
 Date: 27/01/2025

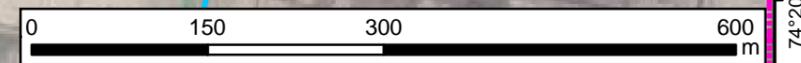


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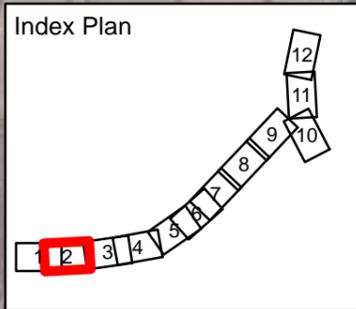
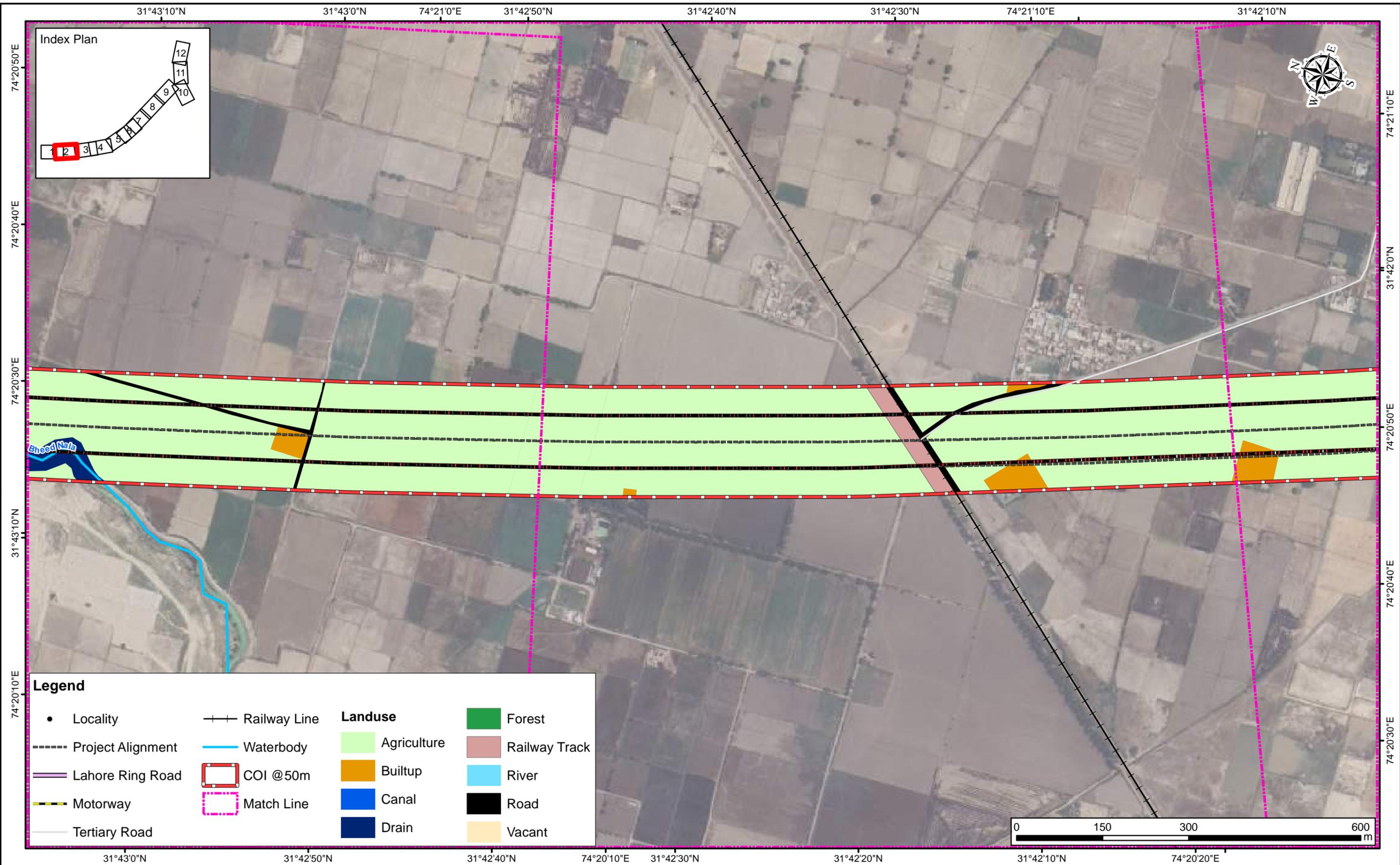
ANNEX-II
DETAILED LANDUSE MAPS



| Legend | | | |
|-----------------------|------------------|----------------|---------------|
| • Locality | --- Railway Line | Landuse | Forest |
| --- Project Alignment | --- Waterbody | Agriculture | Railway Track |
| --- Lahore Ring Road | COI @50m | Builtup | River |
| --- Motorway | Match Line | Canal | Road |
| --- Tertiary Road | | Drain | Vacant |

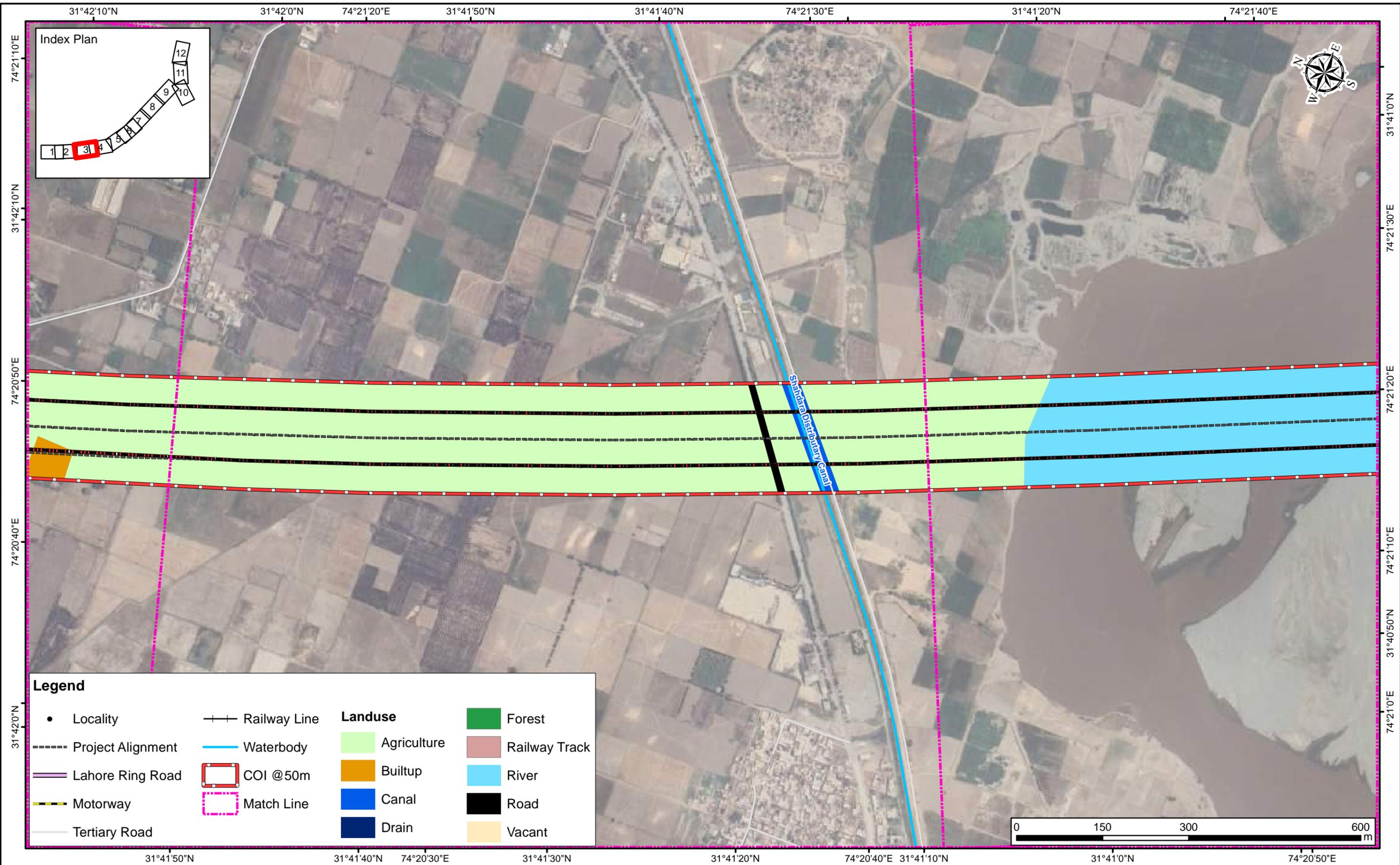


| | | | | | | | | | | | |
|---|--|------|------|-------------|----------|-------------|----------|--|------------------------------|--------------------------|-----------|
| CLIENT RIVA URBAN DEVELOPMENT AUTHORITY (RUDA) | CONSULTANT NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN | 04 | | | | DRAWN | FARHEEN | PROJECT NAME RRUDP-BRIDGE 03 ROAD | EXISTING LAND USE MAP | | SCALE |
| | | 03 | | | | SUBMITTED | | | | | 1:6,020 |
| | | 02 | | | | RECOMMENDED | | | DATE FEBRUARY - 2025 | FIG. NO. Page 1 of 12 | REV. 0 |
| | | 01 | | | | CHD/VER. | | | | | |
| | | REV. | DATE | DESCRIPTION | APPROVED | APPROVED | SHEHNILA | | | | |



| Legend | | Landuse | |
|-----------------------|------------------|-------------|---------------|
| • Locality | --- Railway Line | Forest | Railway Track |
| --- Project Alignment | --- Waterbody | Agriculture | River |
| --- Lahore Ring Road | COI @50m | Builtup | Road |
| --- Motorway | Match Line | Canal | Vacant |
| --- Tertiary Road | | Drain | |

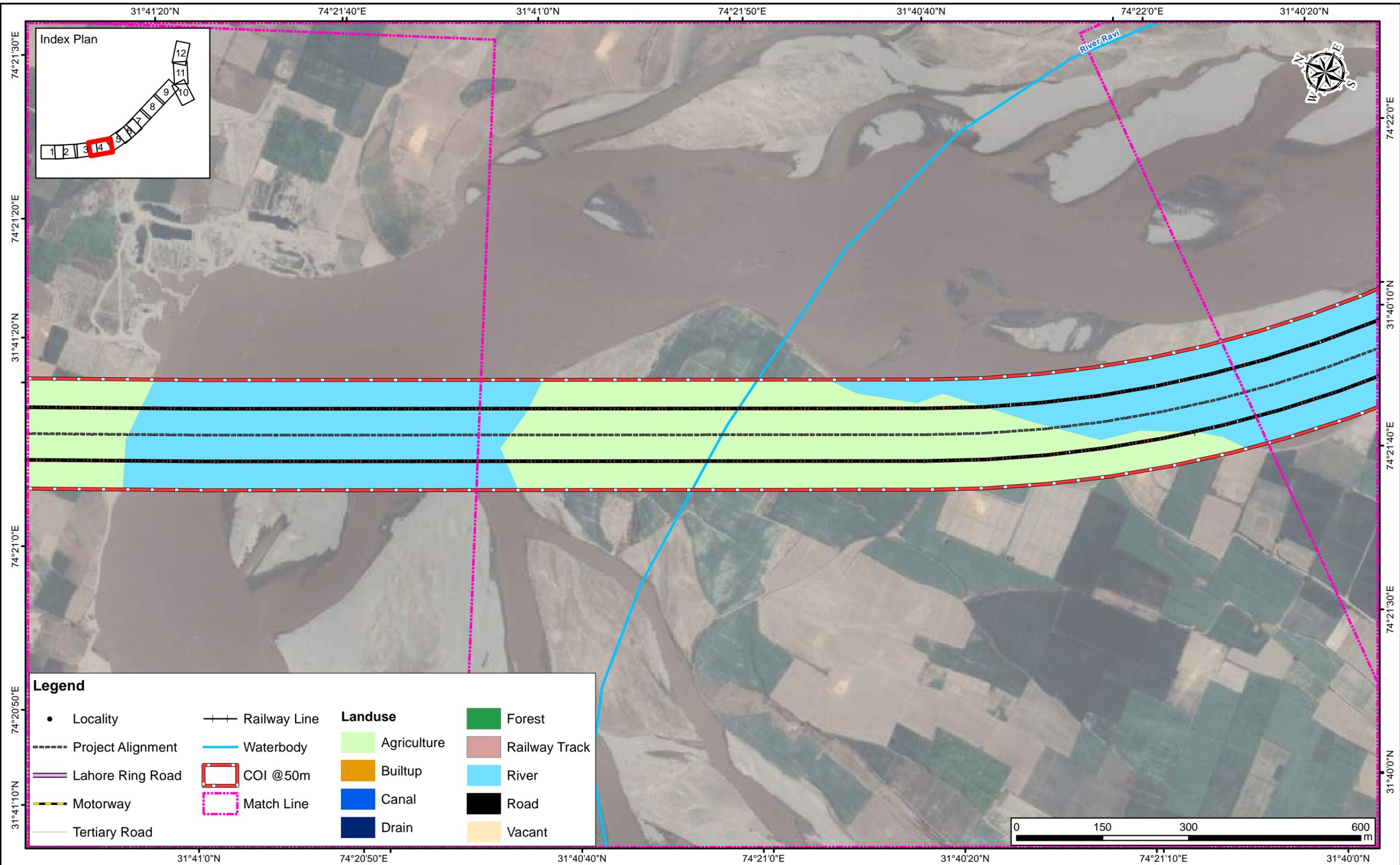
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|---|--|------|------|-------------|----------|-------------|----------|--|------------------------------|--------------------------|-----------|
| CLIENT RIVA URBAN DEVELOPMENT AUTHORITY (RUDA) | CONSULTANT NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN | 04 | | | | DRAWN | FARHEEN | PROJECT NAME RRUDP-BRIDGE 03 ROAD | EXISTING LAND USE MAP | | SCALE |
| | | 03 | | | | SUBMITTED | | | | | 1:6,020 |
| | | 02 | | | | RECOMMENDED | | | DATE FEBRUARY - 2025 | FIG. NO. Page 2 of 12 | REV. 0 |
| | | 01 | | | | CHD/VER. | | | | | |
| | | REV. | DATE | DESCRIPTION | APPROVED | APPROVED | SHEHNILA | | | | |



Legend

- Locality
- Project Alignment
- Lahore Ring Road
- Motorway
- Tertiary Road
- ++ Railway Line
- Waterbody
- COI @50m
- Match Line
- Landuse**
- Agriculture
- Builtup
- Canal
- Drain
- Forest
- Railway Track
- River
- Road
- Vacant

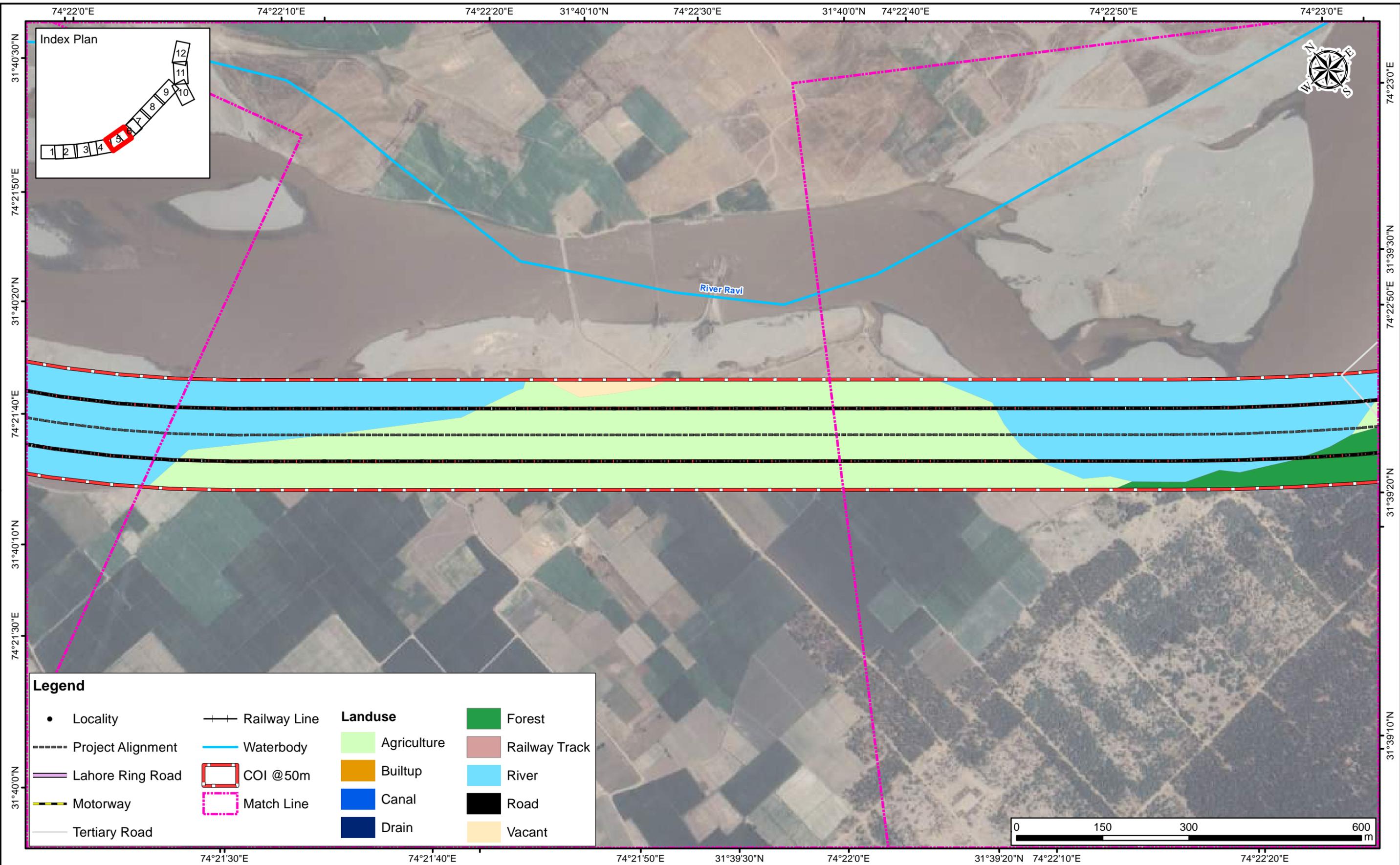
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|--|--|------|------|-------------|----------|-------------|----------|--|------------------------------|--------------|-------|
| | CONSULTANT NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN | 04 | | | | DRAWN | FARHEEN | PROJECT NAME RRUDP-BRIDGE 03 ROAD | EXISTING LAND USE MAP | | SCALE |
| | | 03 | | | | SUBMITTED | | | 1:6,020 | | |
| | | 02 | | | | RECOMMENDED | | | DATE | FIG. NO. | REV. |
| | | 01 | | | | CHD/VER. | | | FEBRUARY - 2025 | Page 3 of 12 | 0 |
| | | REV. | DATE | DESCRIPTION | APPROVED | APPROVED | SHEHNILA | | | | |



Legend

- Locality
- Project Alignment
- Lahore Ring Road
- Motorway
- Tertiary Road
- +--- Railway Line
- Waterbody
- COI @50m
- Match Line
- Landuse**
- Agriculture
- Builtup
- Canal
- Drain
- Forest
- Railway Track
- River
- Road
- Vacant

| | | | | | | | | | | | |
|--|---|------|------|-------------|----------|-------------|----------|--|------------------------------|--------------|--------------|
| RIVA URBAN DEVELOPMENT AUTHORITY (RUDA) | NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN | 04 | | | | DRAWN | FARHEEN | PROJECT NAME RRUDP-BRIDGE 03 ROAD | EXISTING LAND USE MAP | | SCALE |
| | | 03 | | | | SUBMITTED | | | | | |
| | | 02 | | | | RECOMMENDED | | | | | |
| | | 01 | | | | CHD/VER. | | | | | |
| | | REV. | DATE | DESCRIPTION | APPROVED | APPROVED | SHEHNILA | | DATE | FIG. NO. | REV. |
| | | | | | | | | | FEBRUARY - 2025 | Page 4 of 12 | 0 |



Legend

- Locality
- Project Alignment
- Lahore Ring Road
- - - Motorway
- Tertiary Road
- + + + Railway Line
- Waterbody
- [Red Box] COI @50m
- [Pink Box] Match Line
- Landuse**
- [Green Box] Forest
- [Light Green Box] Agriculture
- [Orange Box] Builtup
- [Blue Box] Canal
- [Dark Blue Box] Drain
- [Red Box] Railway Track
- [Light Blue Box] River
- [Black Box] Road
- [Yellow Box] Vacant



CLIENT

RIVA URBAN DEVELOPMENT AUTHORITY (RUDA)

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD

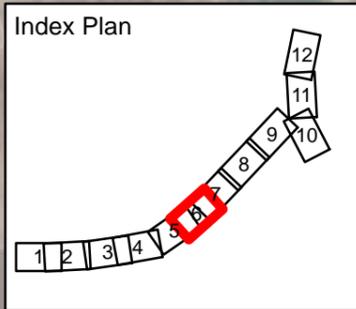
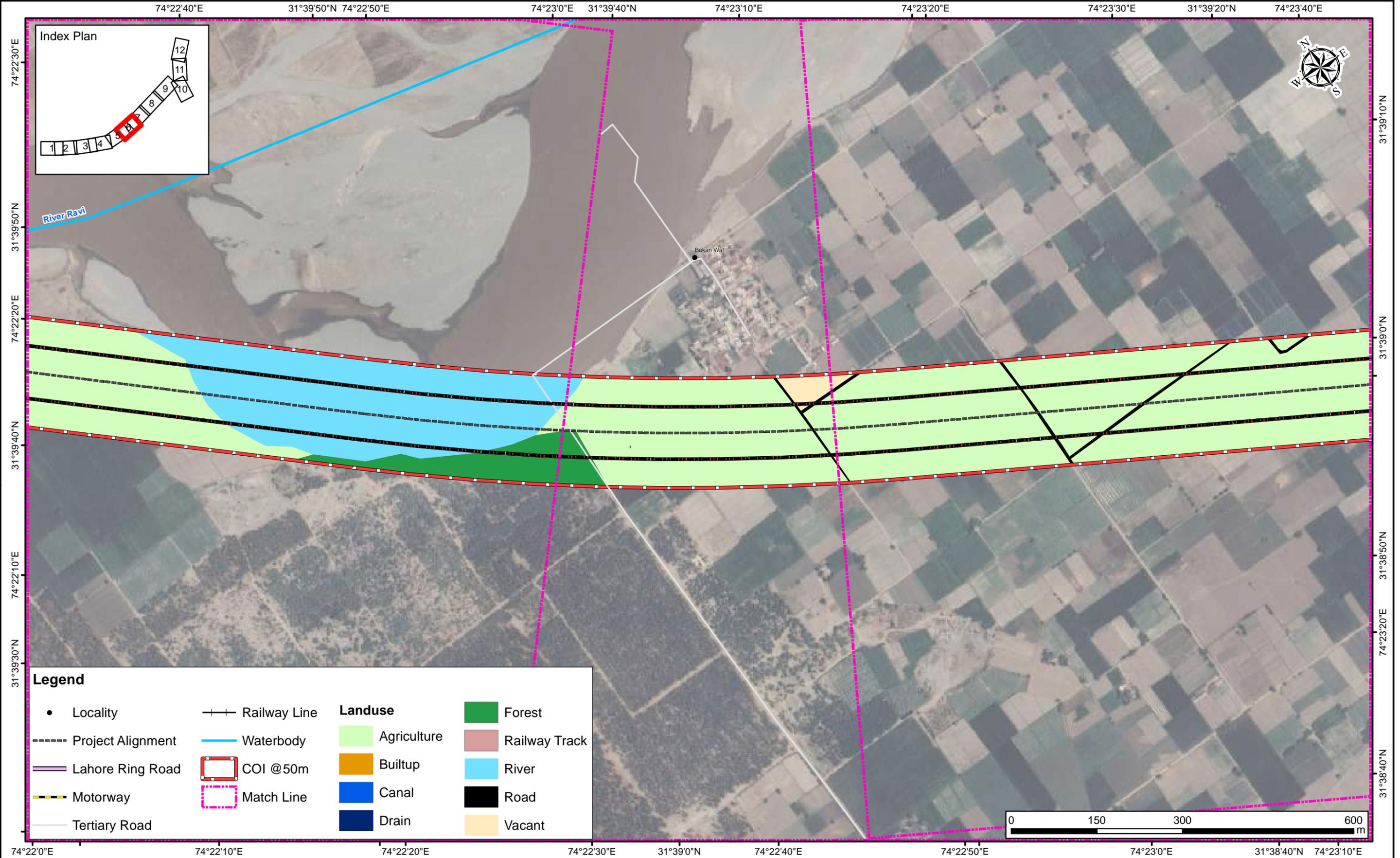
HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN

| | | | | | | |
|------|------|-------------|----------|----------|----------|--|
| 04 | | | | | | |
| 03 | | | | | | |
| 02 | | | | | | |
| 01 | | | | | | |
| REV. | DATE | DESCRIPTION | APPROVED | APPROVED | SHEHNILA | |

PROJECT NAME

RRUDP-BRIDGE 03 ROAD

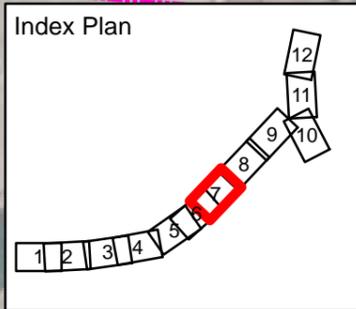
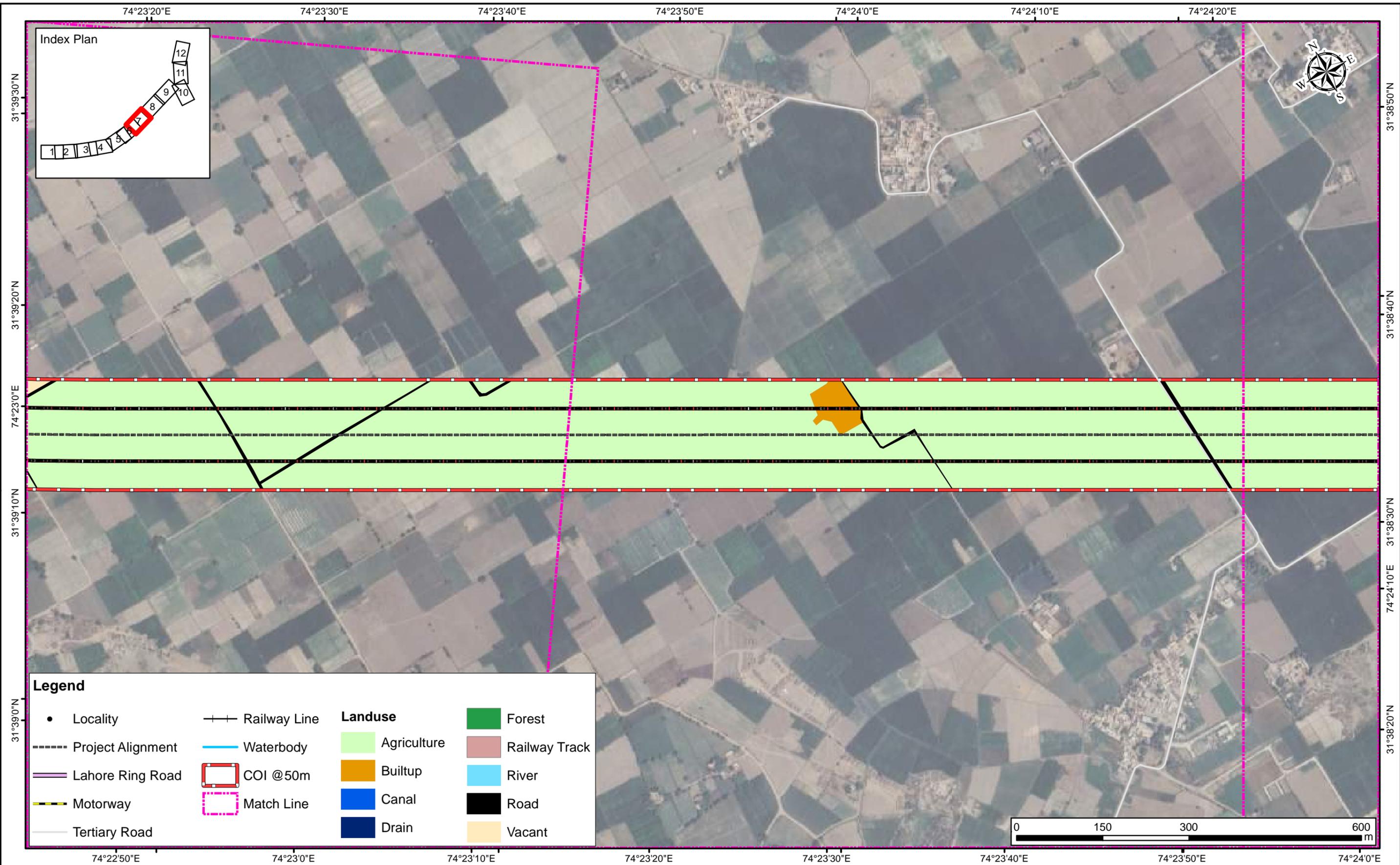
| | | |
|--------------------------------|---------------------------------|-------------------------|
| EXISTING LAND USE MAP | | SCALE 1:6,010 |
| DATE FEBRUARY - 2025 | FIG. NO. Page 5 of 12 | REV. 0 |



| Legend | | Landuse | |
|-----------------------|------------------|-------------|---------------|
| • Locality | --- Railway Line | Forest | Railway Track |
| --- Project Alignment | --- Waterbody | Agriculture | River |
| --- Lahore Ring Road | --- COI @50m | Builtup | Road |
| --- Motorway | --- Match Line | Canal | Vacant |
| --- Tertiary Road | | Drain | |



| | | | | | | | | | | |
|--|---|-------------|----------|----------|-------------|---------|--|------------------------------|--------------------------|-----------|
| CLIENT RIVA URBAN DEVELOPMENT AUTHORITY (RUDA) | CONSULTANT NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN | 04 | | | DRAWN | FARHEEN | PROJECT NAME RRUDP-BRIDGE 03 ROAD | EXISTING LAND USE MAP | | SCALE |
| | | 03 | | | SUBMITTED | | | | | 1:6,020 |
| | | 02 | | | RECOMMENDED | | | DATE FEBRUARY - 2025 | FIG. NO. Page 6 of 12 | REV. 0 |
| | | 01 | | | CHD/VER. | | | | | |
| REV. | DATE | DESCRIPTION | APPROVED | APPROVED | SHEHNILA | | | | | |



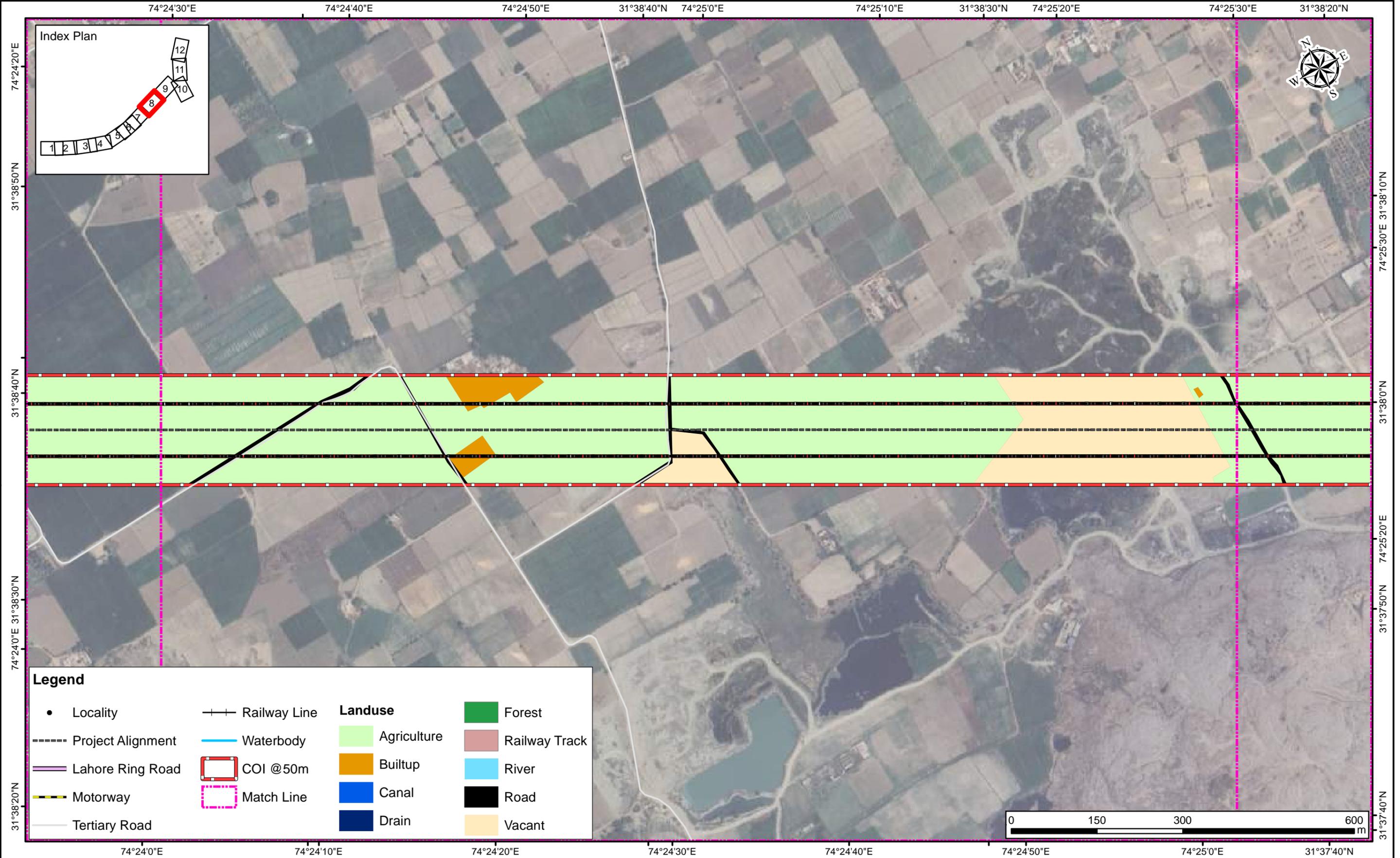
Legend

- Locality
- Project Alignment
- Lahore Ring Road
- Motorway
- Tertiary Road
- ++ Railway Line
- Waterbody
- COI @50m
- Match Line

Landuse

- Agriculture
- Builtup
- Canal
- Drain
- Forest
- Railway Track
- River
- Road
- Vacant

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| | | 02 | | | | RECOMMENDED | | | DATE FEBRUARY - 2025 | FIG. NO. Page 7 of 12 | REV. 0 |
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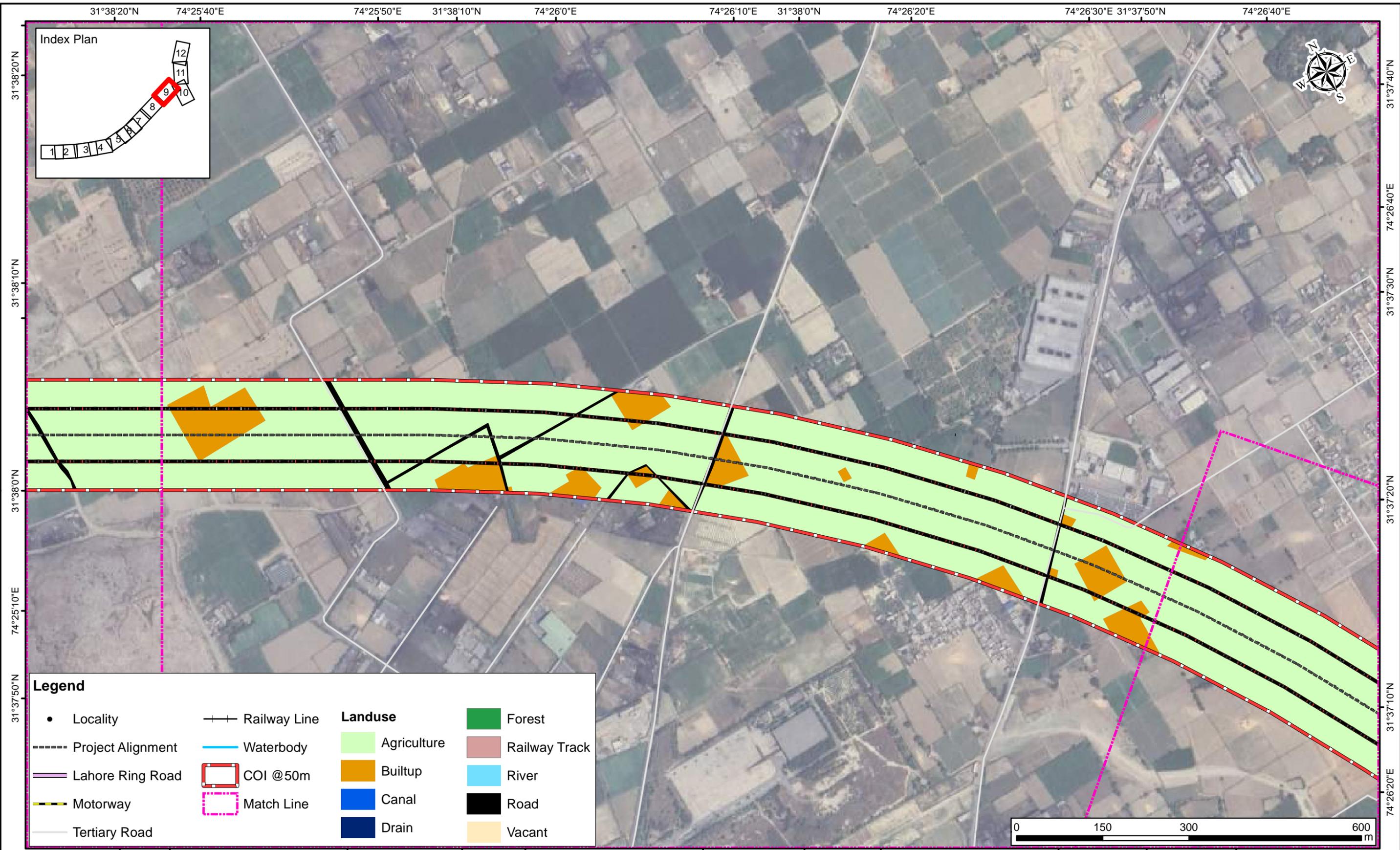
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- Locality
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- COI @50m
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Landuse

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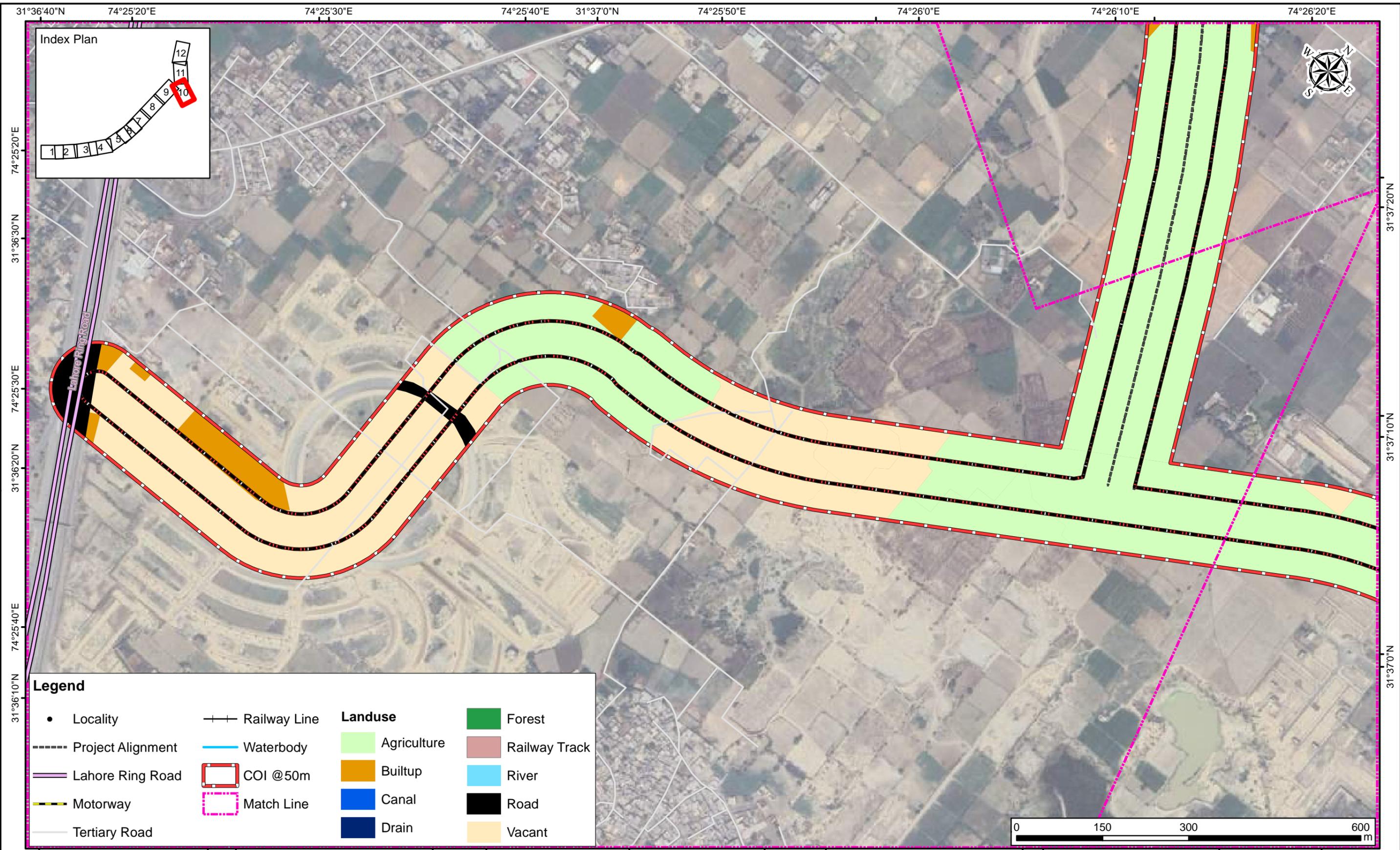
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Landuse

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Legend

- Locality
- Project Alignment
- Lahore Ring Road
- Motorway
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- + + + Railway Line
- Waterbody
- COI @50m
- Match Line
- Landuse**
- Agriculture
- Builtup
- Canal
- Drain
- Forest
- Railway Track
- River
- Road
- Vacant



CLIENT



RIVA URBAN DEVELOPMENT AUTHORITY (RUDA)

CONSULTANT



NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD

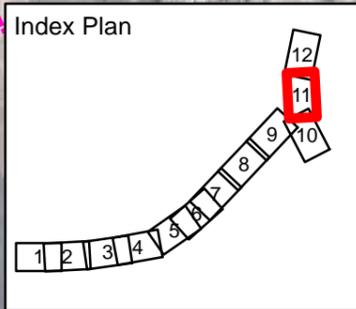
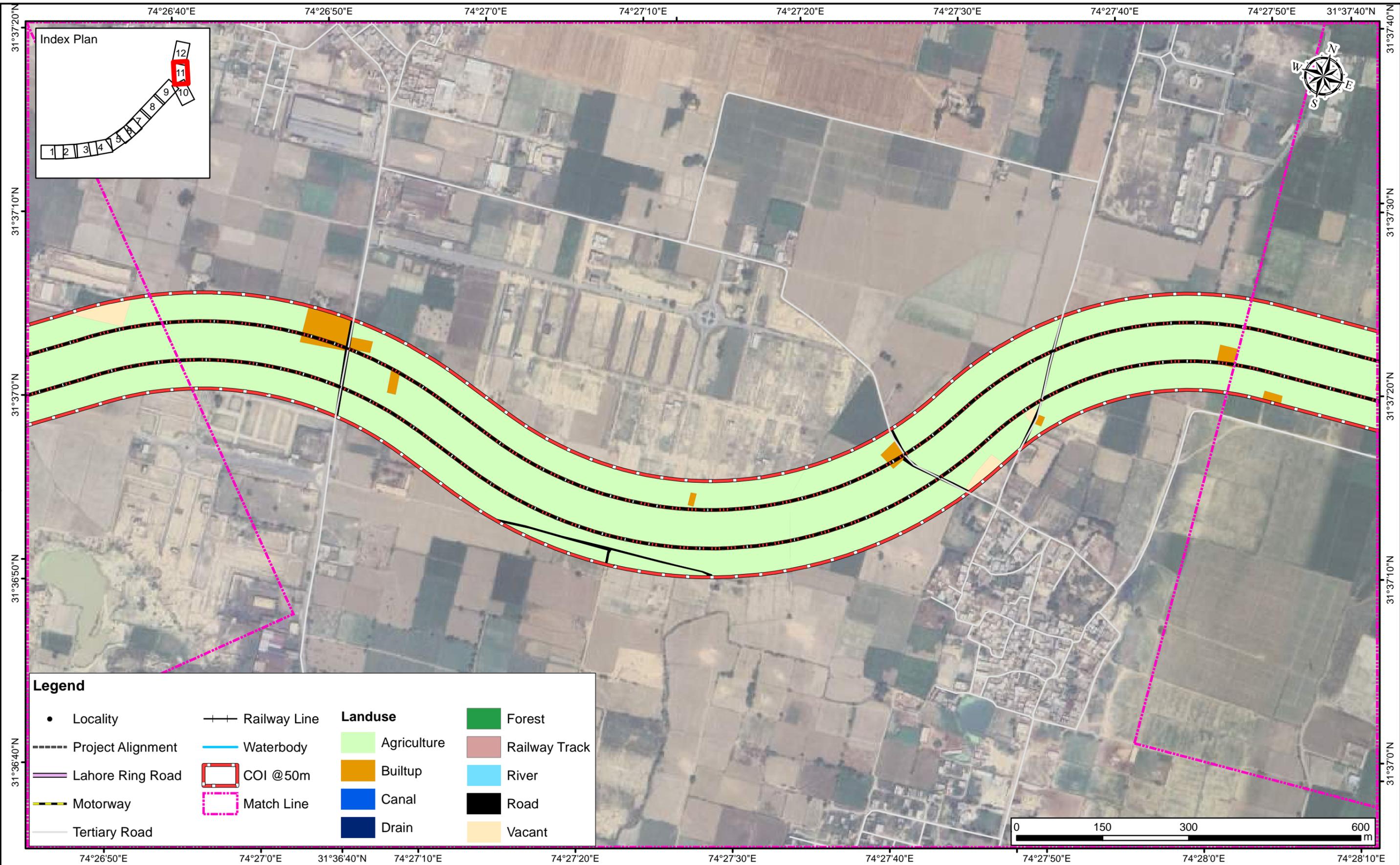
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PROJECT NAME

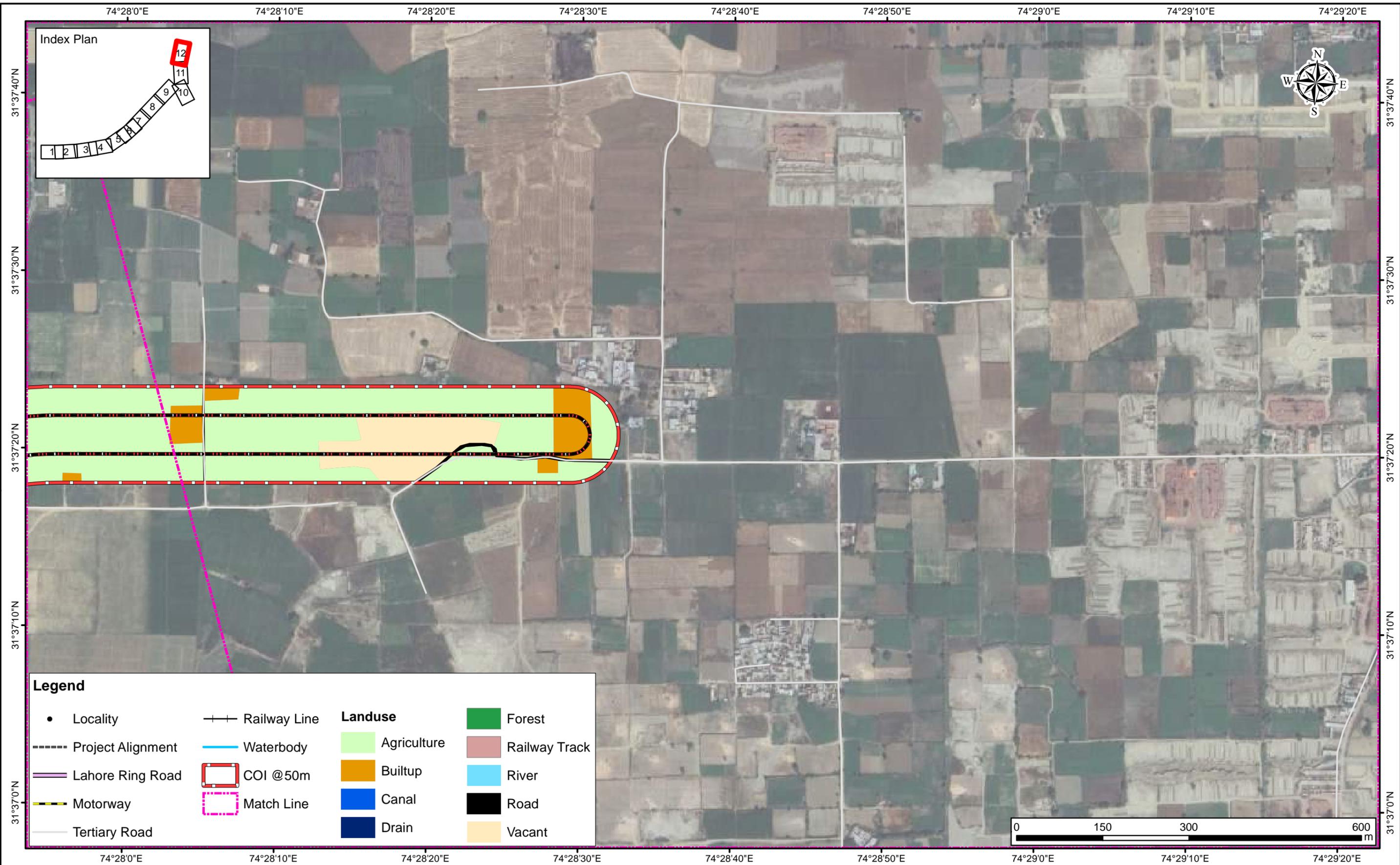
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| DATE FEBRUARY - 2025 | FIG. NO. Page 10 of 12 | REV. 0 |



| Legend | | | |
|-----------------------|------------------|----------------|---------------|
| • Locality | --- Railway Line | Landuse | Forest |
| --- Project Alignment | Waterbody | Agriculture | Railway Track |
| --- Lahore Ring Road | COI @50m | Builtup | River |
| --- Motorway | Match Line | Canal | Road |
| --- Tertiary Road | | Drain | Vacant |

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| Legend | | | |
|-----------------------|------------------|----------------|---------------|
| • Locality | --- Railway Line | Landuse | Forest |
| --- Project Alignment | Waterbody | Agriculture | Railway Track |
| --- Lahore Ring Road | COI @50m | Builtup | River |
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| CLIENT RIVA URBAN DEVELOPMENT AUTHORITY (RUDA) | CONSULTANT NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN | 04 | | | | DRAWN | FARHEEN | PROJECT NAME RRUDP-BRIDGE 03 ROAD | EXISTING LAND USE MAP | | SCALE |
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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
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 | <ul style="list-style-type: none"> ▪ Errors in contract documents; and ▪ Contract documents incomplete at commencement of construction. |
| Design | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ Ordering errors (i.e. ordering items not in compliance with specification); ▪ Over allowances (i.e. difficulties to order small quantities); and ▪ Supplier errors. |
| Transportation | <ul style="list-style-type: none"> ▪ Damage during transportation; ▪ Difficulties for delivery vehicles accessing construction sites; ▪ Insufficient protection during unloading; and ▪ Inefficient methods of unloading |
| On-Site Management and Planning | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ Inappropriate site storage space leading to damage or deterioration; ▪ Improper storing methods; and ▪ Materials stored far away from point of application. |
| Material Handling | <ul style="list-style-type: none"> ▪ Materials supplied in loose form; ▪ On-site transportation methods from storage to the point of application; and ▪ Inadequate material handling. |
| Site Operation | <ul style="list-style-type: none"> ▪ Accidents due to negligence; ▪ Unused materials and products; ▪ Equipment malfunction; |

| Origins of Waste | Causes of Waste |
|------------------|--|
| | <ul style="list-style-type: none"> ▪ Poor craftsmanship; ▪ Use of wrong materials resulting in their disposal; ▪ Time pressure; and ▪ Poor work ethics. |
| Residual | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 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-V
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 as 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-VI
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-VII
GUIDELINES TO COMBAT WITH COVID-19

PRECAUTIONARY ACTION AGAINST THE POTENTIAL RISK OF NOVEL CORONAVIRUS

INTRODUCTION

On February 11, 2020 the World Health Organization announced an official name for the disease that is causing the 2019 novel coronavirus outbreak, first identified in Wuhan China. The new name of this is coronavirus disease 2019, abbreviated as COVID-19. In COVID-19, 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for disease. Formerly, this disease was referred to as "2019 novel coronavirus" or "2019-nCoV".

Coronaviruses are a large family of viruses. Some cause illness in people, and others, such as canine and feline coronaviruses, only infect animals. Rarely, animal coronaviruses that infect animals have emerged to infect people and can spread between people. This is suspected to have occurred for the virus that causes Coronavirus Disease 2019 (COVID-19). Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) are two other examples of coronaviruses that originated from animals and then spread to people.

The risk of exposure to COVID-19 is no different for employees of Employer, Engineer, Contractor, and suppliers than for the general population. Contractor, therefore, must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals. As experience has shown in other countries, confirmed cases of COVID-19 expand exponentially if health and safety controls are left unheeded.

Contractor should enforce all health and safety procedures at Site including sanitary protocols, proper hygiene, social distancing, use of personal protective equipment (PPE), toolbox talks on special COVID-19 requirements, and prompt reporting of health issues related to COVID-19. Contractors must put safeguards in place to keep workers exposed to COVID-19 away from Site for at least 14 days after the last potential exposure.

WHO declared the COVID-19 as a Public Health Emergency of International Concern (PHEIC) in January 2020 and afterwards announced the COVID-19 outbreak as pandemic on 11th March 2020 due to the widespread of the disease in 114 countries at that time. WHO Director General urged the countries to take action now to stop the disease.

The rapid spread of COVID-19 hits all the provinces of Pakistan Sindh, Balochistan, Punjab & Khyber Pakhtunkhwa including the Gilgit Baltistan and Azad Jammu & Kashmir. The prevailing virus creates the menacing and distressing situation when it arrived around the closed proximities of the Project Area.

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-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>.

All the stakeholders are on board to jointly prevent/ limit/ control the spread of COVID-19. All of the staff is required to take precautionary measures as well as maintain social distances. The

use of thermal guns for checking every single person body temperature, placement of relevant flyers and disinfection spray inside of all the containers are few of the measures to combat COVID-19.

OBJECTIVE

Following are the objectives of this report to jointly prevent / limit/ control the spread of COVID-19 at Site that can hamper the progress of proposed Project:

1. To enhance understanding of the evolving COVID-19;
2. To share knowledge on COVID-19 and preparedness measures being implemented at Site;
3. To generate recommendations for adjusting COVID-19 containment and response measures; and
4. Outline the measures taken at Site. The advised measures will help all the stakeholders to plan their work continuity in response to the COVID-19.

Due to the evolving situation of the COVID-19, this document should be read in conjunction with the latest relevant advisories issued by WHO (especially "[Getting your workplace ready for COVID-19, 3 March 2020](#)") and Government of Pakistan.

WHAT IS CORONA VIRUS (COVID-19)

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)¹.

SYMPTOMS

The symptoms of the COVID-19 are similar to that of regular pneumonia. Typical symptoms include;

- Fever;
- Cough;
- Difficulty in breathing;
- Pneumonia;
- Runny nose;
- Sore throat; and
- Feeling of being unwell.

MODE OF SPREAD

Infected person – person transmission; Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, similar to how influenza and other respiratory pathogens spread. The spread from person-to-person is most likely among close contacts (about 6 feet);

- Infected animals' dead or Alive;

¹ Source: World Health Organization

- Air by coughing and sneezing;
- Close personal contact, such as touching or shaking hands;
- Touching an object or surface with a virus on it; and
- Touching your mouth nose or eyes before washing your hands.

GENERAL STANDARDIZED PRECAUTIONARY MEASURES

Following measures/recommendations are suggested as a general guidance to be followed for the protection of potential impacts of COVID-19:

Since, there is no vaccine available to protect against human Coronavirus infections. Therefore, transmission can be prevented through following measures:

- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;
- Avoid touching your eyes, nose, and mouth with unwashed hands;
- If you are concerned about your symptoms you should see your health care provider at site or in office;
- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately;
- Sterilization / disinfection of medical devices at Site dispensaries; and
- Do not touch, buy or eat wild animals (gamey). Try to avoid visiting markets that sell such animals.

PROJECT SITE SPECIFIC PRECAUTIONARY MEASURES

Measures for protecting staff and labour from exposure to, and infection with, the COVID-19 depend on the type of work being performed and exposure risk, including potential for interaction with infectious people and contamination of the work environment. Regardless of specific exposure risks, following are the main actions that have been jointly taken at Site to combat the COVID-19:

Employer's Side

Employer should issue the notification containing the precautionary measures in the light of GoPb guidelines to be implemented at Site. Upon receiving the Employer notification all the mentioned precautionary measures will be communicated to Engineer staff for compliance. Employer technical staff is also complying with the GoPb guidelines and Contractor suggestion to control the spread of COVID-19 at Site in the best interest of the Project and country.

Consultant's Side

Consultant's top management will issue the orders in the light of GoPb guidelines containing the precautionary measures to control the spread of COVID-19 for the staff working at Site.

Consultant staff at Site will fully complying with the orders including photographic evidence. Considering the severity of the prevailing virus Engineer devised the Standard Operating Procedure (SOP) containing precautionary action against the potential risk of novel corona virus.

Besides, above Consultant will ensure the following precautionary measures at Site.

- Adequate signage and information at all entrances and exits showing what is Corona Virus, how it spreads, what are the symptoms, standard precautions;
- The awareness session for the Contractor staff is equally important as of Consultant staff to combat the COVID-19 at Site. The Consultant will ensuring that Contractor is arranging such session at Site from time to time to reduce the potential risk of COVID-19. Further, all the newly inducted and existing staff have been given HSE training by the Consultant & Contractor.

Contractor's Side

Contractor will communicate various precautionary measures to Employer and Engineer through letters to control the spread of COVID-19 at Site. Following are the major steps to be taken by the Contractor:

- Contractor will convey the instructions and requirements of its superior unit for the prevention and control of COVID-19 epidemic at Site.
- Contractor will establish a special organization for epidemic prevention and control on the Project Site that is responsible for arranging, implementing, publicizing and supervising the epidemic prevention and control measures.
- Launch the plan for epidemic prevention and control on the project Site that includes:
 - All personnel in temporary camp are required to wear masks;
 - Contractor personnel incharge of Site to wear masks;
 - Arranged special personnel to measure and record the temperature of all personnel when entering or leaving the temporary camp;
 - If any person with fever, cold and other symptoms are found, they will be admonished to go home for isolation and asked about the development of the disease every day; and
 - Propagate and implement the epidemic prevention measures for the staffs and labours and warn them not to go outside and home as much as possible.
- All these meetings should carried out through video conference.

Contractor is not limited to the above precautionary measures but practicing and implementing the following;

- Contractor will prepare a pamphlet for the awareness of Site staff to combat the COVID-19. It will also place/posted at strategic points at Site.
- Launch awareness campaign to inform all the staff and labour about the coronavirus, to use facemask, hand hygiene, cough etiquette, and avoidance of close contact with animals and consumption of their raw products.
- Everyday awareness speech in English and Urdu in the temporary camp.
- All the employees are not allowed to go outside of the Project Area or on vacation to their homes and on daily basis visit to sites;

- Contractor will provide medical masks and antibacterial liquid hand wash to all personnel.
- Contractor will prepare the isolation facility at Site and provided three isolated rooms for such patients inside the temporary camp. Each room have three beds, oxygen cylinder, sanitizers, isolation kit, hand wash.
- Thermal scanning will be carried out continuously in the morning for everybody at the main gate of temporary camp.
- Record will be maintained for everyone that includes the temperature value of each person with their names, every morning and afternoon go to each department for scanning separately and noted down their name with temperature values.
- Contractor carry out disinfectant spray on daily basis morning and afternoon in each office and rooms and all the area of the camp.
- SSWMB and Consultant staff will also requested by Contractor to do not interact physically rather through electronically by emails or video conferencing.

RECOMMENDATIONS FOR THE CONTROL OF COVID-19 AT SITE

To Avoid Transmission

For all personnel at Site, it is always a good to practice the following precautionary measures:

- Workers to remain at least two meters apart from each other at all times (social distancing) – i.e. spread out and reduce the number of people working together in one area of the site;
- Avoid eating lunch in the form of group in available mess/canteens at Site;
- Close site canteens/ food preparation and eating areas (avoid gatherings) – workers to bring their own prepared lunch to site and eat alone e.g. in their van, car, or in an open space;
- Avoid in-person meetings if possible. In the case that an in-person meeting is unavoidable, make sure to have it in a well-ventilated area with sufficient space for attendees to distance themselves from one another. For meetings such as toolbox talks, consider breaking them up into smaller group meetings versus one large meeting;
- Introduce enhanced cleaning procedures across the Site and touch points e.g. office equipment, plant and machinery controls, taps/toilet/washing facilities, handrails;
- Stagger start times on site to avoid congestion in entrance areas;
- Reduce the number of people on site inductions at any one time and hold them outdoors if possible;
- Stop workers moving across various sites (potential for cross contamination);
- No outsiders should be at the Project Site;
- Contractor, Consultant and Employer personnel are advised to avoid travelling and in case traveling is unavoidable, prior approval from the management should be essential. In case of travelling, the above mentioned measures need to be strictly followed by the traveller;
- Prompt identification and isolation of potentially infectious individuals is a critical first step in protecting workers and other Site staff. An isolated area should be available at Site to immediately isolate suspected person, as it is most important to stop its spread at Site.
- Rapid Response Team should be formed and be informed immediately in case of suspect and confirmed case of COVID-19.

- Medical team at Site should separate the suspected person displaying fever, cough or difficulty breathing from other personnel; and
- If a person has had close contact with an individual that has confirmed COVID-19, that person will not be allowed to return to the Site until he/she has been symptom free for 14 days.
- Clean and fumigate all the workplaces at Site on daily basis;
- Ask people to stay at home if they have fever, cough, difficulty in breathing, runny nose, sore throat as per organizational rules;
- An immediate replacement of solid soap with liquid anti-bacterial soap bottles may be appropriate.
- Provision of alcohol-based hand sanitizer need to available for all staff;
- Clean the religious places carpets and rugs. Have them washed in place over the weekend and then do regular cleaning;
- Have the cleaners/ maintenance crews regularly clean surfaces that are touched frequently by personnel with disinfectants such as in and out doors;
- Fresh medical tests of staff working should be carried out at Site;
- Dispose of all contaminated waste (gloves, paper, swab handles, etc.) into biohazard waste bags for disposal;
- Ensure that panic is not created. In fact the posters should start with statements such as do not panic and fear the virus but know and prevent; and
- Ensure proper ventilation system for all the personnel at Site.

Use of Personal Protective Equipment (PPEs)

- Necessary PPE should be available at Site all the times and are being issued to each personnel at Site;
- Practice of using masks is also being ensured by all parties at Site (a surgical or N95 masks);
- Re-usable PPE should be thoroughly cleaned after use and not shared between workers. Single use PPE should be disposed of so that it cannot be reused;

Outside Visitors

- Visitors should enter with strictly wearing visitors card;
- Ensure sanitization of hands;
- All parties should ensure that the sick persons should be wearing a surgical or N95 masks;
- Note down the complete information of outsiders before entrance;
- Proper screening should be carried out before entering the Site;
- Refrain from handshakes. Rather than shaking hands, visitors may explain why handshakes can contribute to the risk of spread;
- Attempt to maintain a general six (6) feet distance between themselves. This will be challenging to follow at all times but it is Engineer recommendation to follow;
- Refrain from and/or limit touching of workplace surfaces; and
- In addition to these on-site procedures, it is advised to follow their respective organizational instructions related to Site visits.

ANNEX-VIII
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-IX
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 | <ul style="list-style-type: none">▪ 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) | <ul style="list-style-type: none">▪ 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 |
|-----------------------------|--|
| | <ul style="list-style-type: none"> ▪ Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. ▪ Establish and appoint all emergency organization structure and team. ▪ Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. ▪ Ensure resources available to purchase needed emergency response equipment and supplies. ▪ Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. ▪ Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. ▪ The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event. |
| Security Team | <ul style="list-style-type: none"> ▪ Ensure that the exit route is regularly tested and maintained in good working order. ▪ Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel. ▪ Assist with strong/activation of services during an emergency. ▪ Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency. |
| Rescue & Medical Team | <ul style="list-style-type: none"> ▪ Protect the injured from further danger and weather. ▪ Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. ▪ Remain familiar with the rescue activities and rescue apparatus. ▪ Assist outside medical services personnel when they arrive |
| General Administration Team | Response to support any requested general facilities for assisting Emergency Response Team in their work. |
| Government Relation Team | <ul style="list-style-type: none"> ▪ Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. ▪ Coordinate emergency plan with the government authorities, local community. |
| Environment Team | In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation. |
| Department Heads | <ul style="list-style-type: none"> ▪ Call up of personnel into the safe location for protective life and property. ▪ Take immediate and appropriate action while Emergency Response Team is being mobilized. ▪ Keep in touch with the Emergency Commander ▪ Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. ▪ Provide and maintain emergency equipment of their responsible areas. |

| Action Group | Responsibility |
|---------------------------|---|
| Other Staff and Employees | <ul style="list-style-type: none"> ▪ 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

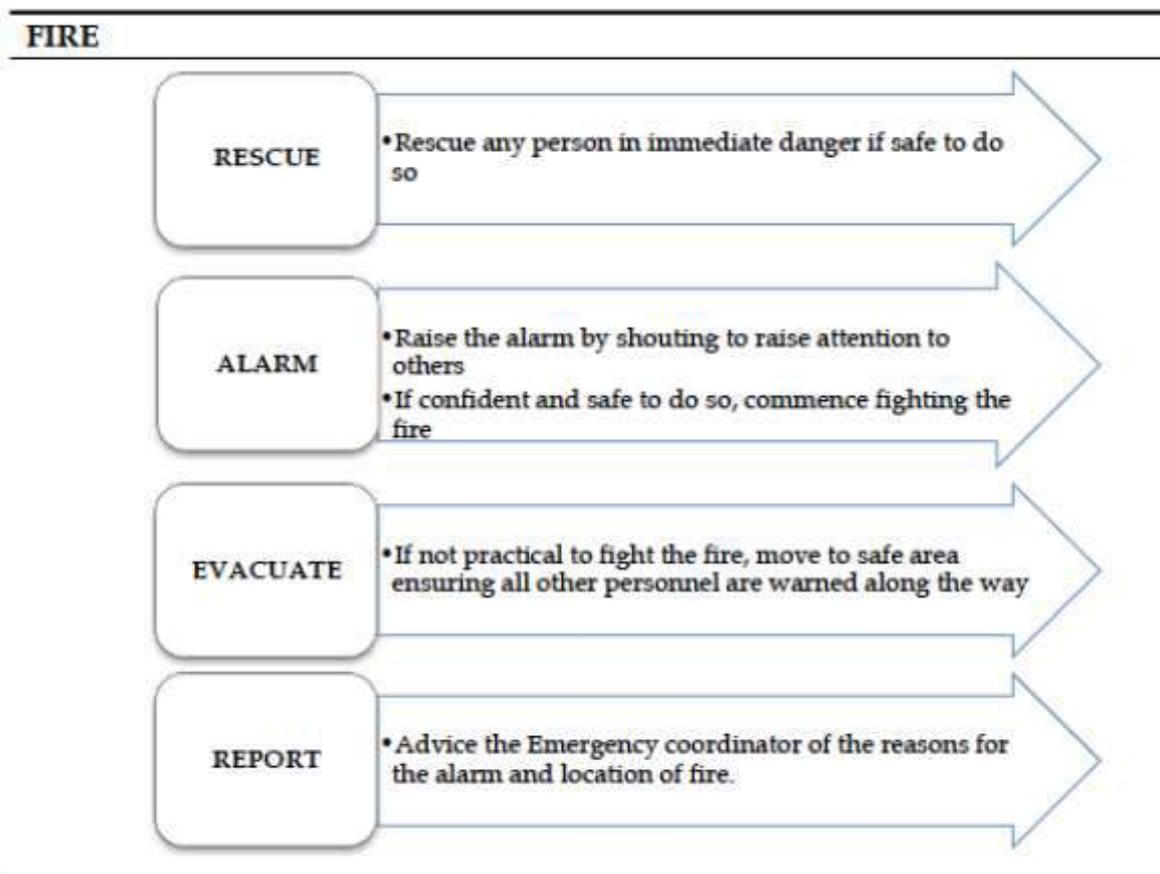
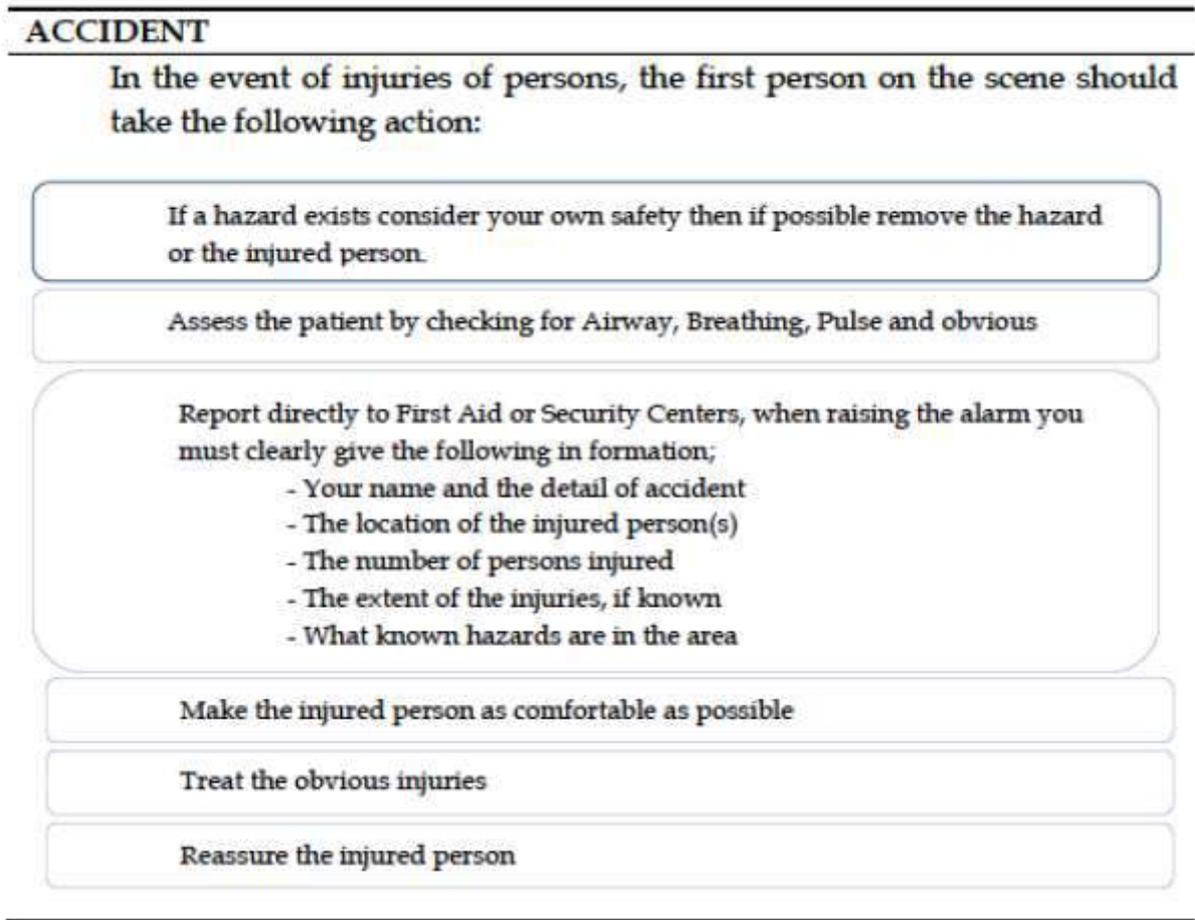


Figure 3.2 Emergency Procedures for Serious Accident



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 avoided 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

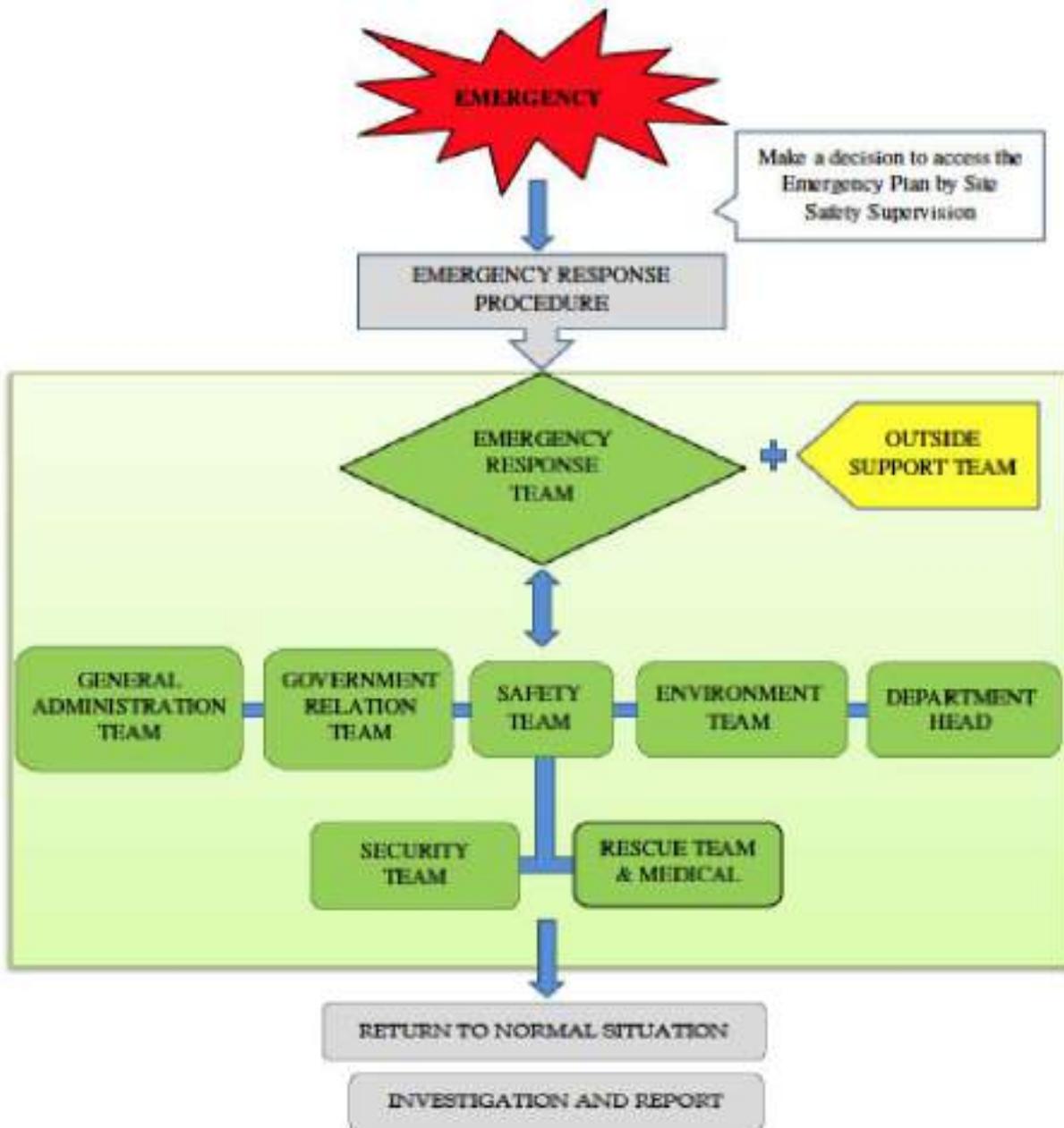
Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

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: <input type="checkbox"/> 01-Death <input type="checkbox"/> 02-Serious Injury <input type="checkbox"/> 03-Lost Time Injury <input type="checkbox"/> 04-First Aid <input type="checkbox"/> 05- Not Injury <input type="checkbox"/> 06-Near Miss | | | | | | | | | |
| Property Damage Cost: <input type="checkbox"/> 1-2,000 USD <input type="checkbox"/> 2,001-10,000 USD <input type="checkbox"/> 10,001-50,000 <input type="checkbox"/> > 50,001 | | | | | | | | | |
| Section C: Environmental Impact | | | | | | | | | |
| Affected area | <input type="checkbox"/> Construction area | | <input type="checkbox"/> Public area | | | | | | |
| Receptor | <input type="checkbox"/> None | | <input type="checkbox"/> Workers | | <input type="checkbox"/> Community | | | | |
| Type of pollution | <input type="checkbox"/> Physical | | <input type="checkbox"/> Chemical | | <input type="checkbox"/> Biological | | | | |
| Toxicity | <input type="checkbox"/> Non-toxic | | <input type="checkbox"/> Low - toxic | | <input type="checkbox"/> High - toxic | | | | |
| Return to Normal | <input type="checkbox"/> 1 day | | <input type="checkbox"/> 1 day to 1 week | | <input type="checkbox"/> ≥ 1 week | | | | |
| Cumulative impact | <input type="checkbox"/> Non-cumulative | | <input type="checkbox"/> Cumulative | | | | | | |
| Section D: Injured/Illness Employee | | | | | | | | | |
| 1.Name: | | Sex | Date of Birth: | | | Age: | Regular Job Title: | Experience: | |
| | | <input type="checkbox"/> Male <input type="checkbox"/> Female | Month | Day | Year | | | In this job title Years Weeks | In this Project Years Weeks |
| Site: | Company: | | Reference: | | | Phone No: | | Social Security Number | |
| Part of Body Injured or Affected: | | | | | Nature of Injury or Illness: | | | | |
| <input type="checkbox"/> Head | <input type="checkbox"/> Hands | <input type="checkbox"/> Face | <input type="checkbox"/> Nose | <input type="checkbox"/> Laceration | <input type="checkbox"/> Amputation | <input type="checkbox"/> Puncture | <input type="checkbox"/> Fracture | | |
| <input type="checkbox"/> Eyes | <input type="checkbox"/> Legs | <input type="checkbox"/> Teeth | <input type="checkbox"/> Neck | <input type="checkbox"/> Strain & Sprain | <input type="checkbox"/> Burns | <input type="checkbox"/> Contusion | <input type="checkbox"/> Dry Heat Friction | | |
| <input type="checkbox"/> Trunk | <input type="checkbox"/> Toes | <input type="checkbox"/> Elbow | <input type="checkbox"/> Shoulder | <input type="checkbox"/> Hematoma | <input type="checkbox"/> Foreign Body | <input type="checkbox"/> Chemical | <input type="checkbox"/> Contamination | | |
| <input type="checkbox"/> Back | <input type="checkbox"/> Ankle | <input type="checkbox"/> Wrist | <input type="checkbox"/> Foot | <input type="checkbox"/> Skin (Occupational) | <input type="checkbox"/> Rash | <input type="checkbox"/> Irritation | | | |
| <input type="checkbox"/> Arms | <input type="checkbox"/> Thumb | <input type="checkbox"/> Fingers | <input type="checkbox"/> Internal | Remark: | | | | | |
| 2.Name: | | Sex | Date of Birth: | | | Age: | Regular Job Title: | Experience: | |
| | | <input type="checkbox"/> Male <input type="checkbox"/> Female | Month | Day | Year | | | In this job title Years Weeks | In this Project Years Weeks |
| Site: | Company: | | Reference: | | | Phone No: | | Social Security Number | |
| Part of Body Injured or Affected: | | | | | Nature of Injury or Illness: | | | | |
| <input type="checkbox"/> Head | <input type="checkbox"/> Hands | <input type="checkbox"/> Face | <input type="checkbox"/> Nose | <input type="checkbox"/> Laceration | <input type="checkbox"/> Amputation | <input type="checkbox"/> Puncture | <input type="checkbox"/> Fracture | | |
| <input type="checkbox"/> Eyes | <input type="checkbox"/> Legs | <input type="checkbox"/> Teeth | <input type="checkbox"/> Neck | <input type="checkbox"/> Strain & Sprain | <input type="checkbox"/> Burns | <input type="checkbox"/> Contusion | <input type="checkbox"/> Dry Heat Friction | | |
| <input type="checkbox"/> Trunk | <input type="checkbox"/> Toes | <input type="checkbox"/> Elbow | <input type="checkbox"/> Shoulder | <input type="checkbox"/> Hematoma | <input type="checkbox"/> Foreign Body | <input type="checkbox"/> Contamination | <input type="checkbox"/> Chemical | | |
| <input type="checkbox"/> Back | <input type="checkbox"/> Ankle | <input type="checkbox"/> Wrist | <input type="checkbox"/> Foot | <input type="checkbox"/> Skin (Occupational) | <input type="checkbox"/> Rash | <input type="checkbox"/> Irritation | | | |
| <input type="checkbox"/> Arms | <input type="checkbox"/> Thumb | <input type="checkbox"/> Fingers | <input type="checkbox"/> Internal | 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 <input type="checkbox"/> Inadequately Guarded | 1 <input type="checkbox"/> Operating Without Authority / Training | |
| 2 <input type="checkbox"/> Unguarded | 2 <input type="checkbox"/> Operating at Unsafe Speed | |
| 3 <input type="checkbox"/> Defective Tools, Equipment, or Substance | 3 <input type="checkbox"/> Marking SHB Device Inoperative | |
| 4 <input type="checkbox"/> Unsafe Design or Construction | 4 <input type="checkbox"/> Using Unsafe Equipment or Equipment Unsafely | |
| 5 <input type="checkbox"/> Hazardous Arrangement | 5 <input type="checkbox"/> Unsafe Loading, Placing, Mixing | |
| 6 <input type="checkbox"/> Unsafe Illumination | 6 <input type="checkbox"/> Taking Unsafe Position | |
| 7 <input type="checkbox"/> Unsafe Ventilation | 7 <input type="checkbox"/> Working on Moving or Dangerous Equipment | |
| 8 <input type="checkbox"/> Unsafe Clothing | 8 <input type="checkbox"/> Distraction, Teasing, Horse Play | |
| 9 <input type="checkbox"/> Insufficient Instruction | 9 <input type="checkbox"/> Failure to use Personal Protective Devices | |
| 10 <input type="checkbox"/> Lack of system of work | 10 <input type="checkbox"/> 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 |
| <input type="checkbox"/> Stop the Behaviour | <input type="checkbox"/> Remove | <input type="checkbox"/> Site Engineer, or |
| <input type="checkbox"/> Study the job | <input type="checkbox"/> Guard | <input type="checkbox"/> Site Manager, or |
| <input type="checkbox"/> Instruct (tell-show-try-check) | <input type="checkbox"/> Warn | <input type="checkbox"/> Project Manager, or |
| <input type="checkbox"/> Follow Up | <input type="checkbox"/> Supervisory Training | <input type="checkbox"/> Safety Committee |
| <input type="checkbox"/> 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-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 (more than 1:10) by planting 1500 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 area's carrying capacity in many positive ways.

It is pertinent to mention that approximately **130 trees** may be impacted (GIS-based, needs field verification) on site, which is recommended for compensation (**1500 plants**) 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 colour 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.

ANNEX-X

AREA ENHANCEMENT PLAN

The plants will be raised along the road. The Total number of plants to be planted is **1500** Number for this project. The compensation cost and trees for Anu Bhatti PF is other than the given plan, which will be provided by Punjab FD, and the cost will be provided by the RUDA for restoration.

**The Forest Department/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/English Name | Scientific Name |
|---------|--------------------|---------------------------|
| 1. | Neem | <i>Azadirachta indica</i> |
| 2. | Sukh Chain | <i>Pongamia pinnata</i> |
| 3. | Jaman | <i>Eugenia jambolina</i> |
| 4. | Kachnar | <i>Bauhinia variegata</i> |

COST

Break-up of Expenditure per Avenue kilometer @ Rs. 1500/- per diem: Break-up of Expenditure per Avenue kilometer or 250 plants @ Rs. 1500/- per diem:

FIRST YEAR

| Sr. No. | Item | Quantity | Rate | Amount (PKR) |
|--------------|---|-----------|----------------|-------------------|
| 1. | Layout | 1 Av.km | 2 MD/Av.km | 3,000.00 |
| 2. | Digging of Pits 2.5 ft. each 2.5x250 = 625 cft. | 625 cft. | 5 MD/Av.km | 7,500.00 |
| 3. | Cost of Plants including | 250 No. | Rs100/- plant | 25,000.00 |
| 4. | Cost of planting of plants | 250 No. | Rs. 25/- plant | 6,250.00 |
| 5. | Carriage of plants from private nursery to site including loading/unloading | 250 No. | Rs. 10/- plant | 2,500.00 |
| 6. | Cost of Manure and Bhall (silt) including carriage | 1 Av. Km | | 20,000.00 |
| 7. | H/watering 50 times 250x50 with water bowser, one driver and one coolie | 12500 no. | 5MD/per %0 | 100,000.00 |
| 8. | Weeding twice 250x2 | 500 no. | 2 MD/per % | 15,000.00 |
| 9. | Reopening of Pits twice (250x2)/cft/pit | 500 cft. | 2 MD/per % | 15,000.00 |
| 10. | Unforeseen | | | 5750.00 |
| Total | | | | 200,000.00 |

SECOND YEAR

ANNEX-X

| Sr. No. | Item | Quantity | Rate | Amount (PKR) |
|--------------|--|-----------|----------------|--------------------|
| 1. | Cost of Plants 20% Restocking | 50 No. | Rs.100/- plant | 5,000.00 |
| 2. | Cost of planting | 50 No. | Rs. 25/- plant | 1,250.00 |
| 3. | Carriage of plants | 50 No. | Rs. 10/- plant | 500.00 |
| 4. | H/watering 50 times with water bowser, one driver and one coolie | 12500 no. | 5MD/per %0 | 100,000.00 |
| 5. | Reopening of Pits twice (250x2) | 500 cft. | 2 MD/per % | 1,5000.00 |
| 6. | Weeding twice 250x2 | 500 no. | 2 MD/per % | 1,5000.00 |
| 7. | Unforeseen | | | 1,250.00 |
| Total | | | | 1,38,000.00 |

THIRD YEAR

| Sr. No. | Item | Quantity | Rate | Amount (PKR) |
|--------------|--------------------------------------|------------|----------------|------------------|
| 1. | Cost of Plants 10% Restocking 25 No. | 25 No. | Rs.100/- plant | 2,500.00 |
| 2. | Cost of planting | 25 No. | Rs. 25/- plant | 625.00 |
| 3. | Carriage of plants | 25 No. | Rs. 10/- plant | 250.00 |
| 4. | H/watering 40 times x250 no. | 10,000 no. | 5MD/per %0 | 75,000.00 |
| 5. | Reopening of Pits twice (250x2) | 500 | 5MD/per %0 | 3,750.00 |
| 6. | Unforeseen | | | 2,875.00 |
| Total | | | | 85,000.00 |

FOURTH YEAR

| Sr. No. | Item | Quantity | Rate | Amount (PKR) |
|--------------|--------------------------------|----------|------------|------------------|
| 1. | H/watering 30 times | 7500 no. | 5MD/per %0 | 56,250.00 |
| 2. | Pruning and cleaning of plants | 250 no. | 5MD/per %0 | 1,875.00 |
| 3. | Unforeseen | | | 1,875.00 |
| Total | | | | 60,000.00 |

*Cost for raising 1 Av. Km and Maintenance or 250 plants in single row: = **PKR. 483,000/-**

For 4 years cost of 1500 Plants = PKR 2,898,000 Total.

**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