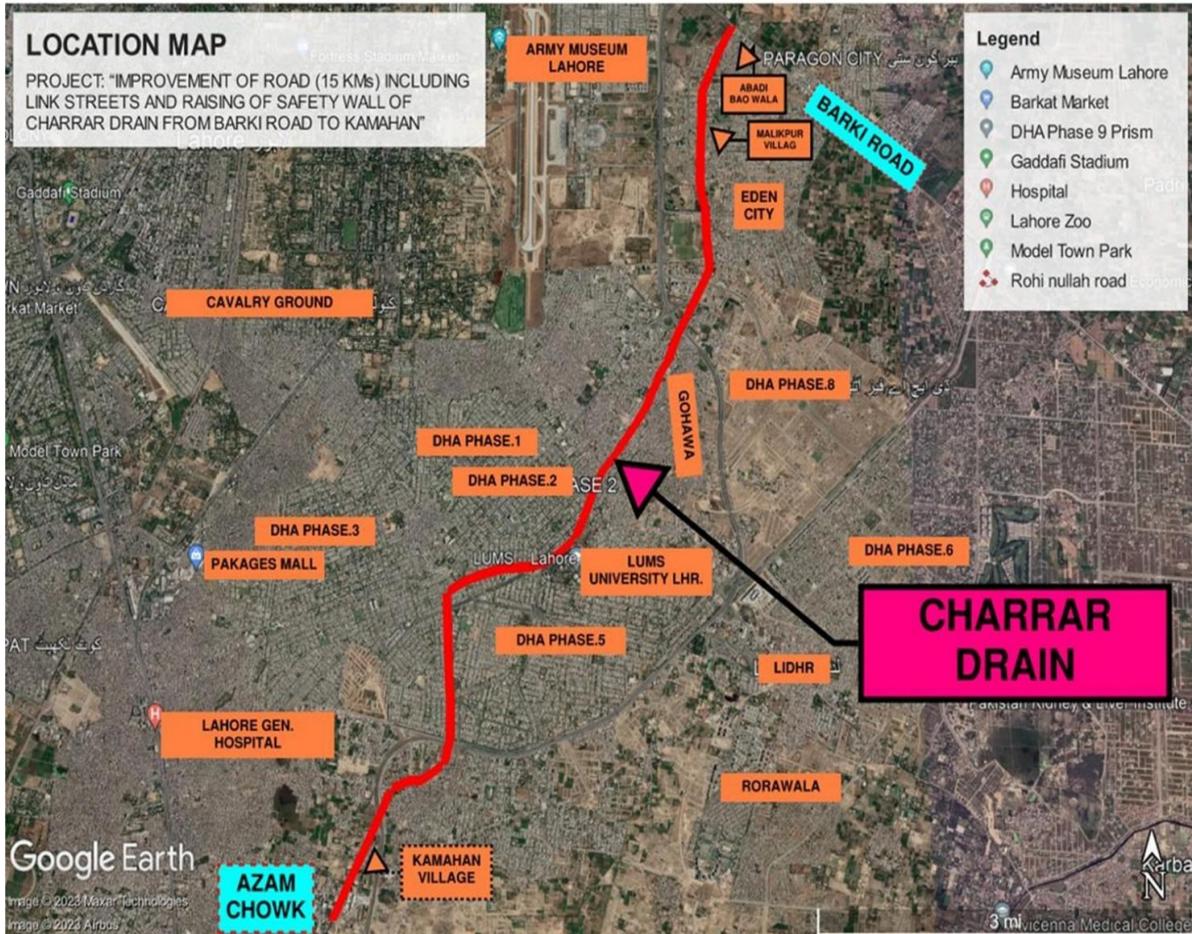


Environmental Impact Assessment (EIA) for Improvement of Road (15 kms) Including Link Streets and Raising of Safety Wall Charrar Drain from Burki Road to Kamahan Road - Lahore



PROPONENT: Lahore Cantonment Board



Draft report

March, 2025



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Executive Summary

Es-1: The Environmental Impact Assessment (EIA) for the development of a 15-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore, aims to evaluate the potential environmental, social, and economic impacts associated with the project. This assessment, prepared by Contemporary Associates (CONAST) on behalf of the Lahore Cantonment Board, provides a comprehensive analysis to guide decision-makers in adopting sustainable development practices. The primary objective of this EIA is to assess the project's compliance with environmental laws and regulations, including the Pakistan Environmental Protection Act, 1997, and the Punjab Environmental Protection Regulations, 2022.

Es-2: The proposed project seeks to address critical infrastructural issues along the deteriorated road adjacent to the Charrar Drain. This route serves as a vital connection between residential and commercial areas, impacting local communities' access to essential services like healthcare, education, and markets. The deteriorated condition of the road has led to increased vehicular accidents, traffic congestion, and excessive wear and tear on vehicles, affecting the quality of life for local residents. Rehabilitation efforts aim to enhance transportation efficiency, reduce pollution from dust, and improve road safety.

Es-3: The EIA is structured to adhere to the regulatory framework established by the Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022, aligned with the Pakistan Environmental Protection Act, 1997. The assessment considered baseline environmental conditions within a 2-kilometer radius of the project site, exploring physical, biological, and socio-economic factors. The physical assessment evaluated air and water quality, noise levels, and geological features. The biological assessment included flora, fauna, and habitat conditions, while the socio-economic study analyzed population demographics, livelihood sources, and local infrastructure.

Es-4: Several alternatives were evaluated to balance development with environmental protection. The 'no project' option would avoid all environmental impacts but maintain existing infrastructure challenges. The 'site alternative' option considered rerouting to minimize ecological disruption, while the 'build as proposed' option was selected for its feasibility, cost-effectiveness, and ability to maximize socio-economic benefits. Identified adverse impacts include air and noise pollution, traffic congestion, potential loss of vegetation, and possible disruption to local wildlife. These impacts can be mitigated through traffic management plans, solid waste management strategies, and conservation efforts.

Es-5: Stakeholder consultations were conducted with local residents, government agencies, environmental authorities, and community organizations to ensure inclusive decision-making. Public consultations highlighted concerns about increased traffic, water drainage, solid waste management, and disruptions during construction. These inputs were incorporated into the project planning, and specific mitigation measures were proposed, such as constructing culverts, safety walls, and implementing traffic control mechanisms.

Es-6: The Lahore Cantonment Board, as the project proponent, has committed to implementing an Environmental Monitoring and Management Plan (EMMP) during all project phases—pre-construction, construction, and operational. The EMMP outlines monitoring strategies, waste management protocols, and safety standards to minimize negative impacts. Specific actions include regular monitoring of air and water quality, noise level assessments, and ensuring the proper disposal of construction waste. Post-project monitoring will ensure compliance with environmental standards, securing long-term sustainability and minimizing residual impacts.

Es-7: A robust grievance redress mechanism (GRM) has been established to address the concerns of stakeholders and local communities during the construction and operational phases. The GRM aims to resolve conflicts promptly, minimize disruptions, and build trust among stakeholders. It ensures transparency through regular updates, community meetings, and feedback sessions.

Es-8: The EIA highlights the cumulative impacts of the project, considering interactions with other ongoing developments in the region. These impacts include increased vehicular traffic, urbanization pressures, and the need for improved waste management systems. The assessment proposes integrated strategies to mitigate cumulative impacts, including coordination with local authorities, monitoring programs, and periodic environmental audits.

Es-9: The conclusion and recommendations of the EIA affirm the feasibility of the project, emphasizing the importance of adhering to the proposed mitigation measures. The assessment recommends continuous environmental monitoring, adherence to legal standards, and adaptive management strategies to address unforeseen impacts during the project's lifecycle. These efforts will ensure that the road development aligns with sustainable urban growth and community well-being.

Es-10: In summary, the development of the 15-kilometer road along the Charrar Drain is a necessary and beneficial project for the region, offering socio-economic improvements while addressing environmental challenges. The Lahore Cantonment Board's commitment to environmental stewardship, stakeholder engagement, and regulatory compliance is pivotal in realizing the project's objectives. Through effective implementation of the Environmental Monitoring and Management Plan (EMMP) and adherence to mitigation measures, the project can achieve its intended goals sustainably and responsibly.

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Chapter 1: Introduction

The Environmental Impact Assessment (EIA) for the project titled "Improvement of Road (15 KMs) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan" aims to evaluate the potential environmental, social, and economic impacts associated with the proposed infrastructure development. This project, initiated by the Lahore Cantonment Board under the sponsorship of the Ministry of Defense, Pakistan, seeks to upgrade the existing road network, enhance connectivity, and ensure safer commuting for the local population. Given the deteriorated condition of the existing roadways and the challenges faced by residents and commuters, this initiative is crucial for improving accessibility, reducing transportation costs, and promoting sustainable urban development in the area. The EIA will assess potential environmental risks, propose mitigation strategies, and ensure that the project aligns with sustainable development goals and relevant environmental regulations.

The project involves the construction/improvement of the road along Charar Drain and link streets in adjacent areas where required from Barki to Baaowala, from Malikpur start point to main Malikpur village to Eden City DHA, from Eden City to Broadway, from Ring Road to Bedian Road, from Bedian Road to Chungh Village, from Chungh Village to LUMS DHA, shapes to DHA Bus Depot to LGS, LGS to Filter House DHA Kamah to Azam Chowk and Adjacent Roads (Gohawa Village Roads, Sajpal Village Roads, Baowala Roads, KB Colony Roads, Chungh Village Roads, Malikpur Village Roads, and Alfalah Town Roads)

Existing Conditions of Road along Charar Drain

The roads are broken to its worst extent. The condition has become much serious as so many accidents are happening daily. Those who commute on roads frequently, mostly the drivers of public and private transport vehicles, and the people residing in towns along the charrar drain complaining about the poor condition of the roads and bumpy rides. Many villages and small towns are connected by this road and many people travel here daily. Local transport owners don't earn as much money per day as they are wasting money on fixing their cars. Due to this, local transport is not used and locals are facing severe problems. If people continue to use their car and they face the same problem, their car breaks down. It is a road full of dust or potholes.

1.1 Environmental Objective of ESIA

Environmental Impact Assessment (EIA) is a proactive approach to identify and manage potential environmental and social consequences of developmental projects.

The environmental objectives of EIA are:

1. Predict potential environmental and social impacts.
2. Comply with national and international safeguards.
3. Avoid, minimize, or mitigate adverse effects.
4. Integrate environmental and social concerns into decision-making.
5. Ensure stakeholder participation throughout project planning and operation.
6. Promote sustainable solutions and development.

By conducting EIA before project implementation, stakeholders can:

- Identify potential risks and opportunities.
- Develop strategies for mitigation and management.
- Ensure environmentally and socially responsible decision-making.
- Foster transparency and accountability.

EIA provides a comprehensive evaluation of significant environmental consequences, enabling projects to:

- Protect ecosystems and biodiversity.

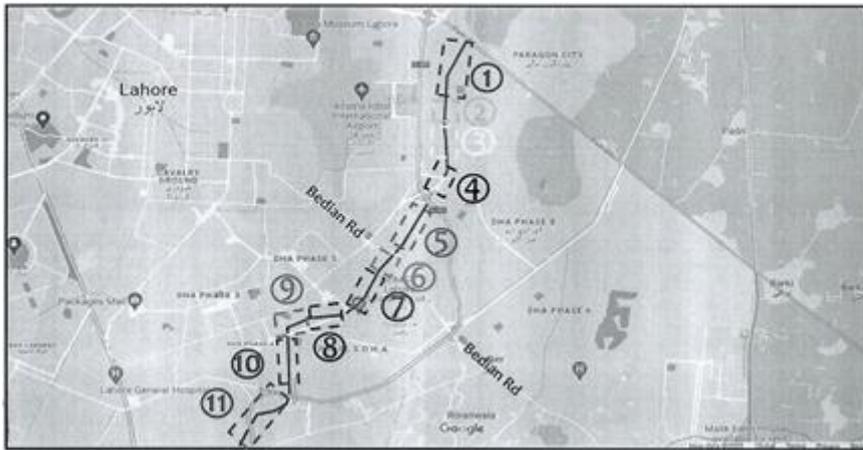
- Preserve natural resources.
- Support sustainable development.

In essence, EIA is a critical tool for responsible project planning, ensuring that environmental and social considerations are integrated into project design and implementation.

1.2 The Project

The Project is the construction of a Road Along Charrar Drain (15 kms) From Burki Road to Kamahan Road, Lahore. The key map of the project location has been shown in Figure.

Figure 1.1 Key Map of the Project Location



1.3 An Overview of the Project

The project involves the construction/improvement of the road along Charar Drain and link streets in adjacent areas where required from Burki Road to Kamahan Road in Lahore. It crosses through residential areas of Lahore cantt and different phases of DHA Lahore. Its length is 15 km.

1.4 The Proponent

The proponent of the project, namely the construction of a Road Along Charrar Drain (15 kms) From Burki Road to Kamahan Road, Lahore is Lahore Cantonment Board. represented by Engr Adnan Aslam. Throughout this report, the term 'Proponent' will refer to Lahore Cantonment Board. All necessary documents will be signed by the Focal person Engr Adnan Aslam, Dy of Lahore Cantonment Board acting on behalf of the Proponent, as required.

1.5 Name of the Organization Preparing the Report

M/s Contemporary Associates (shall be referred as “The Consultant” in this report) has prepared the Environmental Impact Assessment (EIA) for Road Along Charrar Drain (15 kms) From Burki Road to Kamahan Road - Lahore Project. The list of names and roles of team members carrying out the ESIA has been attached below.

1.6 Details of Project Study Team

S. No	Name	Qualification	Designation
1	Dr Ayesha Naveed Ul Haq	PhD-Environmental Sciences	Team Leader/Focal Person
2	Dr Asad Gufran	PhD-Natural Resources	Senior Ecologist
3	Salman Zafar	MS-Sociology	Sociologist

4	Ms. Savera Ali	MS Environmental Sciences	Dy Manager Environment
5	Engr. Awais Khalid	BS Civil Engineering (Structure Engineer)	Engineering Support

1.7 Contact Persons

The authorized representatives of Lahore Cantonment Board and environmental consultant are the following:

Lahore Cantonment Board	Environmental Consultant
Project Proponent Lahore Cantonment Board <u>Focal Person</u> Engr Adnan Aslam Ph#+92 332 4846557 enr.adnansandhu@gmail.com	Dr. Ayesha Naveed Ul Haq H# PD 1096, Street 6, Cricket Stadium Road, Rawalpindi Ph#0333-5400681, ayesha.naveed.ul.haq@gmail.com

1.8 Environmental Impact Assessment

In Punjab Environment Protection and Climate Change Department (EP & CCD), all developmental projects undergo thorough environmental impact assessments before execution.

This aligns with international guidelines, focusing on analyzing potential environmental, social, and economic impacts, as well as implementing appropriate mitigation measures to address these impacts. These measures are outlined in Environmental Monitoring and Management Plans (EMMPs), which detail strategies for avoiding, minimizing, or compensating for negative impacts while promoting sustainable development practices.

1.9 Scope of EIA

This project necessitates an Environmental Impact Assessment (EIA) to identify the potential environmental impacts during the construction and operational phases of the proposed 15-kilometer road development along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore.

The scope of EIA of 15-kilometer road development along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore project is as follows:

- The identification and assessment of all major and minor impacts during pre-construction, construction and operational phases;
- Identification of all significant impacts that may require detailed assessment;
- Propose mitigation measures to minimize, eliminate or to compensate for the potential adverse impacts that may arise during pre-construction, construction and operational phases of the project;
- Public consultation with all the stakeholders of the proposed project;
- Preparation of Environmental and Management Plan;
- Conclusions and recommendations; and
- Preparation of an Environmental Report for submission to Environmental Protection Agency, Pakistan.

1.10 Approach and Methodology

1.10.1 Approach for EIA

The EIA for the development of 15-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore will be conducted in accordance with the regulatory framework established by the Punjab Environmental Protection (Review of

Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022. This structured approach will guarantee a thorough evaluation of the project's potential environmental impacts, aligning with national environmental regulations and standards.

1.10.2 Kick-off Meeting with the Proponent

The Kickoff meeting was held between the consultant's team and the focal person Lahore Cantonment Board on March 7, 2025 (Pictorial evidence Attached in Annexure-I)

1.10.3 Scoping of Project

On March 18, 2025, a detailed scoping session took place. During this session, a comprehensive discussion concerning the project's scope was conducted with Mr. Noor Ahmad, Deputy Director EP&CCD. (Pictorial evidence is provided in Annexure II.)

During this meeting, the list of activities for the study relevant to the environmental impact assessment to the project was discussed. This project falls under Category D (2) of Schedule II in the Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022.

1.10.4 Collection of Secondary Data

All available published and unpublished information pertaining to the background environment was obtained and reviewed. All data sources were carefully reviewed to collect the information:

Physical Environment: topography, geology, soils, seismic risk, major earthquake, surface and groundwater resources and climate;

Biological Environment: habitat types, flora and fauna (particularly rare or endangered species), critical habitats, and vegetation communities within the area;

Socio-Economic Environment: settlements, socio-economic conditions, infrastructure and land use; and

Heritage Aspects: sites of cultural, archaeological or historical significance.

The list of references of secondary data consulted during the EIA study is provided in Annexure.

1.10.5 Collection of Primary Data and Field Visit

The consultant team conducted a site visit and explored the surrounding areas to gain a comprehensive understanding of the project site's environmental conditions. Through field observations and the application of Rapid Social Appraisal methodology, the team gathered empirical data on the existing socio-economic and cultural context of the project area, focusing on communities within a 500-meter radius. During the field survey, the team took care to observe local wildlife, including mammals, birds, and other species, without causing any disruption or disturbance to their natural habitats.

1.10.6 Public Consultation

Public consultations were held with the community living around the 15-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore. The consultations informed them about the potential impacts of the proposed project on the physical, biological, and socio-economic environment. Their concerns, suggestions, and feedback were solicited and documented. Stakeholder meetings

were also held with representatives from EP & CCD universities, Lahore Cantonment Board, environmental practitioners, and developers. The insights gathered from the community and stakeholders were used to identify and address concerns and issues, which are subsequently highlighted and mitigated in the EIA report. A comprehensive list of individuals consulted is provided in the dedicated consultation chapter.

1.10.7 Review of Legislative Requirement

The information on environmental policies, national and international laws, as well as guidelines relevant to the project, was reviewed, and a synopsis of all relevant laws has been narrated in the report.

1.10.8 Identification and Evaluation of Impacts

A comprehensive impact assessment was conducted for the development of 15-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore, methodically identifying and evaluating potential environmental effects. Each impact was scrutinized for its likelihood and significance, with a focus on severity and probability. Insignificant impacts were filtered out, while significant ones were prioritized based on their ecological effects, public concern, and regulatory compliance. The assessment considered various factors, including impact characteristics, magnitude, and duration. This rigorous evaluation process informed the development of the Environmental Monitoring and Management Plan, targeting the most critical impacts and ensuring effective risk management and mitigation strategies.

1.10.9 Identification of Impacts and Propose Mitigation Measures

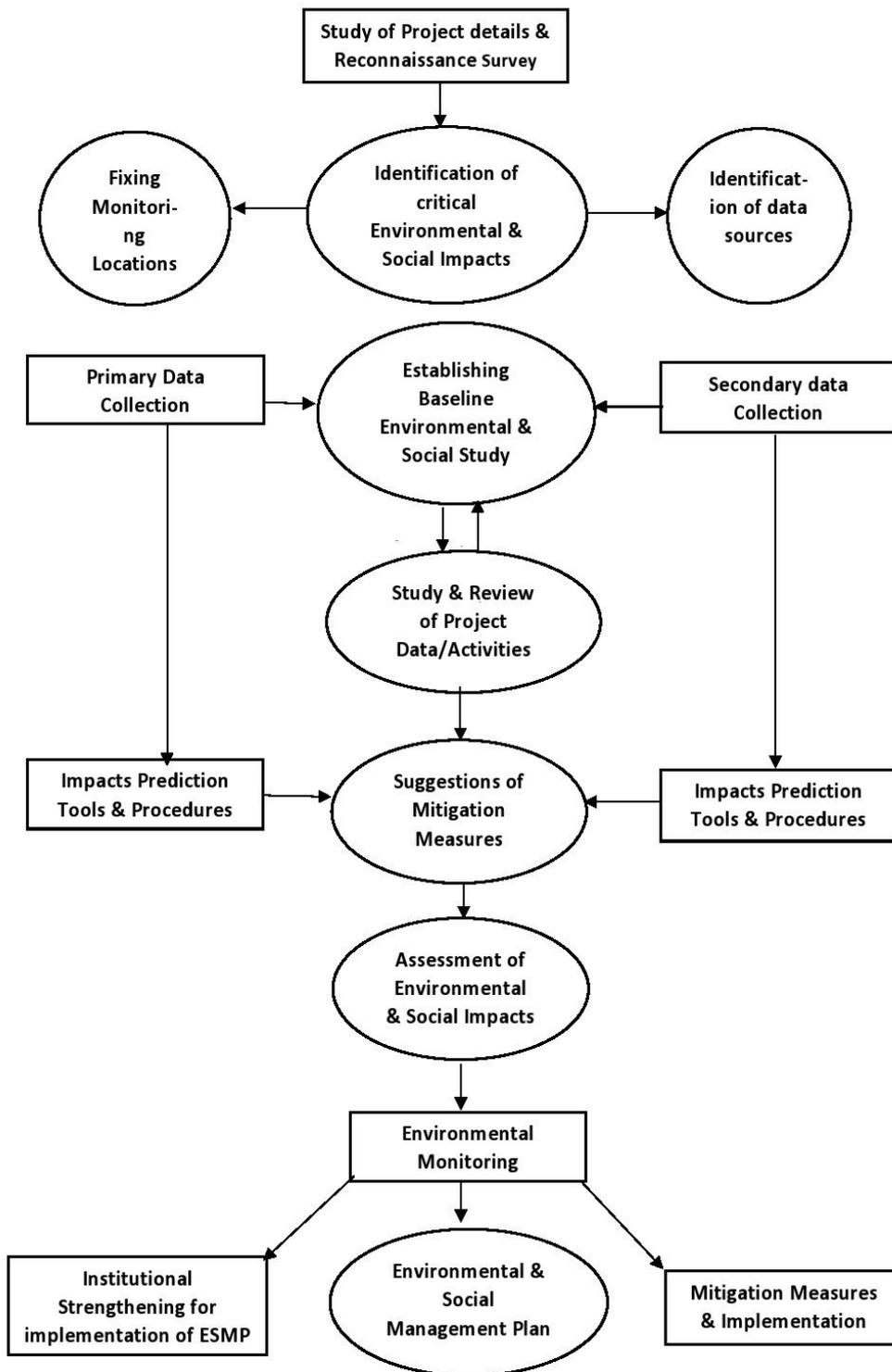
The primary goal of identifying mitigation measures is to determine effective practices, technologies, or activities that can prevent or minimize significant environmental impacts. This involves proposing physical and procedural controls to ensure the effectiveness of mitigation efforts. Following the impact evaluation, suggestions have been made for changes or improved practices in the planned activities to prevent and control unacceptable adverse impacts resulting from normal or extreme events. Additionally, monitoring requirements and institutional arrangements for monitoring have been established and recommended to ensure the ongoing effectiveness of mitigation measures.

1.10.10 Development of Environmental Monitoring and Management Plan (EMMP)

A comprehensive Environmental Monitoring and Management Plan (EMMP) has been established to ensure the effective implementation of mitigation measures for negative impacts throughout the project's pre-construction, construction, and operational phases. Additionally, an Environmental Monitoring Plan (EMMP) has been developed to track the progress and achievement of the EMMP's objectives during these phases. The EMMP outlines procedures for operational phase activities, defines roles and responsibilities for all relevant personnel, and establishes reporting requirements to ensure ongoing environmental stewardship and accountability.

The EIA methodology chart is presented in Figure 1.2.

Figure 1.2 EIA Methodology



1.11 Organization of the EIA Report

This report has been structured in the following manner:

Chapter 1 (*Introduction*) provides an overall introduction to the project and impact assessment methodology.

Chapter 2 (*Legal Framework*) describes the regulatory framework of Pakistan on the environment and its implications of the project.

Chapter 3 (*Project Description*) provides the description of the proposed project, its layout plan and associated activities, raw material details and utility requirement.

Chapter 4 (*Project Alternatives*) details the potential alternatives that were considered during design phase.

Chapter 5 (*Existing Environment*) provides a description of the micro-environment and macro-environment of the proposed project site. This chapter describes the physical, ecological and socio-economic resources land of the project area and surroundings.

Chapter 6 (*Impact Assessment and Mitigation Measures*) details the potential environmental and social impacts of the proposed project on the different features of the micro and macro-environment using matrix method.

Chapter 7 (*Environmental Monitoring and Management Plan*) explains the mitigation measures proposed for the project in order to minimize the impacts to acceptable limits. It also describes the implementation of mitigation measures on ground and monitoring of environmental parameters against likely environmental impacts.

Chapter 8 (*Public Consultation*) describes details of discussions held with primary and secondary stakeholders.

Chapter 9 (*Grievance Redressal Mechanism*) describes details of GRM.

Chapter 10 (*Conclusion*) summarizes the report and presents the conclusions. The last chapter is followed by Annexures that provides supporting information.

Table 1.1: Summary of Methodologies and Activities to conduct EIA

Objectives	Steps of EIA	Activities
<ul style="list-style-type: none"> • To develop a detailed understanding of the planned activities • To obtain equipment-specific information • To obtain information on alternatives and best construction practices • To form the basis of impact identification and evaluation • To define normal conditions for various parameters • To define current and expected trends • To understand and define nature and degree of impacts • To form the basis for developing a mitigation program • To compile all the information in one document • To submit a final report 	<p>Review of proposed alternatives</p> <p style="text-align: center;">↓</p> <p>Information on baseline Conditions</p> <p style="text-align: center;">↓</p> <p>Impact Assessment</p> <p style="text-align: center;">↓</p> <p>EIA Report</p>	<ul style="list-style-type: none"> • Meetings and discussions • Review of secondary data • Collection of baseline data • Public consultation with the community and stakeholders • Analysis of data • Identification of impacts • Evaluation of impacts • Preparation of Environmental Monitoring and Management Plan • Compilation and finalization of the report • Feedback from EP & CCD • Approval of EIA Report

Chapter 2: Legislative and Institutional Framework

2.1 Introduction

This section provides an overview of the legal and institutional framework governing environmental protection in Pakistan, with specific reference to the Lahore Cantonment Board - Charrar Drain Project. It outlines national policies, acts, and international commitments that guide environmental assessments and project implementation.

The legal framework primarily includes the Pakistan Environmental Protection Act, 1997 (PEPA), the Punjab Environmental Protection Act, 1997 (amended 2017), and the Punjab Environmental Quality Standards (PEQS), 2016. Additionally, the regulations under the Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022 are considered for this EIA.

EIA Requirements

The environmental challenges resulting from industrialization, urbanization, and inadequate environmental policies necessitated the establishment of a structured legal framework. The Pakistan Environmental Protection Act, 1997 serves as the core legislation for regulating environmental standards and compliance.

For this project, compliance with the following is mandatory:

- **Air Quality Standards:** PM_{2.5} and PM₁₀ levels must remain within PEQS limits.
- **Noise Pollution:** Must adhere to PEQS limits of 65 dB(A) for daytime and 55 dB(A) for nighttime.
- **Water Quality Standards:** Fecal coliforms and other contaminants should not exceed PEQS thresholds.
- **Wastewater Discharge:** COD, BOD, and oil & grease levels must meet PEQS criteria to avoid water contamination.

National & Provincial Legislation

- Pakistan National Conservation Strategy 1992
- National Environmental Policy 2005
- National Biodiversity Strategy & Action Plan
- The Land Acquisition (Punjab Amendment) Act, 1894
- National & Provincial Conservation Strategy
- Punjab Environmental Protection Act, 1997 as amended 2017;
- Punjab EPA Review of IEE and EIA Regulations, 2022;
- Punjab Environmental Quality Standards, 2016

2.2 National Conservation Strategy 1992

The National Conservation Strategy (NCS) is the first policy document that pledged to balance Pakistan's economic development with the conservation of natural resources. It is the underlying goal of this document that all economic and statutory development in the country should be such that it does not conflict with the interests of nature conservation. The Pakistan Environment Protection Act, 1997¹ is the basic legislative

¹ <https://environment.gov.pk/SitelImage/Misc/files/Act/brf-act1997.pdf>

tool empowering the government to frame regulations for the protection of the environment. The policy laws, regulations and standards relevant to construction of a Road Along Charrar Drain (15 kms) From Burki Road to Kamahan Road, Lahore. in context of environmental protection are described in the following sections.

2.3 Biodiversity Action Plan

As a signatory to the Convention on Biological Diversity, Pakistan is committed to developing a national strategy for biodiversity conservation. To this end, the Government of Pakistan has established a Biodiversity Working Group under the Ministry of Environment, Local Government, and Rural Development. Following an extensive consultative process, a draft Biodiversity Action Plan has been formulated. This Plan, designed to align with the National Conservation Strategy (NCS) and proposed provincial conservation strategies, identifies the key drivers of biodiversity loss in Pakistan and proposes a range of measures to conserve the country's biodiversity.

2.4 National Environmental Policy, 2005

The National Environmental Policy (2005) provides an overarching framework for addressing the environmental issues (particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification etc.) confronting Pakistan. It recognizes the goals and objectives of the Pakistan National Conservation Strategy (PNCS, 1992), National Environmental Action Plans, and other existing environment related national policies, strategies, and action plans. 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.

2.5 Laws & Regulation

2.5.1 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 (the Act) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The Act is application to a brand range of issues and extends to air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the Punjab Environment Quality Standards (PEQS) specified by the Environment Protection and Climate Change Department (EP & CCD) has been prohibited under the Act, and penalties have been prescribed for those contravening the provisions of the Act. The powers of Environment Protection and Climate Change Department (EP & CCD), established under the Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022; have also been considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint. Punjab Environmental Quality Standards (PEQS), 2016

The Punjab Environmental Quality Standards (PEQS) 2016 provide regulatory limits on various environmental pollutants to ensure sustainable development in Punjab, Pakistan. These standards, established under the Punjab Environmental Protection Act 1997, cover air emissions, noise pollution, wastewater discharge, and solid waste

management. PEQS 2016 sets permissible limits for vehicular emissions, dust levels, and noise, which are particularly relevant to road construction projects. Compliance with these standards is mandatory to minimize environmental degradation and protect public health. The PEQS also include guidelines for industrial and construction activities, requiring Environmental Impact Assessments (EIA) to assess and mitigate potential environmental impacts.

In the context of road development, adherence to PEQS 2016 is crucial to controlling dust, noise, and emissions from construction machinery and vehicular traffic. Road construction projects must ensure that noise levels remain within the prescribed limits, especially in residential and sensitive areas. The standards also regulate wastewater discharge and soil contamination, ensuring that construction activities do not pollute nearby water bodies. To comply with PEQS, mitigation measures such as dust suppression techniques, proper waste disposal, and noise barriers should be implemented. Regular environmental monitoring and reporting are required to ensure that the project remains within permissible environmental limits throughout its execution.

2.5.2 Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022.

The Punjab Environmental Impact Assessment (EIA) Regulations 2022 introduce significant procedural reforms to enhance environmental governance in Punjab, Pakistan. These regulations, established under the Punjab Environmental Protection Act 1997, extend the scope of projects requiring mandatory environmental clearance, now encompassing developments such as solar energy installations exceeding five megawatts, cutlery units, iron and steel re-rolling mills, rubber industries, battery manufacturing, flyovers, underpasses, and bridge constructions.

In the context of road development projects, these regulations necessitate a comprehensive EIA to assess potential environmental impacts, ensuring that all phases from planning and design to construction and operation—adhere to sustainable practices.

To expedite the environmental approval process, the regulations have reduced the public hearing period for environmental assessments from thirty days to seven days. Additionally, approval timelines have been shortened: Initial Environmental Examinations (IEEs) now require a decision within thirty days, reduced from forty-five, and Environmental Impact Assessments (EIAs) within forty-five days, down from ninety. An Advisory Committee, chaired by the Director General of the Punjab Environment Protection Agency, oversees these processes. The agency holds the authority to monitor compliance and revoke approvals if environmental requirements are not met.

For road construction projects, adherence to these streamlined procedures ensures timely identification and mitigation of environmental risks, promoting sustainable infrastructure development in Punjab.

Here are the salient features of the Punjab Environmental Impact Assessment (EIA) Regulations 2022, relevant to a road construction project:

- The regulations mandate an Environmental Impact Assessment (EIA) for large-scale infrastructure projects, including roads, bridges, and flyovers.
- Projects are categorized under Schedule I (IEE required) and Schedule II (EIA required) based on their potential environmental impact.

- The public hearing period for EIAs has been reduced from 30 days to 7 days to streamline approvals.
- Decision timelines have been shortened: IEE approval within 30 days (previously 45), and EIA approval within 45 days (previously 90).
- The Director General of Punjab EPA chairs an Advisory Committee responsible for reviewing and approving EIAs.
- The Punjab EPA has the authority to monitor project compliance and revoke approvals if environmental conditions are violated.
- Developers must implement mitigation measures to control dust, noise, air pollution, and waste disposal during road construction.
- Environmental monitoring and reporting are required throughout the project lifecycle to ensure adherence to regulatory standards.

2.5.3 Environmental Management Framework in Pakistan

The approach taken for the protection of the environment in Pakistan is laid down in the Environmental Conservation Strategy of 1992 and its review in 2000. For specific rules and regulations, “The Environmental Protection Act” was enacted in 1997 and it provides the backbone and framework for environmental legislation in Pakistan. This act establishes the Pakistan Environmental Protection Council, the highest decision-making body in environmental issues, the Pakistan Environmental Protection Agency (Pak EPA) and Environmental Tribunals.

The Pakistan Environmental Protection Council (PEPC) shall, among other duties, co-ordinate and approve comprehensive national environmental policies and approve National Environmental Quality Standards.

The act further defines the functions of institutions, providing a broad mandate to for enacting rules, procedures and technical standards in different areas of environmental protection. The Act requires Pak EPA to co-ordinate environmental policies and programs nationally and internationally, initiates legislation, establish surveys, manage monitoring and auditing schemes, and promote research as well as education and awareness in the field of the environment.

The Environmental Protection Act does further require the provincial authorities to establish Provincial Environmental Protection Agencies for carrying out functions delegated to the provinces.

The Government of Pakistan has recently elaborated its further action in-line with the finding of the review of the National Conservation Strategy in the form of the National Environmental Action Plan, NEAP (as approved by PEPC in 2001).

2.5.4 Administrative Framework

a-General

The Pakistan Environmental Protection Act, 1997 lays down the administrative framework for environmental management and monitoring.

The Federal and Provincial EPAs has the overall responsibility for monitoring the environmental parameters and for ensuring that any proposed project would not unduly harm to the existing environmental resources. They are also responsible for checking that the pollution generation and waste management in projects are within the allowable limits as set out in the NEQs.

In the case of this Project, the administrative provincial agency for environmental conservation is the Pakistan Environmental Protection Agency (EPA), Punjab.

Pakistan Environmental Protection Agency (PEPA)

Pakistan Environmental Protection Agency (PEPA), which works under the Federal Government, is the prime body responsible for implementation and monitoring of policies concerning environmental protection in Pakistan. As a first step, it has created an awareness among the masses about the deteriorating situation of environment and has urged the people, through the press and media campaigns, to participate in the fight to protect environment.

In addition to this, guidelines/regulations have been formulated to control the pollution created by domestic sewage, industrial effluents discharged into water bodies, emissions into atmosphere, etc. As a policy, it has been decided that in future any industrial unit which does not include a sound environmental protection and management plan would not be sanctioned. Moreover, environmental assessment and protection studies must form an essential part of the feasibility studies of every project.

The functions of PEPA include:

- Preparation of National Environmental Quality Standards
- Establishment of systems for surveys, surveillance and monitoring
- Measurement, examination and inspection to contain environmental pollution
- Identification of the legislative requirements in the environmental field
- **Pakistan Environmental Protection Agency (Pak-EPA):** Implements and monitors environmental policies at the federal level.
- **Punjab Environmental Protection Agency (Punjab EPA):** Oversees provincial compliance with PEQS and conducts EIA evaluations.

Guidelines for the Preparation and Review of Environmental Reports

- Provide a structured approach for compiling, assessing, and reviewing environmental reports.
- Ensure transparency and comprehensiveness in documenting potential environmental impacts and mitigation strategies.

Guidelines for Public Consultation

- Outline procedures for engaging stakeholders, including local communities, industry representatives, and environmental experts.
- Ensure that public concerns and recommendations are integrated into the decision-making process.

Guidelines for Sensitive and Critical Areas

- Identify environmentally sensitive regions such as wetlands, forests, wildlife habitats, and areas prone to natural disasters.
- Establish measures to protect and conserve these areas while enabling sustainable development.

Sectoral Guidelines

- Provide sector-specific environmental assessment criteria for industries such as agriculture, mining, infrastructure, and manufacturing.
- Define best practices for pollution control, resource management, and sustainable industrial operations.

As per the Environment Protection and Climate Change Department (EP & CCD) Review of IEE and EIA Regulations, all IEEs and EIAs must be prepared in accordance with these guidelines to the extent practicable. This ensures that development projects in Punjab are environmentally sustainable, comply with national and international

environmental standards, and promote responsible industrial and infrastructural growth.

2.6 Other Relevant Laws & Policies

2.6.1 National Rangeland Policy 2010

The main objectives² of policy include.

- To enhance productivity and the related functions and services of the rangeland ecosystem
- To promote rangeland enterprises for the livelihood improvement of the rangeland dependent communities
- To conserve and maintain rangeland biodiversity
- To mitigate the negative impacts of global warming and climate change especially related to desertification
- To enhance the skill and capacity of the key stakeholders for sustainable management of the rangeland management
- To undertake applied and action research on the key problems of the rangeland

2.6.2 National Drinking Water Supply 2009

In September 2009, the government approved the National Drinking Water Policy³ that provides a framework for addressing the key issues and challenges facing Pakistan in the provision of safe drinking water to the people by 2025.

Drinking water is the constitutional responsibility of the provincial governments, and the specific provision function has been developed to specially created agencies in cities, towns, and Tehsil Municipal Administrations under the Local Government Ordinance 2001.

Therefore, this policy framework is intended to guide and support the provincial and district governments in discharging their responsibility in this regard. The overall goal of the national drinking water policy is the following:

- To ensure safe drinking water to the entire population at an affordable cost in an equitable, efficient and sustainable manner.
- To ensure a reduction in the incidence of mortality and morbidity caused by water-borne diseases.

The policy is expected to be reviewed and updated every five years to examine its implementation and efficacy and to adapt it to the changing situation in the country.

2.6.3 National Sanitation Policy

The National Sanitation Policy⁴ aims at providing adequate sanitation coverage for improving the quality of life of the people of Pakistan and to provide the physical environment necessary for a healthy life. The Policy can be accessed at:

2.6.4 Land Acquisition Act, 1984

The Land Acquisition Act (LAA) of 1894⁵ amended from time to time has been the defacto policy governing land acquisition and compensation in the country. The LAA is the most commonly used law for acquisition of land and other properties for

² <https://pbit.punjab.gov.pk/system/files/National%20Rangeland%20Policy%202010.pdf>

³ <https://www.nation.com.pk/29-Sep-2009/cabinet-okays-national-drinking-water-policy>

⁴ <http://waterinfo.net.pk/sites/default/files/knowledge/National%20Sanitation%20Policy%202006.pdf>

⁵ [https://www.fao.org/faolex/results/details/en/c/LEX-FAOC065320/#:~:text=Pakistan-Land%20Acquisition%20Act%2C%201894%20\(Act%20of%201894\),on%20account%20of%20such%20acquisition](https://www.fao.org/faolex/results/details/en/c/LEX-FAOC065320/#:~:text=Pakistan-Land%20Acquisition%20Act%2C%201894%20(Act%20of%201894),on%20account%20of%20such%20acquisition)

development projects. It comprises 55 sections pertaining to area notifications and surveys, acquisition, compensation and apportionment awards and disputes resolution, penalties and exemptions.

2.6.5 Building Energy Code of Pakistan, 2008

The scope of this code⁶ is to provide:

- a) Minimum energy-efficient requirements for the design and construction of:
 - New buildings and their systems.
 - New portions of buildings and their systems.
 - New systems and equipment in existing buildings

Criteria for determining compliance with these requirements.

The Building Energy Code of Pakistan 2008 is available at the following link;

2.6.6 Antiquity Act, 1975

The Antiques Act of 1975⁷ ensures the protection of cultural resources in Pakistan. The act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc.

The law prohibits new construction in the proximity to protected antiquity and empowers the Government of Pakistan to prohibit excavation in an area that may contain articles of archaeological significance.

Under the Act, the project proponent is obligated to:

- Ensure that no activity is undertaken in the proximity of protected antiquity, and
- If during the course of the project, an archaeological discovery is made, it should be reported to the Department of Archaeology, Government of Pakistan.

2.6.7 Cutting of Trees (Prohibition Act), 1992 – Gazette of Pakistan

Section 3 of this Act states “No person shall, without the prior written approval of the local formation commander or an officer authorized by him in his behalf, cut fell or damage or cause to cut, fell or damage any tree⁸.”

2.6.8 Protection of Trees and Bush wood Act, 1949

Section 3 of this Act states “No person shall, without the prior written approval of local formation commander or an officer authorized by him in this behalf, cut fell or damage or cause to cut, fell or damage ant tree⁹.”

2.6.9 Pakistan Explosive Act, 1884

This act provides regulations for the handling, transportation and use of explosives during quarrying, blasting and other purposes. The transmission line tower installation may need blasting at rocky/mountainous areas. Thus, these regulations will be applicable to the proposed project¹⁰.

2.6.10 Employment of Child Act, 1991

Section 3, Prohibition of employment, of this Act starts “No child shall be employed or permitted to work in any of the occupations set forth in Part I of the Schedule or in any

⁶ <https://www.pec.org.pk/downloads-documents/building-code-of-pakistan/http://www.enercon.gov.pk/images/building%20code.pdf>

⁷ <https://heritage.pakistan.gov.pk/SiteImage/Misc/files/annex-2doam.pdf>

⁸ <http://extwprlegs1.fao.org/docs/pdf/pak64061.pdf>

⁹ <http://extwprlegs1.fao.org/docs/pdf/pak64061.pdf>

¹⁰ https://www.ajne.org/sites/default/files/document/laws/6973/explosives_act_1884.pdf

workshop wherein any of the processes set forth in Part II of that Schedule is carried on: Provided that nothing in this section shall apply to any establishment wherein such process is carried on by the occupier with the help of his family or to nay school established, assisted or recognized by Government¹¹.”

2.6.11 Factories Act, 1934

These clauses¹² relevant to the proposed project are those that address the health, safety and welfare of the workers, disposal of and effluents, and damage to private and public property. The Act also provides regulations for handling and disposing toxic and hazardous substances. The Pakistan Environment Protection Act, 1997 (discussed above), supersedes parts of this Act pertaining to the environment and environmental degradation.

2.6.12 Pakistan Penal Code, 1860

This outlines the penalties for violation concerning pollution of air, water bodies and land¹³. Sections 272 and 273 of this Act deal with the adulteration of food or drink. Noise pollution has been covered in Section 268, which defines and recognizes noise as a public nuisance. “A person is guilty of a public nuisance who does any act or is guilty of an illegal omission which causes any common injury, danger or annoyance to the public or to the people in general who dwell or occupy the property in the vicinity, or which must necessarily cause injury, obstruction, danger or annoyance to persons who may have occasion to use any public right.”

The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents. Most of the environmental aspects of the Code have been superseded by Pakistan Environmental Protection Act, 1997.

2.7 Obligation under International Treaties

Pakistan is a signatory to various international treaties¹⁴ and conventions on the conservation of the environment and wildlife protection. The country is obliged to adhere to the commitments specified in these treaties. The Convention on Biological Diversity (CBD) was adopted during the Earth Summit of 1992 in Rio de Janeiro. The Convention requires parties to develop national plans for the conservation and sustainable use of biodiversity and to integrate these plans into national development programs and policies.

Parties are also required to identify components of biodiversity that are important for conservation and to develop systems to monitor the use of such components with a view to promoting their sustainable use.

The Convention on the Conservation of Migratory Species of Wild Animals, 1979 requires countries to take action to avoid endangering migratory species, where the term migratory specie refers to species of wild animals of which significant proportions cyclically and predictably cross one or more national jurisdictional boundaries.

The parties are also required to promote or cooperate in the research into migratory species. Under the international plant protection convention, 1951, Pakistan is

¹¹ http://www.na.gov.pk/uploads/documents/1335242011_887.pdf

¹² <https://www.ma-law.org.pk/pdf/law/FACTORIES%20ACT%201934.pdf>

¹³ <https://www.fmu.gov.pk/docs/laws/Pakistan%20Penal%20Code.pdf>

¹⁴ <https://www.oas.org/legal/english/docs/Vienna%20Convention%20Treaties.htm>

required to take steps to ensure the protection of certain plant species that face the extinction threat. Pakistan signed and ratified on a number of international agreements and Convention and bound to implement them in its territory.

2.7.1 Implication of Legislations of the Project

The implication of the above-mentioned legislation to the pre-construction, construction and operational phase of development of 15-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore Project would be as follows:

Lahore Cantonment Board, being the proponent of the project will ensure that the construction and operational phases of the project be carried out in accordance with the EIA report and Environmental Monitoring and Management Plan is effectively implemented.

The project will be subjected to four basic provisions relating to pollution control under the Pakistan Environmental Protection Act, 1997, as contained in section 11, 13, 14 and 15 as follows:

- Section 11 prohibits discharge or emission of any effluent or waste or air pollutant or noise in excess of the NEQS, or the establishment ambient standards for air, water or land.
- Section 13 prohibits hazardous wastes
- Section 14 prohibits the handling of hazardous substance except under a license or in accordance with the provision of any local law or international agreement.
- Section 15 prohibits the operation of motor vehicles for each air pollutant or noise is being emitted in excess of the NEQS of the established ambient standard.

Chapter 3: Project Description

3.1 Introduction

This chapter provides a description of the project, its salient features, location, components and various phases.

3.2 Type and Category of the Project

The proposed project is development of 15-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore, which falls in Schedule II of Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022, Category D (2), which includes Highways, Mo motorways, Express ways or major roads.

3.3 Justification/Need of Project

This project is pivotal to creating a safer and more welcoming environment within the densely populated areas it spans. Improving road infrastructure will facilitate connectivity and safe mobility, granting better access to health, education, and economic opportunities. This connectivity is a crucial step towards poverty alleviation by providing safe, affordable, accessible, and sustainable transport systems, benefiting those who need it most.

Economic factors also strongly justify the establishment of this project. Improving the road will reduce transportation costs for goods and people, improve access to markets, stimulate competition, and generate broader economic benefits. Furthermore, the efficient flow of traffic, human mobility, and movement of products and services is not just an economic benefit, but a societal one.

The project serves a vital role in public safety. The proposed improvements will significantly reduce the frequency of road accidents, enabling faster emergency response times, thereby saving lives and improving public confidence in the region's transport infrastructure.

3.4 Benefits of Project

1. Economic Benefits

The construction of the road is expected to yield significant financial benefits. Reduced travel times and improved traffic conditions are expected to lower vehicle operating costs significantly.

Residents will be able to save on fuel expenses, and vehicle wear-and-tear costs will be reduced due to better road conditions.

Moreover, improved road connectivity will enable businesses in the area to operate more efficiently. Deliveries and transportation of goods will be quicker and more efficient, reducing the costs associated with delays and improving overall business productivity. There may also be an increase in property values in the areas surrounding the improved roadway due to increased accessibility.

	Econ (VOC+TTV) *	Economic (VOC)
B/C Ratio	2.609	1.772
NPV (@12%	541.626	259.702
EIRR/SIRR (X%)	41.503%	29.284%
=		

2. Social Benefits

The project will significantly improve access to essential services like employment, education, and healthcare. For instance, school students, office workers, and patients currently face difficulties due to the poor condition of the roads. The new road will make daily commutes easier, quicker, and safer, enhancing overall quality of life.

Additionally, the project will improve the local transport system, making it easier for residents to travel within the area, thereby increasing social mobility and enhancing social inclusion. Also, the project will potentially increase public safety by reducing the rate of road accidents.

	Social
B/C Ratio=	1.924
NPV@12%=	310.967
EIRR/SIRR (X%)=	31.135%

3. Environmental Benefits

Improved traffic flow on the new carriageway will lead to smoother vehicle movement, reducing the instances of stop-and-go traffic, which in turn will lower fuel consumption and thereby carbon emissions. By contributing to environmental sustainability, the project aligns with global goals for reducing greenhouse gas emissions. The improved road infrastructure can also lead to reduced noise pollution.

4. Employment Generation (Direct & Indirect)

The construction of the road will generate numerous job opportunities. This includes direct employment opportunities in the construction phase, such as manual labor, site supervisors, engineers, and project managers.

Indirect employment opportunities will also arise in supporting sectors like transportation, food services, and other businesses that will see increased demand due to the influx of construction workers.

5. Urban Development & Improved Public Services

The road can lead to balanced urban development in the area. Improved infrastructure often attracts new residential and commercial developments. It will also encourage the government to improve public services in the area, such as water supply, sanitation, electricity, and public transportation.

Indirect employment opportunities will also arise in supporting sectors like transportation, food services, and other businesses that will see increased demand due to the influx of construction workers.

6. Improvement in Land Use

The project may lead to better land use in the surrounding areas. Areas which were previously inaccessible or inconvenient due to poor road connectivity might see more efficient utilization for residential, commercial, or industrial purposes.

7. Increase in Local Government Revenues

With the increase in commercial activities and improved property values, the local government's revenue may increase through taxes. These funds can be reinvested into the community for further improvements and services.

8. Improved Community Connectivity

The road will enhance connectivity within the community, making it easier for residents to visit friends and family, attend community events, and participate in social activities. This could lead to stronger community ties and improved social wellbeing.

3.5 Scope of Work

The master plan for the construction of 5-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road in Lahore, as approved, delineates the following scope of work

Improvement of road alongside the Charrar Drain

Detailed Scope of Work

02 Link Roads Connecting to Eden Housing Society and Green Avenue. (Total Length= 1.22 KMs)

Improvement /rehabilitation is required at different locations/sites within these reference points, identified.

Rigid pavement (RCC, PCC) & flexible pavement (Asphalt work) is required at these sites.

3 Nos of Culvert required for crossing of existing Drain.

Repair / Maintenance of Safety Wall of Drain. (Where Required)

1. RHS (BARKI ROAD TO LUMS UNIVERSITY)

A. Rehabilitation Work

Total Length: 19,671.82 ft

The predominant existing surface in need of rehabilitation is PCC (Portland Cement Concrete), observed in sections like ABADI BAO WALATO DHA, MALIK PUR VILLAGE, and BADIAN ROAD with a combined length of 4,871.82 ft. These segments' width varies between 18 to 22 ft.

Asphaltic Road segments also need rehabilitation in sections like ABADI SAJWAL, ABADI SAJWAL TO BROADWAY, RING ROAD PATH, RING ROAD TOBADIAN ROAD. These sections add up to 12,300 ft.

B. New Construction of Road

Total Length: 7,308.00 ft

All the roads mentioned under this category have an existing surface described as a Non-developed Area.

The segments include MALIK PUR VILLAGE GRAVEYARD, ABADI CHOUND KHURD TO LUMS UNIVERSITY, and DHA PORTION. The widths for these new constructions are consistent at 20 ft, except for DHA PORTION which is 16 ft.

C. No Work Required

Total Length: 5,200.00 ft

The entire length classified under this category is described as Asphalt Road. These Sections like DHA AREA, BROAD WAY TO RING ROAD, and KAMAHAN VILLAGE TO AZAM CHOWK, with lengths 2,400 ft, 2,800 ft, and 3,900 ft

2. LHS (BARKI ROAD TO LUMS UNIVERSITY)

Total Length: 10,400 ft

The sections under this category are ABADI BAO WALA TO DHA, RING ROAD TO BADIAN ROAD, and BADIAN ROAD TO ABADI CHOUND. These segments are uniformly PCC surfaces.

B. No Work Required

Total Length: 34,500.00 ft

Primarily Asphalt Roads, sections like DHA AREA, MALIK PUR VILLAGE, MALIK PUR VILLAGE TO EDEN SOCIETY, and DHA TO AZAM CHOWK.

3. Link Roads

Total Length: 5,994 ft

The Link Roads - Eden Society (4000 ft; double road) and Sajpal Road (1994 ft; single road) are both Asphalt Roads.

4. Culverts

There are three culverts marked for replacement. They are located at BaoWala Abadi, DHA Bao wala Abadi, and DHA PH#5. IMPROVEMENT OF ROAD (15 KM) INCLUDING LINK STREETS ANDRAISING OF SAFETY WALL OF CHARRAR DRAIN FROM BARKI ROAD TO KAMAHAAN BRIEF					
Sr. #	Description			Length of Roads (Ft)	Width of Roads(ft)
1	R.H.S (BARKI ROAD TO LUMS UNIVERSITY)				
A	REHABILITATION WORK				
	RDs	LOCATION	TYPE OF EXISTING SURFACE		
	RD (0+00 To 33+71)	ABADI BAO WALA TO DHA	PCC	3,371.82	20
	RD (63+00 To 75+00)	MALIK PUR VILLAGE	PCC	800	20
	RD (75+00 To 90+00)	MALIK PUR VILLAGE TO EDEN SOCIETY	SUB-BASE LAYING ALREADY	1500	22
	RD (90+00 To 109+00)	ABADI SAJWAL	ASPHALTICROAD	1900	20
	RD (109+00 To 117+00)	ABADI SAJWAL TO BROADWAY	ASPHALTICROAD	800	18
	RD (117+00 To 145+00)	RING ROAD PATH	ASPHALTICROAD	2800	
	RD (145+00 TO 195+00)	RING ROAD TO BADIAN ROAD	ASPHALTICROAD	7800	18
	RD (195+00 TO 202+00)	BADIAN ROAD	PCC	700	20
	Total A			19,671.82	
B	NEW CONSTRUCTION OF ROAD				
	RD (57+00 To 63+00)	MALIK PUR VILLAGE GRAVEYARD	NON-DEVELOPED AREA	600	20
	RD (221+00 To 246+00)	ABADI KHURD TO LUMS UNIVERSITY	NON-DEVELOPED AREA	2408	20
	RD (260+00 TO 303+00)	DHA PORTION	NON-DEVELOPED AREA	4300	16
	Total B			7,308.00	
C	No WORK REQUIRED				
	RD (33+71 To 57+00)	DHA AREA	ASPHALT ROAD	2400	20
	RD (117+00 To 145+00)	BROAD WAY TO RING ROAD	ASPHALT ROAD	2800	20
	RD (246+00 TO 260+00)	SOME PORTION OF LUMS UNIVERSITY	ASPHALT ROAD	1400	

	RD (360+00 TO 390+00)	RING ROAD TO GO PETROL PUMP	ASPHALT ROAD	3000	
	RD (410+00 TO 449+37)	KAMAHAN VILLAGE TO AZAM CHOWK	ASPHALT ROAD	3900	
	Total C			5,200.00	
	TOTAL (A+B+C)			32,179.82	
C	L.H.S (BARKI ROAD TO LUMS UNIVERSITY)				
A	REHABILITATION WORK				
	RD (0+00 To 25+00)	ABADI BAO WALA TO DHA	PCC	2,500.00	12
	RD (145+00) To 195+00)	RING ROAD TO BADIAN ROAD	PCC	5,000.00	14
	RD (195+00 To 224+00)	BADIAN ROAD TO ABADI CHOUND	PCC	2,900.00	12
	Total A			10400	
B	No WORK REQUIRED				
	RD (25 TO 57)	DHA AREA	ASPHALT ROAD	3,200.00	20
	RD (57 To 63)	MALIK PUR VILLAGE GRAVEYARD	ASPHALT ROAD	600	20
	RD (63 To 75)	MALIK PUR VILLAGE	ASPHALT ROAD	1200	20
	RD (75 To 90)	MALIK PUR VILLAGE TO EDEN SOCIETY	ASPHALT ROAD	1500	22
	RD (90 To 117)	EDDEN SOCIETY TO BROAD WAY	ASPHALT ROAD	2700	20
	RD (117 To 145)	BROAD WAY TO RING ROAD	ASPHALT ROAD	2800	20
	RD (224+00 TO 449+37)	DHA TO AZAM CHOWK	ASPHALT ROAD	22500	20
	Total C			34,500.00	
	TOTAL (A+B)			44,900.00	
	Link Road				
	Eden Society		ASPHALT ROAD	4000	40
	Sajpal Road		ASPHALT ROAD	1994	28
	Total			5994	
3	Culvert				
A	Culvert (RD-27+00)	Bao Wala abadi		1	Each
B	Culvert (RD-33+00)	DHA bao wala abadi		1	Each
C	Culvert (RD-215+00)	DHA PH#5		1	Each

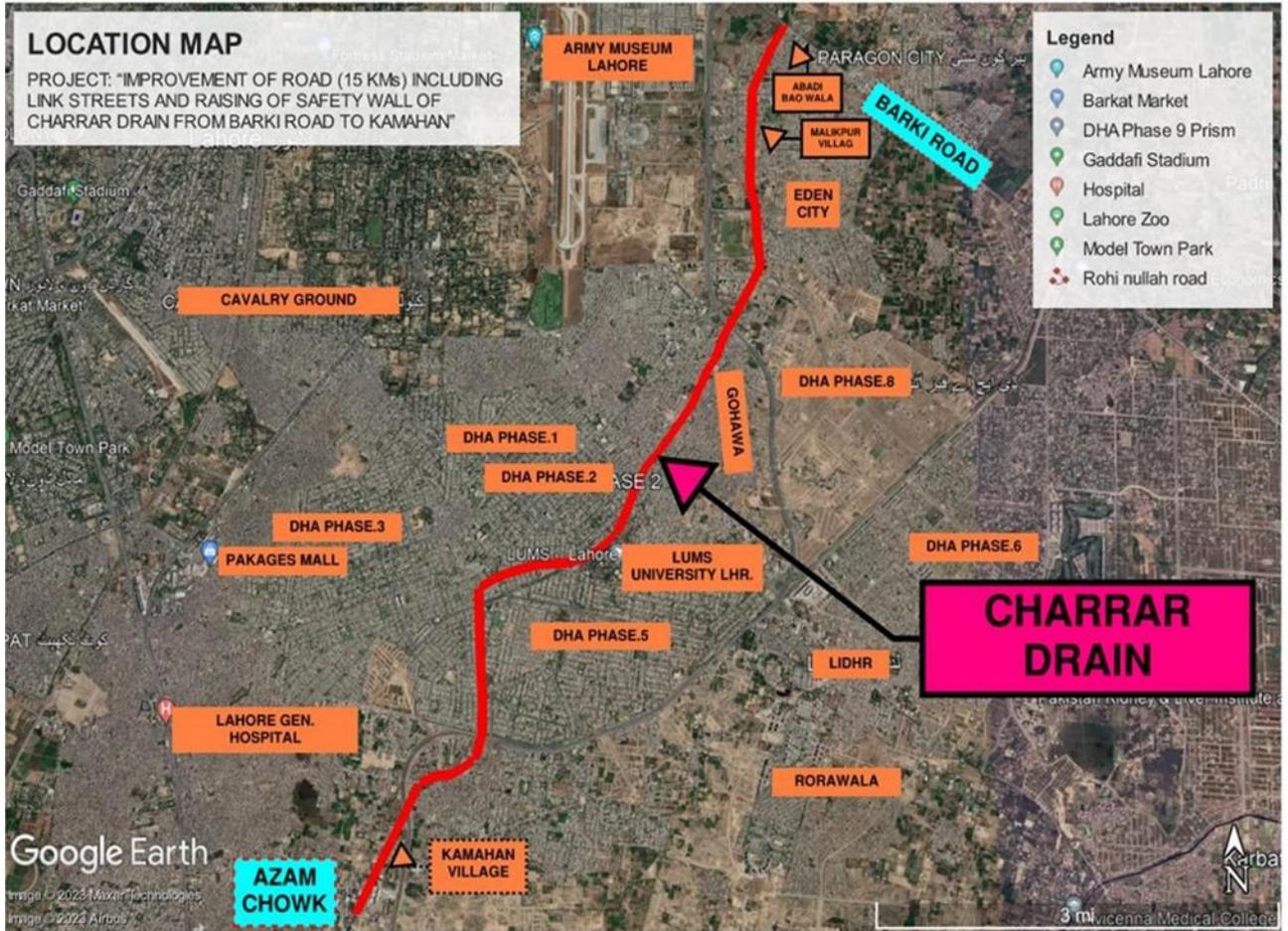
3.6 Project Location and Accessibility

The project is located in Lahore, Punjab, Pakistan, and involves the improvement of a 15-kilometer road, including link streets and the raising of a safety wall along the Charrar Drain. The project spans from Barki Road to Kamahan and is being executed under the authority of the Lahore Cantonment Board (LCB) with sponsorship from the Ministry of Defense. This infrastructure development aims to enhance connectivity,

safety, and economic activity in the region by upgrading deteriorated roads and improving drainage systems.

The location and accessibility of the project is illustrated in Figure;

Figure 3.1 Location Map



3.7 Existing Situation

The existing road conditions along Charrar Drain are critically deteriorated. The road is broken to its worst extent, causing daily accidents and jeopardizing safety. Commuters and locals complain about the poor state of the roads and bumpy rides. Villages and small towns connected by this road are particularly affected, with local transport owners struggling with frequent vehicle repair costs. This situation impacts the local economy, public health, and emergency response times, creating an urgent need for road improvement.

Figure 3.2 existing road conditions



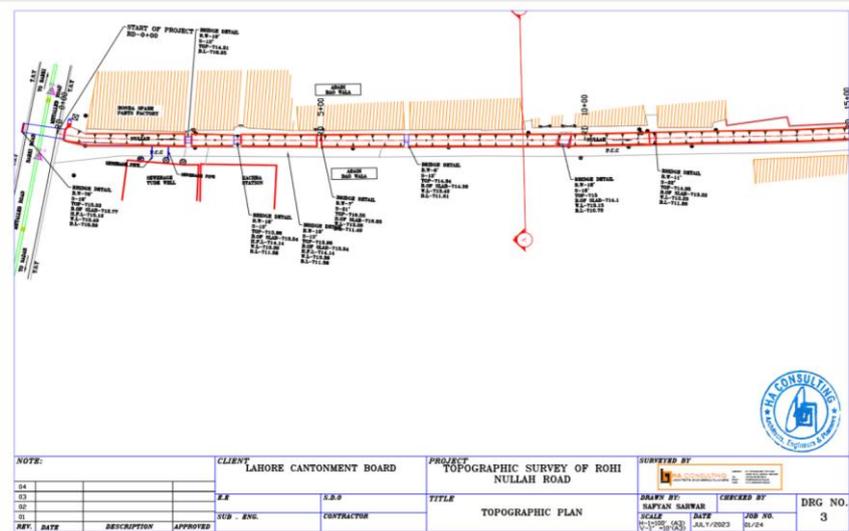


3.8 Description of the Project

- Improvement of road alongside the Charrar Drain
- 02 Link Roads Connecting to Eden Housing Society and Green Avenue. (Total Length= 1.22 KMs)
- Improvement /rehabilitation is required at different locations/sites within these reference points, identified.
- Rigid pavement (RCC, PCC) & flexible pavement (Asphalt work) is required at these sites.
- 3 Nos of Culvert required for crossing of existing Drain.
- Repair / Maintenance of Safety Wall of Drain. (Where Required)

Project alignment is divided into 18 parts, starting from Burki Road towards Azam Chowk to Kamahan Road. Topographic survey, profile and cross sections (existing & proposed) of 1st part are given below. The drawing of remaining parts can be seen in PC-1

Figure 3.3 Topographic Survey of the 1st Part of Alignment



1st Figure 3.4 Profile of the Part of Alignment

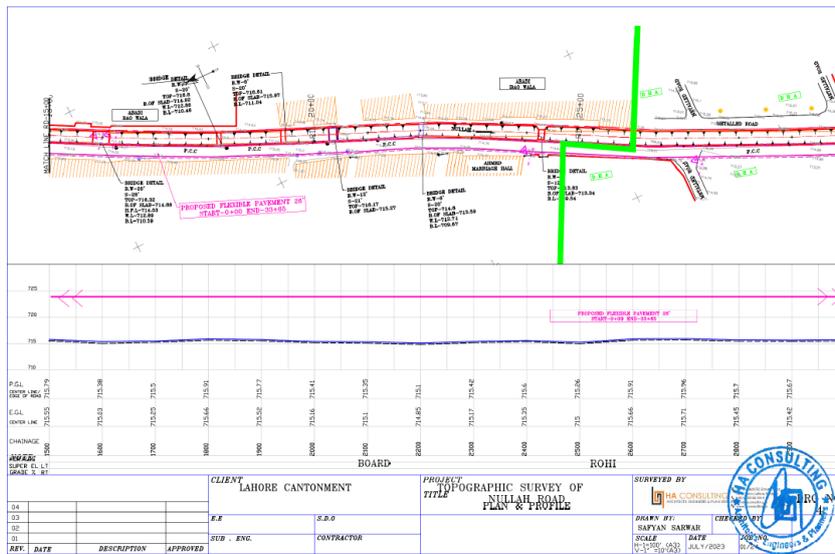
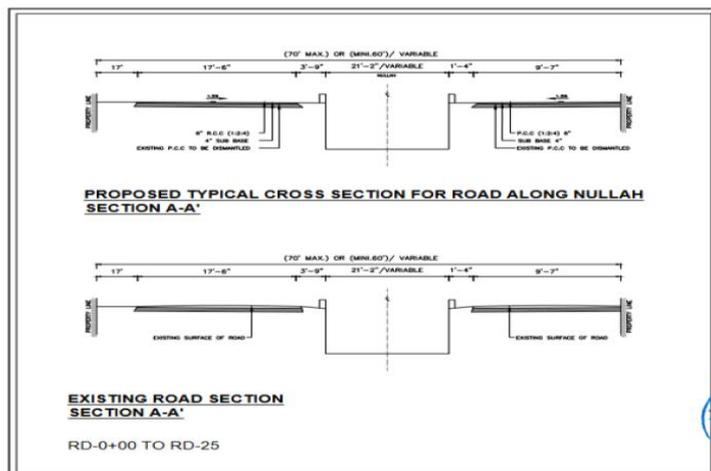


Figure 3.5 Cross Section of 1st Part of Alignment



3.9 Land Acquisition/ Encroachment Removal

There is no land acquisition involved in this project. The land is owned by provincial government. Further to it no encroachment removal is involved.

3.10 Construction materials and road Specifications

The foundation material for construction should be thoroughly inspected by a geotechnical engineer to ensure it matches the explored borehole conditions. If discrepancies arise, consultation with the reporting authority is necessary. Any weak or loose soil must be removed and replaced with compacted engineered fill in layers no thicker than 150 mm, compacted to at least 95% of the maximum modified Proctor density. Temporary excavation slopes should not exceed a 1:1 (vertical: horizontal) ratio, with a maximum height of 3.0 m, while fill slopes should be constructed at a 1:2 ratio or flatter. Backfilling should use selected materials free from expansive soils, placed in layers not exceeding 450 mm and compacted to the satisfaction of the Engineer. If seepage water is encountered, proper dewatering methods, such as sump-pumps, must be implemented, along with damp-proofing measures like controlled water-cement ratio, water-reducing agents, and rich mix concrete.

For road construction, proper site preparation is crucial to ensure the subgrade supports vehicular loads. This includes clearing objectionable materials and proof-rolling in-situ soil to eliminate soft pockets. Fill placement should be done in layers with moisture content controlled within $\pm 2\%$ of the optimum level. Sub-base and base courses should not exceed 15 cm compacted thickness, while embankment layers should follow specified thickness and compaction levels based on depth. Construction verification and inspections are necessary to ensure actual ground conditions align with design assumptions, requiring a performance monitoring program throughout the project.

3.11 Cost of the Project

The estimated cost of infrastructure of development of 15-kilometer road along the Charrar Drain, extending from Burki Road to Kamahan Road (Azam Chowk) in Lahore, is Rs.378.60 million.

3.12 Road Geometric Standards, Design Speed, Design Life, and Technical Aspects

1. Road Geometric Standards

The project follows geometric design standards suitable for an urban road network. The road alignment has been designed considering the expected traffic volume, drainage requirements, and local site constraints. The design includes proper camber and gradient to ensure smooth vehicular movement and drainage efficiency.

2. Design Speed

The road improvement project is designed for a moderate-speed urban setting, ensuring safety and efficiency. While the exact design speed is not explicitly mentioned, it is expected to follow standard urban road guidelines, likely in the range of 50-70 km/h depending on the terrain and urban constraints.

3. Design Life

The project has a design life of 10 years, which is standard for urban roads. The pavement structure has been designed based on projected traffic growth and anticipated Equivalent Single Axle Loads (ESALs) over this period.

4. Design Criteria

The pavement design is based on AASHTO standards for low-volume roads. Soil conditions range from lean clay to silty sand, with necessary geotechnical considerations taken into account.

The minimum subgrade California Bearing Ratio (CBR) required is 8% at 95% Modified Proctor Density.

Traffic studies have determined high traffic within low-volume classification, influencing pavement thickness calculations.

The pavement layers consist of asphaltic concrete, aggregate base course, and granular sub-base, each designed to meet structural requirements.

5. Technical Aspects for Culverts

Culverts will be shallow foundations placed at a minimum depth of 2 to 3 meters below Natural Surface Level (NSL).

Dewatering measures will be necessary due to potential seepage from the nearby drain. This will include sump-pump arrangements to remove water before foundation placement.

The allowable bearing pressure has been evaluated using Terzaghi's and Meyerhof's methods, with a factor of safety of 3 considered in the bearing capacity calculations.

The recommended cement type for concrete structures is sulfate-resistant cement (SRC) to withstand potential sulfate exposure

6. Other Components of the Project

Site preparation includes clearing and proof-rolling the subgrade to eliminate soft pockets.

Compaction levels for different pavement elements follow AASHTO standards, requiring at least 95% Modified Proctor Density for embankments and subgrade.

The design also includes raising a safety wall along the Charrar drain to prevent erosion and improve structural stability

This road improvement project follows industry best practices and ensures durability, safety, and effective traffic management over its designed lifespan.

9. Rainwater Provision in the Project-Road Camber

Rainwater drains off towards the edges of the designed road camber. In this project road camber of 1.5% is designed towards the drain. Therefore, rainwater will be drained into the Charrar Drain automatically.

3.13 Manpower Requirements

During the execution and operation, a Project Management Unit (PMU) needs to be established with following team:

During execution:

Table 3.1 Manpower Requirements

S#	Designation	Qualification	No
1	Cheif Cantt Engr	B.Sc Civil	01
2	Senior Cantt Engr	B.Sc Civil	01
3	Asstt. Cantt Engr	B.Tech/DAE Civil	01
4	Cantt Sub Engr	DAE Civil	01
5	Site Supervisor	Metric	02
6	Computer	Intermediate	01

A maximum of 100 skilled and unskilled laborers shall be employed during the peak construction phase.

During Operation:

Regular staff of LCB will perform the duty during operation

3.14 Traffic Count Estimation

Traffic volume estimation is a critical component in the planning and design of road infrastructure. It helps assess the current vehicular load, anticipate future traffic demand, and determine necessary improvements for the proposed road project. The traffic study conducted for the Improvement of Road (15 KM) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan provides an in-depth analysis of current traffic patterns and future projections.

Methodology of Traffic Volume Estimation

To accurately estimate traffic volume, a Manual Classified Count (MCC) survey was conducted at four different locations along the project corridor. These surveys were carried out over a 24-hour period at each location, ensuring data reliability. In addition, a two-day survey was performed at one location to account for weekday traffic fluctuations. Trained surveyors monitored and recorded vehicle counts under the supervision of traffic engineers to minimize errors.

The traffic count data was categorized based on different vehicle types, including:

- Animal-drawn carts
- Bicycles and motorcycles
- Rickshaws and motorized three-wheelers
- Passenger vehicles (cars, SUVs, pickups, and Hiace vans)
- Buses (medium and large)
- Light and heavy commercial vehicles (trucks, tractor-trolleys, and multi-axle vehicles)

Existing Traffic Volume

The collected data provided daily vehicle counts at different locations. Below is a summary of classified daily traffic volumes (2023):

- Location 1 (Burki to DHA): 3,574 vehicles/day
- Location 2 (Park View to DHA 6): 6,014 vehicles/day
- Location 3 (Bedian to LUMS): 15,982 vehicles/day
- Location 4 (DHA Flyover to Nishtar Colony): 14,651 vehicles/day

These values indicate a high volume of mixed traffic, including a significant proportion of motorcycles, rickshaws, and light passenger vehicles, along with medium and heavy commercial traffic.

Future Traffic Projections

Traffic forecasts were calculated for a 20-year period (2023-2043) based on growth trends in vehicle registration, fuel consumption, and regional economic factors. The projected growth rates were determined as follows:

- Motorcycles: 3.12% (2023) to 1.85% (2042)
- Rickshaws: 3.00% (2023) to 1.81% (2042)
- Cars/Light Vehicles: 2.53% (2023) to 1.65% (2042)
- Buses/Coaches: 2.01% (2023) to 1.43% (2042)
- Trucks/Heavy Vehicles: 3.41% (2023) to 2.33% (2042)

Using these growth rates, the projected two-way daily traffic volumes for Location 1 are expected to increase from 3,574 vehicles/day in 2023 to 5,090 vehicles/day by 2033, and further to 6,639 vehicles/day by 2043.

Implications for Road Design

The estimated traffic volume highlights the need for proper lane configuration, adequate pavement thickness, and traffic management solutions. The following measures are recommended:

- Widening of road sections at high-traffic locations
- Traffic signal optimization at key intersections
- Designated lanes for motorcycles and slow-moving vehicles
- Enhanced safety measures, such as pedestrian crossings and lighting

Conclusion

The traffic volume study for the Charrar Drain Road improvement project demonstrates a significant existing and projected traffic load. These findings provide a foundation for informed decision-making regarding road capacity, structural design, and future infrastructure needs. Adopting the recommended measures will ensure long-term road performance and efficient traffic flow.

3.15 Expected Equipment's for Construction

The machinery and the equipment required for the proposed project will comprise:

- Dump Trucks
- Front End Loaders
- Dozers
- Graders
- Vibratory Rollers
- Water Tankers
- Aggregate Spreaders
- Three Wheels Rollers
- Tandem Rollers
- Asphalt Plant
- Pavers
- Asphalt Distributors
- Concrete Batching Plants
- Transit Mixers-Trucks
- Vibrators
- Concrete Pumps
- Water Pumps
- Cranes
- Generators
- Other misc.

3.16 Technical Aspects

The pavement design procedure is based on the cumulative number of expected Equivalent Single Axle Loads (ESALs) during the design period. The projected cumulative ESALs for the project road has been computed over the design life of 10 years (refer Annex-B) based on following factors:

Direction Factor = 0.5

Lane Factor = 0.9

Vehicle Type	Axle Load Factor	
	Loaded	Empty
Large Bus	2.5	-
Truck (2-Axle)	4.67	0.07
Truck (3-Axle)	8.84	0.1
Tractor Trolley	3.5	-

3.17 Sustainable Features of the Project

3.17.1 Alignment with Sustainable Development Goals

The project aims to contribute to sustainable urban development, aligning with Pakistan's Vision 2025 and the United Nations' Sustainable Development Goal (SDG) 11, which focuses on creating sustainable cities and communities.

3.17.2 Eco-Friendly Construction Materials & Practices

The construction process will adhere to sustainable and eco-friendly practices to minimize the project's carbon footprint, ensuring minimal environmental impact.

- Ravi Sand — Used for road works as a sustainable alternative when onsite A-4 material is insufficient.
- Soil Aggregates with CBR 30% — Utilized in the bottoming or sub-base layers, ensuring durable and environmentally conscious construction
- Controlled Dewatering: For foundation excavations near culverts, appropriate dewatering measures like sump-pump arrangements are recommended to minimize water wastage and environmental damage.
- Damp-Proofing Measures: The use of water-reducing agents and rich mix concrete helps in controlling moisture levels, reducing the risk of structural damage and increasing the lifespan of the infrastructure.
- Use of Sulphate Resisting Cement: To prevent chemical damage and enhance durability, sulphate-resisting cement (SRC) is recommended for concrete structures.
- Compaction and Fill Material: The project utilizes compacted engineered fill to reduce erosion and ensure stability, minimizing soil degradation
- Compacted Engineered Fill: Any loose or weak soil encountered at shallow foundation levels is excavated and replaced with compacted engineered fill. The fill is placed in horizontal layers with a maximum compacted thickness of 150 mm and is uniformly compacted to at least 95% of maximum modified Proctor density.
- Controlled Lift Thickness: For road embankments and subgrade fill, loose lift thickness does not exceed 30 cm, and the moisture content is maintained within $\pm 2\%$ of the optimum moisture content to ensure effective compaction.
- Sub-Base and Base Courses: The placement of sub-base and base courses is controlled to ensure the compacted thickness does not exceed 15 cm. The

recommended compaction levels are 100% for the base course, 98% for sub-base, and 95% for the upper 30 cm of subgrade.

- **Embankment Construction:** Embankments are constructed using specified or approved soil obtained from borrow excavation, compacted in 150 mm layers up to 95% modified AASHTO density, and shaped according to the required profile to minimize erosion

3.17.3 Reduced Environmental Impact

The installation of eco-friendly materials in road construction aims to reduce the carbon footprint and overall environmental impact of the project.

3.17.4 Resilience to Natural Hazards

The project incorporates disaster risk reduction measures, including adherence to local building codes and consideration of hazard zoning and institutional jurisdictions. It is designed to withstand potential natural hazards such as flooding, earthquakes, and torrential rains.

- **Consideration of Hazard Zoning:** The project considers hazard zoning and institutional jurisdictions to minimize risks from potential natural hazards such as flooding, earthquakes, and torrential rains.
- **Seismic Design Parameters:** The site falls in Seismic Zone 2A, with a Peak Horizontal Ground Acceleration (PGA) of 0.16 for a 500-year return period. The design incorporates guidelines from the Seismic Provisions 2007 of the Building Code of Pakistan

3.17.5 Community and Social Development

The project is designed to improve access to essential services, promote economic growth, and enhance social cohesion, thereby contributing to a more inclusive and sustainable community

3.18 Annual Maintenance Cost

The project falls into jurisdiction of two administrative institutions. The portion of the project from Barki Road to Badian Road is in the territory of Lahore Cantonment Board. And the portion of the project from Baidian Road to Azam Chowk falls under executive control of Walton Cantt.

3.19 Time Schedule

The development works for construction of a Road Along Charrar Drain (15 kms) From Burki Road to Kamahan Road, Lahore will be completed in a period of 18 months.

3.20 Project Approval

The project is approved by DDWP.

3.21 Project Phases

The construction of construction of a Road Along Charrar Drain (15 kms) From Burki Road to Kamahan Road, Lahore will be implemented in three phases, i.e., Pre-construction/ Design, Construction, and Operation Phase.

3.21.1 Pre-construction/ Design Phase

- **Site Analysis:** Evaluation of geological, seismic, and environmental conditions for appropriate road and foundation design.
- **Traffic Studies:** Collection and analysis of traffic data to predict future road usage and determine appropriate pavement design.
- **Material Selection:** Identification of suitable construction materials, considering environmental impact and durability.

- **Geotechnical Investigations:** Borehole drilling, test pits, and soil sampling to assess soil strength and groundwater levels for foundation stability.
- **Environmental Considerations:** Identification of measures to minimize ecological disruption and maintain sustainability.

3.21.2 Construction Phase

- **Establishment of Construction Camps**

Three construction camps will be established at appropriate places located at;

- Near Burki Road
- Near LUMS
- Near Azam Chowk

Each site will be selected keeping in view the availability of adequate areas for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Final locations will be selected by the contractor with consent with supervision consultant after approval from Lahore Cantonment Board.

3.21.3 Operational Phase

- **Traffic Management:** Monitoring traffic flow to minimize congestion and ensure smooth vehicle movement.
- **Maintenance:** Regular inspection and maintenance of the road infrastructure, including drainage and safety features, with an allocated budget of 3.78 million for annual maintenance.
- **Monitoring and Evaluation:** Periodic assessment of environmental and social impacts to ensure compliance with environmental standards.
- **Community Engagement:** Continuous consultation with the local community to address concerns and integrate feedback for improvement.

Chapter 4: Project Alternatives

4.1 Introduction

The Analysis of Alternatives (AoA) evaluates different approaches to achieving the project's objectives: improving road infrastructure, enhancing connectivity, reducing travel time, and increasing socio-economic benefits. The alternatives consider financial feasibility, technical viability, environmental impact, and social acceptance.

4.2 Identified Alternatives

Alternative 1; No-Build (Status Quo)

I. Description:

This option involves leaving the road and the drainage infrastructure as they are, without any improvements.

II. Pros:

No immediate financial investment is required.

No environmental impact from construction activities.

Avoids potential disruptions during construction.

III. Cons:

Continued poor road conditions lead to increased vehicle operating costs.

Safety risks remain high due to deteriorating infrastructure.

Economic growth is hindered by inefficient transportation.

Increased flood risks due to inadequate drainage.

Decreased property values and investment opportunities.

IV. Conclusion:

This alternative is not viable as it does not address the identified infrastructure and connectivity issues.

Alternative 2: Minimal Rehabilitation

I. Description:

This option involves basic maintenance work such as patching potholes, minor resurfacing, and localized drainage repairs.

II. Pros:

Lower initial cost compared to full-scale construction.

Less environmental disturbance.

Shorter project duration with minimal traffic disruptions.

III. Cons:

Temporary solutions do not address the underlying structural deficiencies.

May require frequent maintenance, leading to higher cumulative costs.

Does not provide long-term economic or social benefits.

The drainage system remains inadequate, posing flood risks.

IV. Conclusion:

This alternative is only a short-term fix and does not provide the necessary long-term infrastructure improvements.

Alternative 3: Full Road Reconstruction (Proposed Plan)

I. Description:

This alternative involves comprehensive road reconstruction, including:

Widening and resurfacing of the 15 km road.

Reinforcement of the drainage system along Charrar Drain.

Construction of new link roads and safety walls.

II. Pros:

Provides long-term economic and social benefits.
Enhances safety and reduces vehicle operating costs.
Improves drainage, minimizing flood-related damage.
Encourages urban development and investment.
Reduces travel time and improves access to essential services.

III. Cons:

High initial investment cost.
Temporary disruptions due to construction.
Potential environmental impact (dust, noise, vegetation removal).

IV. Conclusion:

This alternative is the most sustainable and beneficial in the long run, aligning with economic and social development goals.

Alternative 4: Phased Development Approach

I. Description:

Instead of a full reconstruction, the project could be implemented in phases over several years.

II. Pros:

Spreads costs over a longer period, reducing financial burden.
Allows adjustments based on initial phases' performance.
Reduces immediate disruptions to traffic and businesses.

III. Cons:

Longer completion time means prolonged infrastructure inefficiencies.
Incremental improvements may lead to inconsistent road quality.
Potential cost escalation over time due to inflation.

IV. Conclusion:

While financially manageable, these alternative delays have full benefits and does not fully solve the road and drainage problems in the short term.

Recommended Alternative

Based on technical, economic, environmental, and social considerations, **Alternative 3 (Full Road Reconstruction)** is the most viable option. It ensures long-term benefits, improves safety, and enhances regional connectivity, outweighing the temporary costs and disruptions of construction.

Chapter 5: Environmental Baseline

5.1 Introduction

The environmental baseline for this study is aimed at finding out the overall ecological conditions that support the natural flora and fauna in the area. It mainly focusses on the biodiversity conditions in and around the project area. The study is based on the field survey aiming to achieve documentation of the current/prevaling ecological conditions for the designated study area. Therefore, the project's development and construction phase may take/consider measures to reduce the impacts; those carry effect on the overall environmental wellbeing of the local environment.

Hence, this section of the Ecological survey records and presents a detailed description of physical and biological environmental conditions of the study area. The data collection techniques are a combination of both primary and secondary data collection methods/means by field verifications, observations, sampling and monitoring which was supplemented by review of published literature and previous studies in and around the study area. The base line data defines, elaborates and presents physical environmental quality within the project surrounding. The field team, comprising of a senior Ecologist, 2 field assistants and a field photographer, relied on expertise in environment and ecology to provide advice and reliable field data on environmental baseline conditions.

5.2 Project Area Location

The project area is located in Lahore, Punjab, specifically from Barki Road to Kamahan. This region includes a 15 km stretch encompassing link streets and the Charrar Drain. The improvement and development efforts aim to upgrade the existing road infrastructure, ensuring better connectivity, enhanced safety, and smoother transportation for the local population. The area is managed and maintained by the Lahore Cantonment Board under the Ministry of Defense, Government of Pakistan

5.3 Physical Environment

5.3.1 Geology & Soil Conditions

The project area primarily comprises lean clay and silty sand, with variations in soil composition across different locations. Geotechnical investigations indicate that sulphate content ranges from 0.13% to 0.16%, chloride levels are between 0.060% to 0.071%, and organic matter content varies from 0.41% to 0.55%. Soil classification, as per the AASHTO system, identifies A-4 and A-6 types, with A-6 being unsuitable for road construction due to its poor load-bearing capacity. To ensure road stability, appropriate soil stabilization techniques and material selection will be necessary to enhance the structural integrity of the roadway.

5.3.2 Hydrology & Groundwater

The hydrological assessment of the project area reveals no significant groundwater presence up to a depth of 10 meters, as indicated by borehole tests. However, the area is susceptible to waterlogging and surface drainage issues, particularly during the monsoon season. The project includes drainage improvement measures, such as the installation of culverts and stormwater management systems, to mitigate water accumulation and prevent road deterioration. Proper drainage planning will play a crucial role in ensuring the longevity and functionality of the improved road network.

5.3.3 Weather & Climatic Conditions

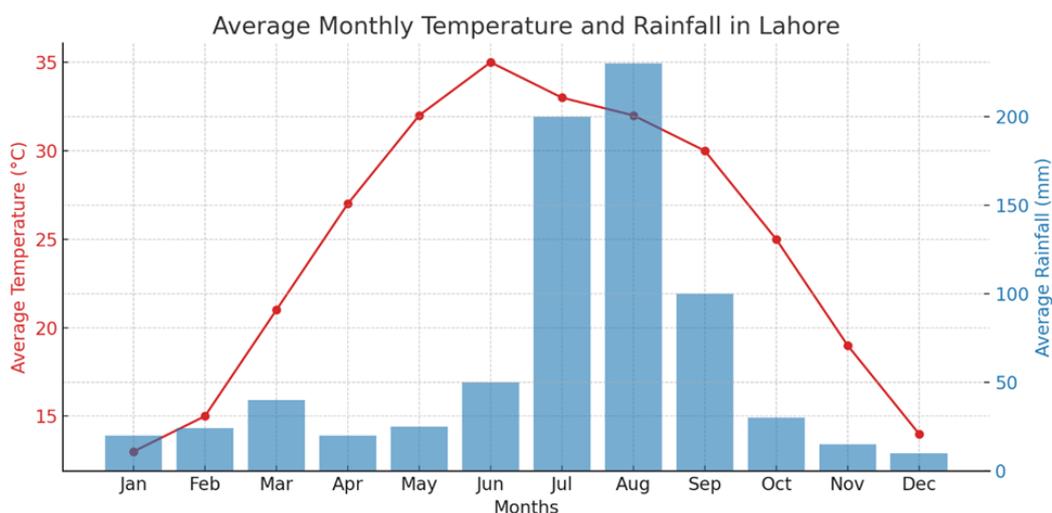
The project site, located in Lahore, Punjab, experiences a humid subtropical climate (Cwa in the Köppen climate classification), characterized by hot summers, mild winters, and a monsoon season. The summer season, extending from April to September, is marked by extreme heat, with temperatures frequently exceeding 45°C (113°F) in peak months such as June and July. Heatwaves are common during this period, often exacerbating urban heat island effects due to extensive concrete and asphalt surfaces.

Winters, lasting from November to February, are relatively mild, with temperatures dropping to as low as 4°C (39°F) in December and January. The region occasionally experiences dense fog, particularly in December and January, significantly reducing visibility and impacting road safety. Lahore also faces smog pollution in the winter months, a consequence of temperature inversion, vehicular emissions, and industrial pollutants, which can lead to poor air quality and health hazards.

The monsoon season, occurring between July and September, brings heavy rainfall averaging 600-800 mm annually. The highest precipitation is recorded in July and August, with frequent thunderstorms and localized flooding, particularly in low-lying urban areas. Given the proximity of the project site to Charrar Drain, inadequate drainage could lead to waterlogging and structural damage to the road network. Additionally, Lahore is located in Seismic Zone 2A, indicating moderate earthquake risk, which necessitates seismically resilient construction methods for infrastructure stability.

Wind patterns vary across seasons, with predominant northwest winds in winter and southwest winds in summer. These wind currents influence dust dispersion and pollution levels, particularly in dry months. Given these climatic factors, the project must incorporate durable road materials, adequate stormwater drainage systems, and pollution control measures to enhance the resilience and sustainability of the infrastructure.

Fig 5.1: Average Monthly Temperature and Rainfall in Lahore



Here is a graph showing the average monthly temperature (°C) and rainfall (mm) for Lahore, the project area.

- The red line represents the average temperature, peaking in June (35°C) and dropping in January (13°C).

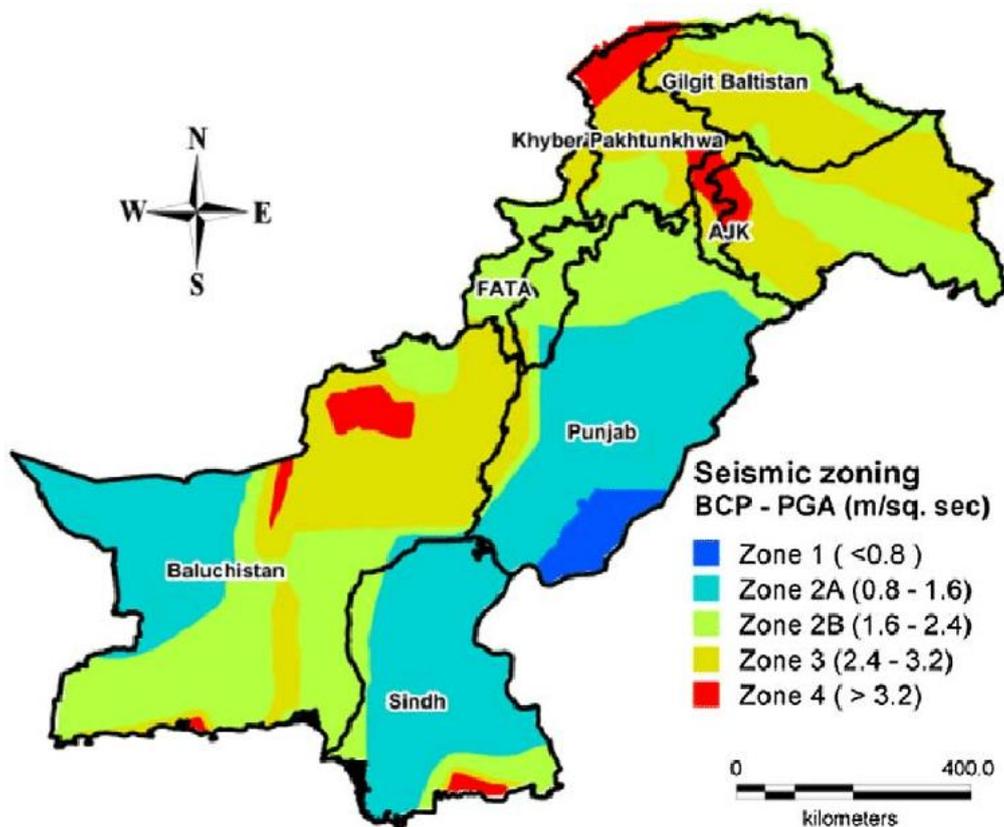
- The blue bars indicate the average rainfall, with the highest precipitation occurring in July and August (200-230 mm) due to the monsoon season.

This data highlights the seasonal variations in climate, which are crucial for planning road construction, drainage systems, and infrastructure durability

5.3.4 Seismic Risk

Lahore, located in Punjab, Pakistan, falls under Seismic Zone 2A, indicating a moderate seismic risk. Although the city is not near the highly active tectonic boundaries like the Main Boundary Thrust (MBT) or Salt Range Thrust (SRT), it can still experience mild to moderate tremors. Historical earthquakes, like the 2005 Kashmir earthquake, had minor impacts in Lahore, but the city's alluvial soil could amplify seismic waves, increasing damage risk. The high population density, unreinforced masonry buildings, and inadequate enforcement of seismic codes make parts of the city vulnerable. Strengthening infrastructure, public awareness, and adherence to the Pakistan Building Code (PBC-2007) are essential to reduce seismic risks.

Figure 5.2 Seismic Zone Map of Pakistan



5.3.5 Air Quality and Noise

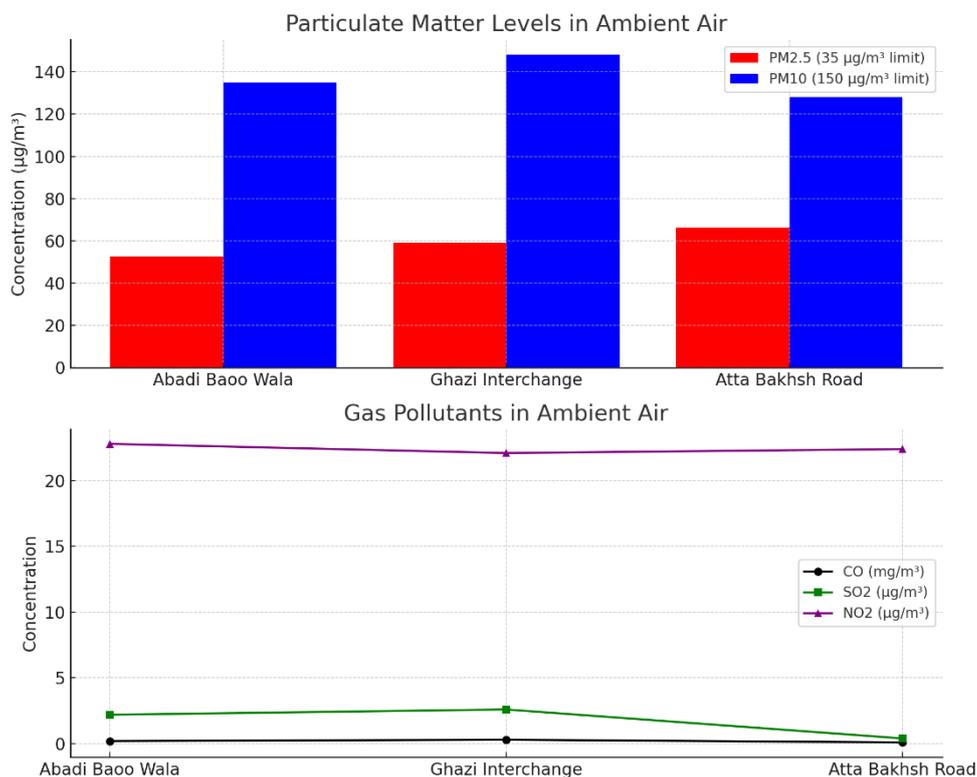
The monitoring of air quality at three locations (Abadi Baoo Wala, Ghazi Interchange, Atta Bakhsh Road) was conducted to assess the potential environmental impact of infrastructure development in the area. The results indicate that most gaseous pollutants, such as Carbon Monoxide (CO), Sulfur Dioxide (SO₂), and Nitrogen Dioxide (NO₂), remain within the prescribed limits set by the Punjab Environmental Quality

Standards (PEQS). However, particulate matter concentrations, particularly PM_{2.5}, exceed the prescribed limit of 35 µg/m³ at all sites. The highest concentration of PM_{2.5} was recorded at Atta Bakhsh Road (66.2 µg/m³), followed by Ghazi Interchange (59.1 µg/m³) and Abadi Baoo Wala (52.7 µg/m³). PM₁₀ levels, while high, remain within the permissible limit of 150 µg/m³.

Key Findings:

- Elevated levels of PM_{2.5} pose potential respiratory health risks, especially for vulnerable populations such as children and the elderly.
- Gaseous pollutants, including CO, SO₂, and NO₂, remain within safe levels but must be continuously monitored.
- Mitigation measures such as dust control through water sprinkling, vehicle emission checks, and increased green cover are recommended to improve air quality.

Figure 5.3: Particulate Matter, CO, SO₂ & NO₂ in Ambient Air



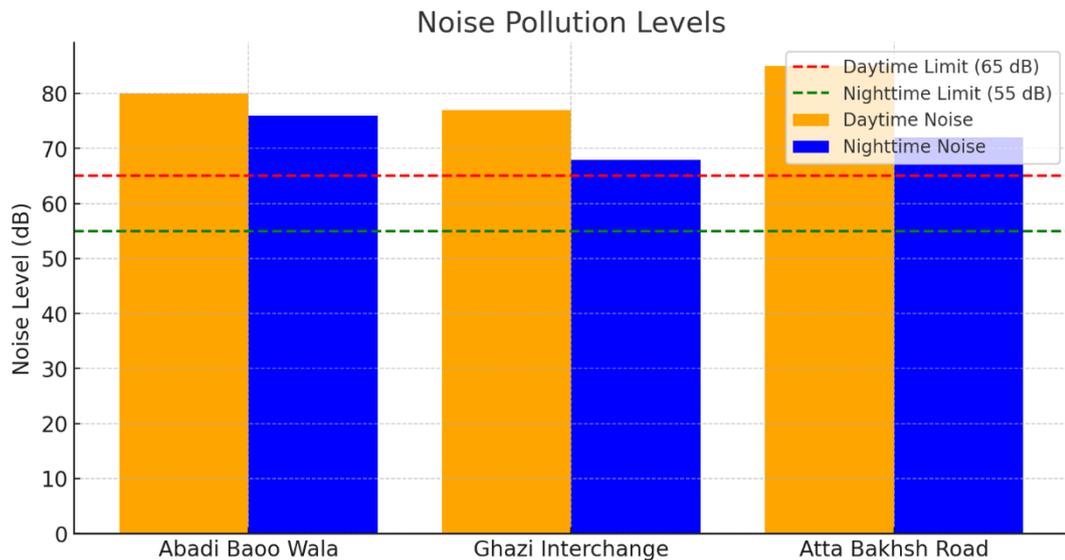
2. Noise Pollution Analysis

Noise levels at all three monitoring locations exceed the PEQS limits for both daytime (65 dB(A)) and nighttime (55 dB(A)). The highest noise levels were recorded at Atta Bakhsh Road, where daytime noise reached 85 dB(A), significantly surpassing the limit, followed by Ghazi Interchange (77 dB(A)) and Abadi Baoo Wala (80 dB(A)). Nighttime noise levels were also above acceptable limits, with readings of 72 dB(A) at Atta Bakhsh Road, 68 dB(A) at Ghazi Interchange, and 76 dB(A) at Abadi Baoo Wala.

Key Findings:

- High noise pollution levels can contribute to adverse health effects, including increased stress, sleep disturbances, and potential hearing impairment.
- Noise pollution is likely linked to traffic congestion, construction activities, and industrial operations in the vicinity.
- Recommended noise mitigation strategies include the installation of noise barriers, regulation of construction activities to daytime hours, and the use of low-noise machinery.

Figure 5.4: Noise Levels at Three Different Points in Project Area



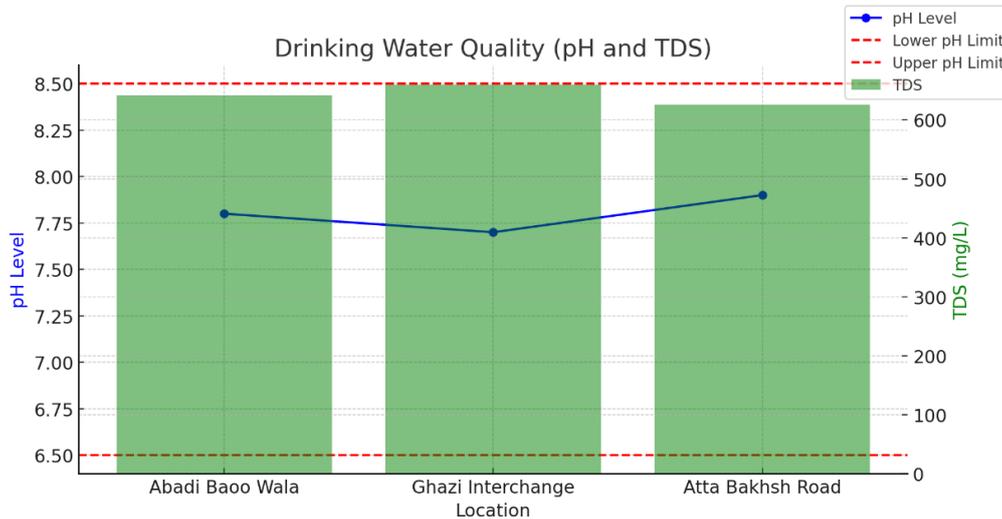
3. Drinking Water Quality Analysis

Drinking water samples were collected from bore wells at Abadi Baoo Wala, Ghazi Interchange, and Atta Bakhsh Road to assess their compliance with PEQS standards. The analysis indicates that pH levels (ranging from 7.7 to 7.9) and Total Dissolved Solids (TDS) concentrations (626-660 mg/L) are within permissible limits, suggesting the water is chemically stable. However, microbiological contamination was detected in samples from Abadi Baoo Wala and Atta Bakhsh Road, with the presence of fecal coliform bacteria indicating possible sewage infiltration or poor sanitation conditions in the area.

Key Findings:

- The presence of fecal coliform bacteria in drinking water poses serious health risks, including waterborne diseases such as diarrhea and typhoid.
- Urgent intervention is required, including proper disinfection (chlorination or UV treatment) and regular monitoring of water sources.
- Awareness campaigns and improved sanitation infrastructure are necessary to prevent further contamination.

Figure 5.5: Drinking Water Quality at Three Different Points of Project Alignment



4. Wastewater Quality Analysis

The wastewater analysis highlights significant environmental pollution concerns in the Charrar Drain. Key pollutant concentrations exceed PEQS limits, particularly:

- Chemical Oxygen Demand (COD): 478 mg/L (PEQS limit: 150 mg/L)
- Biochemical Oxygen Demand (BOD₅): 283 mg/L (PEQS limit: 80 mg/L)
- Oil & Grease: 30.5 mg/L (PEQS limit: 10 mg/L)

These high values indicate severe organic pollution, which can lead to water quality deterioration, aquatic ecosystem degradation, and potential health risks for communities relying on local water sources.

Key Findings:

- High COD and BOD levels suggest excessive organic matter contamination, likely due to industrial discharge or domestic sewage infiltration.
- Elevated oil and grease levels indicate improper disposal of industrial waste and vehicular runoff.
- Immediate intervention, such as the implementation of wastewater treatment plants and enforcement of stricter waste disposal regulations, is necessary to reduce pollution levels.

Figure 5.6: Fecal Coliform in Drinking Water Sample

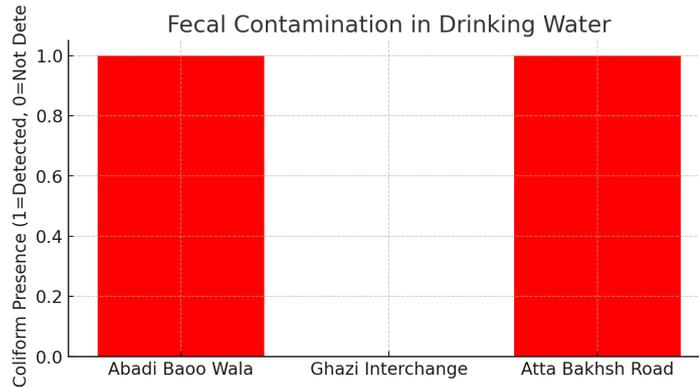
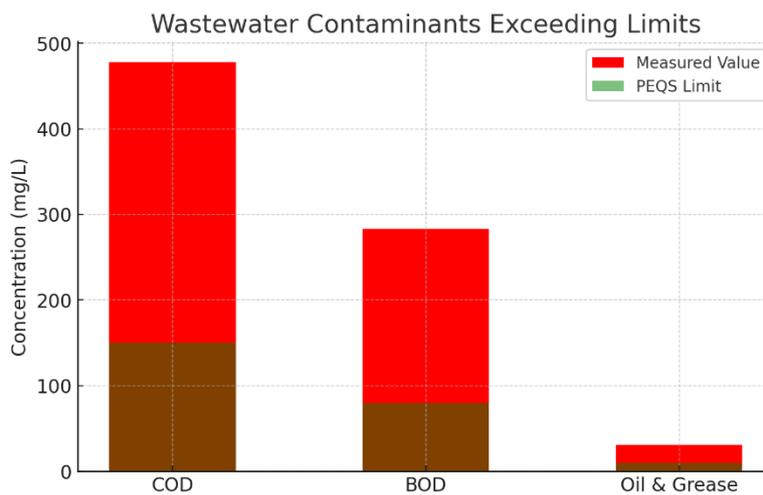


Figure 5.7: Waster Water Contamination Exceeding Limits



5.4 Biological Environment

Current survey was conducted on 17th and 18th March, 2025, aiming to record the biodiversity at the project site and its surroundings. Essentially the survey was to include vegetation, as well as animal (wildlife/fauna) biodiversity in and around the proposed project site as per project's needs and to propose mitigation measures in case some wildlife or forest/native vegetation species are impacted/disturbed due to project activities, and to propose any alternate plantation as well as replacements of plants (primarily tree species) to be removed from the site during construction activities. The current project site along Charrar Drain (at both banks of the drain keeping a 20 to 30 m buffer on each side, where possible) to estimate the ecological conditions and current status of the biodiversity, represented no major wildlife species (fish, amphibians, reptiles and mammals). Very few mature tree species among native species, were recorded to flourish in the area, while many non-native and invasive tree species are found to grow successfully within project boundaries, mainly *Conocarpus* sp. and *Eucalyptus* sp., hence extensive ex-situ mitigation (removal and relocation of large trees) is not proposed, whereas alternate plantation for the said project is part of the report.

As we understand that the post construction phase greening effort/horticulture is needed. The mandatory greening effort is proposed on site in order to improve overall environmental conditions. Project site is an exclusively urbanized area, with almost no

natural settings/wild conditions of flora or fauna existing in the near surroundings, study area is located towards the East of the Lahore city in the neighborhood of several housing schemes/societies which include both planned and unplanned housing schemes and colonies of the metropolitan Lahore towards Cantt area. Additionally, it is situated away from the main (old) Lahore city, and from the major housing projects of LDA but mainly remains close to projects of Lahore Cantonments mentioned above. Origin near Mahfooz Shaeed Garrison, passing through Baoo-Wala village, through DHA Phase-8 and heading towards Gohawa Village to the South. The drain passing various sectors of DHA, Lahore further flows south where sewage is pumped in from neighboring settlements. On its way South among major landmarks along the project include DHA, Badian road, Alfalah Town, Gohawa village and Campus of LUMS University. It further passes South and Pass by Dolu-village and Khaliqbagar village, finally terminating in the Hadyara Drain near Nishat mills. This alignment of the Drain clearly reveals that the project site is located in an extensively populated region, with extremely urbanized surroundings; those used to be villages and allied agricultural lands a few decades ago.

As mentioned earlier, entire project area was found devoid of local Tree flora, with exception of certain non-native mature trees. However, the native herbaceous flora and grasses, survives in very small and relatively insignificant patches along the entire length of drain. Similarly, no large shrub patches were observed, or old trees were found those of specific Ecological value like nesting ground or of cultural importance, while certain local herbaceous species were found to grow in small pockets as a post winter/spring land cover as mentioned above. This cover strictly comprised of common grass and small seasonal herb species. None among the perennial species were found to exist at the project site. Major vegetation in immediate surroundings of the project site is represented by a few dozens of *Acacia*, *Dalbergia sp.*(sisso tree) and *Ficus* trees growing along the alignment, in drain banks and rarely at open spaces near solid waste collection points. As far as the situation of roadside vegetation/plantations concerned, mostly the roads traversing or passing by, remain without any significant plantation, eucalyptus and conocarps plant species are observed planted along the roadsides. Some of the surrounding structures and adjoining buildings may contain certain ornamental plant and tree species, e.g. *Acacia*, *Parkinsonia sp.*, *Mesquite*, *Dalbergia sp.*, and *Eucalyptus sp.*, and very rarely *Brossonatia sp.*, and *Albizzia sp.*, were observed to grow at distance from the project site. These trees are important in a way that these may serve a limited refuge/shelter for those bird species adopted to the human settlements. However, very heavy traffic all day round, and at night the waste carrying trucks and similar vehicles act as a source of noise as well as smoke and dust pollution, along the roadside. Hence, repealing the local fauna including bird species. Reducing the chances of nesting and roosting and even flying around to seek grain and other food.

Some other animal and bird species were reported by the local informants, including the fauna adopted with human settlements and developed industrial areas and roadside as their habitat, for example Crow, Doves, Pigeon, Kites, Finches, Sparrow, and small animals like Field Rat, occasionally Snakes, Mongoose, Mice, etc. but currently due to heavy urbanization, the local wildlife is stressed and have migrated from the area towards open greener places towards east, and North. Being semi dry area, there are chances to find some local reptilian species as mentioned by a

respondent that in past many cases of snakebite used to be reported, but after the quick urbanization, local snake and lizard species are either repealed from the area or got locally extinct; none come to sighting/observation during this survey. Lack of herpeto fauna is mainly due to the population pressure, however during rainy season several Frog species and common Toad are common, as reported by the local informants.

The site is known for warm and humid weather during late summers and monsoons, the chances of finding amphibians are high, however during the survey period i.e. spring 2025, the hibernation of such species is not yet ended, therefore direct or indirect observations are not recorded. It is important to note that around the project site the overall biodiversity conditions are very poor.

Mostly roads exist on each side, Eastern and Western sides of the drain along the Project site, thus enhancing the population-based disturbance to flora and fauna.

Despite the urbanization in immediate surroundings, some distant patches possess certain important ecological features, like Zoo, major Parks, Plantation and wildlife reserves etc. such sites are at least 10to 15 Km away, which contain either significant vegetation cover or open area, that may attract some important bird species seasonally. These patches are not likely to attract migratory birds, but the areas near River Ravi at west (about 20 km away), and the crop fields to the distant East are good examples as refuge for some of these species. Migratory bird species avoid tracking their route towards project area, as urbanized settings of the region are noisy and huge anthropogenic influence on local ecosystems is observed. The major land feature of the Lahore i.e. River Ravi is located at a greater distance i.e. about 15to 20Km from project site towards west, while another large forest/tree reserve, i.e. Changa-Manga Forest/Plantation (reserve) is also 60 to 70 Km Southwards. Hence no such impact on local ecological settings and fauna is expected.

Complete 15 Km project site lies in an unchanged ecological zone, and similar urbanized settings exist throughout its 15 Km alignment, the project is not distinguishable into different sections or regions ecologically. However, the Western and Eastern sides of the surface drain are slightly different from each other as described above, i.e. in terms of planned and unplanned housing societies and local villages.

Some native flora like, *Carthymus sp.*, *Calotropis procera*, *Convolvulus sp.*, occasionally *Cannabis sativa*, and *Zizyphus sp.*, and certain Grass species including, *Cynodon sp.*, *Desmostechea bipinnata*, *Erigeron sp.*, and *Poa sp.*, are known to exist in the surrounding environments. Only grass with clumped and limited growth i.e. *Cynodon sp.*, *Poa sp.* and *Caryx sp.*, were observed growing on the project site in small patches. Although there were no rare or endangered herbs, shrubs and tree species were found to grow at the premises, or around the site. There are certain tree species common for the area, including *Acacia sp.*, *Conocarpus sp.*, *Dalbergia sp.* and *Zizyphus sp.* But these are relatively rare as the construction activity either removed the trees completely, or these are present along roadside in the form of planted tree species which are mainly non-native as described earlier, dominated by *Conocarpus sp.* and *Eucalyptus sp.*, *Ficus sp.* and *Phoenix sp.* are also found occasionally.

Moreover, the large fauna is also absent, no native large mammals are observed or reported, and neither their indirect signs or presence/identification were found including Hair (scratching on tree bark), scats, or paw/foot marks. As mentioned earlier

the large mammalian species, those usually assessed in an area through indirect field identification signs, e.g. field rats, mongoose, Jackals, lizards and snakes etc. are assessed through their burrows, and foot marks. As there were relatively dry conditions during the survey period, the foot marks were not prominent for the small rodents but burrows were rarely observed. There are reports for presence of certain small mammals like Rats, Mice etc. according to the local informants; these existed before the construction of pavements and buildings in surroundings and the roads as well as the housing societies across the area.

Among large mammals found in such ecological regions, any wild cat species or carnivores were absent, no jackals or wild boar species were spotted and even not reported but certain old age informants reported both jackal and wild boar species present in and around this area before the development of housing schemes around 4 to 5 decades ago. Some burrows of mice, small rodents e.g rat, mongoose, or lizards were seen at these areas, the site was searched at Dawn and Dusk, however the effort remained without any additional signs of their existence.

For bird species, small passerines i.e. Warblers, Bulbul, Hoopoe, Babblers, occasionally finches, martins, rarely tree pie, different sparrow species as well as some swifts, parrots and pigeon species, and two different dove and myna species each were observed to exist in the surrounding habitats. Certain birds of prey were reported, but it was essentially before the construction of the buildings in the study areas. Crows are common, Kites are also seen often, but occasional Doves, Hoopoe, Swifts, Drongo and Lapwing species were recorded.

As mentioned above, large birds of prey were not recorded, and neither were they reported by the local informants during interviews, however, the presence of small Hawks, buzzards and other birds of prey cannot be refused, yet the presence was not properly confirmed by local informants as well as the records of the forest and wildlife department. Further this narrative is supported by the presence of a number of small passerine fauna existing, hence there must be birds of prey present in the area previously.

Protected Areas/National Parks/ Sanctuaries:

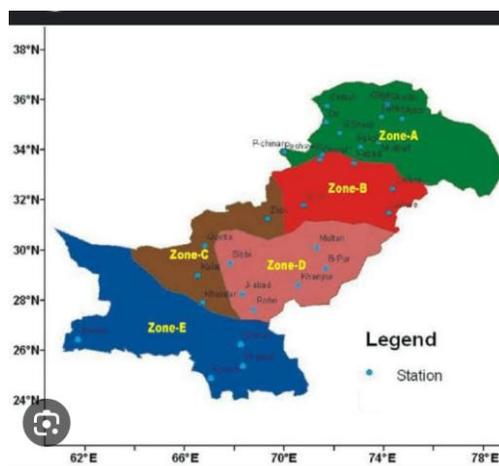
A man mad plantation exists sum 70 Km Southward of the project site named Changa Manga forest, its plated tree reserve and falls under protected forest category, however its distance over 70 Km, and hence no influence on the project site and vice versa.

None of the other Protected Areas and National Sanctuaries exist in the vicinity/boundary of the proposed project site

5.5 Flora

According to the zonation of Pakistan, the region Lahore is located in the subtropical warm ecozone, (Zone-A). Lahore is known for its warm climate during summers and foggy winters. Monsoon rains are more common than the rest of the Zone A. while for the vegetation, ecologically Lahore lies under the thorny zone of vegetation.

Figure 5.8: Ecological Zone map of Pakistan; Lahore is located at Subtropical (A).



The vegetation is a representative of Dry Subtropical Scrub land historically which now has been changed to the agricultural lands, and then urban settings in recent history. Current vegetation has been dominated by *Parkinsonia julifloara*, *Datura stromonium* (Datura), *Ziziphus mauritiana* (Ber), etc.

The most common trees planted in such outskirts of Lahore were of Sissu tree (*Dalbergia sisso*), Amaltas (*Cassia fistulla*), Chinar (*Platanus orientalis*), Dharek (*Melia zardorachita*), Jangali ber (*Zizyphus maurantiana*), Kiker (*Acacia nolotica*), Mulberry-shahtoot (*Morus alba*), Safaida (*Eucalyptus camaldulensis*), Date palm (*Phoenix sp.*) etc.

While certain fruit trees and ornamental species like Mango (*Mangifera indica*), Papaya (*Manikarazepota*), Jamin (*Syzygium cumini*), PeliKaner (*Thevetia peruviana*), Shireen (*Albizia lebbek*), Bamboo (*Bambosa sp.*), Sumbal (*Bombaxceiba*), ornamental Palms (*Phoenix sp.*), Falsa and guava, etc. are common,

For the smaller vegetation there is a variety of herbs and shrubby species including, an invasive species *Parthenium hysterophorus* (bitter broom) found along the roadsides and in the waste lands around the project site. *Calotropis procera* (Desi ak), and *Convolvulus sp.* are also found in open areas along with *Datura sp.* Occasionally *Convolvulus sp.*, *Carthymus oxacantha* are present. The project site has very little vegetation and mostly comprises of local grasses growing in small clusters only include local grasses e.g. *Saccharum sp.*, *Poa sp.* and *Cynodondactylone*, and *Datura sp.* etc. And tree like *Tamarix sp.* (Frash) and are observed.

Table 5.1: Selected Flora of the Site recorded during Field Visit

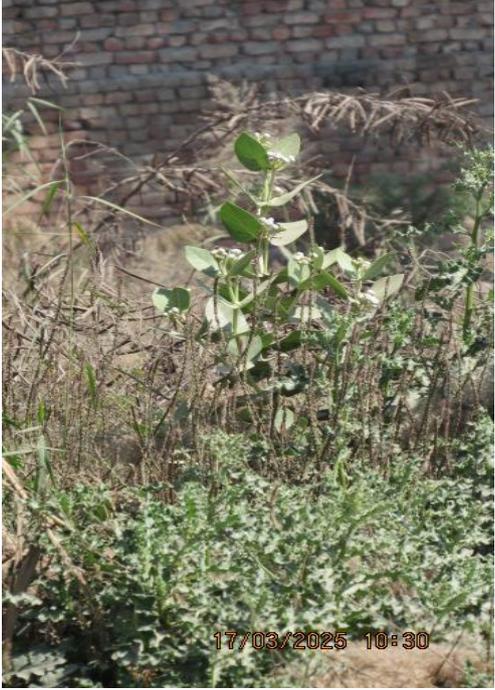
Common Name/ Local Name	Scientific Name	Reference Photograph

Ethiopian Teak	<i>Conocarpus lancifolius</i>			
Deb Grass	<i>Desmosteche abipinnata</i>			
Kana	<i>Saccharum sp.</i>			
Frash	<i>Tamarix sp.</i>			
Dhrek, Chinaberry tree	<i>Melia azedarach,</i>			

<p>Cuscuta (Parasite vine)</p>	<p><i>Cuscuta reflexa</i></p>	
<p>Davils Tree, blackboard tree,</p>	<p><i>Alstonia scholaris</i>,</p>	
<p>Nerium</p>	<p><i>Nerium indica</i></p>	

<p>Datura</p>	<p><i>Datura stramonium</i></p>	 <p>A photograph of a Datura stramonium plant with large, dark green, heart-shaped leaves and several yellow, tubular flowers. The plant is growing in a field of dry, brownish soil. In the background, there is a brick wall. A circular compass rose is overlaid in the top left corner, and a small map inset is in the bottom left corner, showing the location near MATEEN AVENUE, Police Station, and Green Town, Lahore.</p>
<p>Poa grass</p>	<p><i>Poa annua</i></p>	 <p>A photograph of a Poa annua grass plant with long, thin, green blades. The plant is growing in a field of dry, brownish soil. In the background, there is a brick wall. A circular compass rose is overlaid in the top left corner, and a small map inset is in the bottom left corner, showing the location near MATEEN AVENUE, Police Station, and Green Town, Lahore.</p>

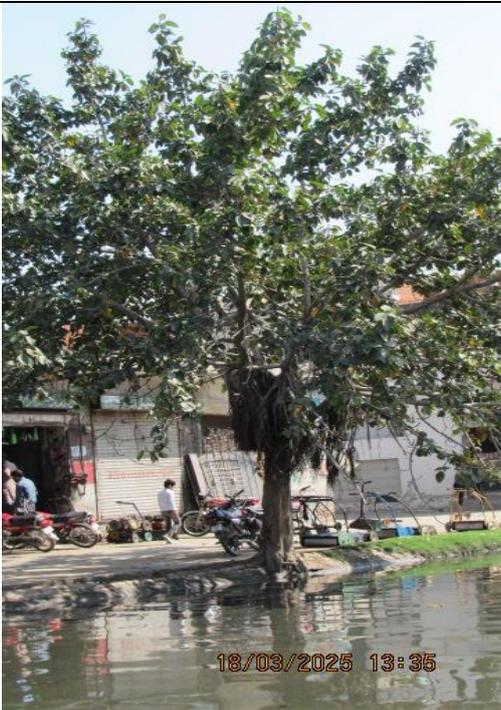
Ber	<i>Ziziphusnimul aria</i>	
Eucalypt	<i>Eucalyptus camaldulensis</i>	

Ak	<i>Calotropis procera</i>	
Bitter broom	<i>Parthenium hysterophorus</i>	
Khabal Grass	<i>Cynodondactylone</i>	

Shatala	<i>Trifolium alexandrinum</i>	 <p>17/03/2025 10:27</p>
Dandelion	<i>Taraxicum officinalis</i>	 <p>18/03/2025 09:18</p>
Thistle	<i>Sassuria</i> sp.	 <p>17/03/2025 10:26</p>
Wild Spinach	<i>Chenopodium</i> sp.	 <p>17/03/2025 10:25</p>
Deer Shoe herb	<i>Convolvulus arvensis</i>	 <p>18/03/2025 09:19</p>

Bougainvillea	<i>Bougainvilleas pectabalis</i>	 <p>18/03/2025 13:21</p>
Palm	<i>Phoenix sp.</i>	 <p>18/03/2025 13:40</p>
Sumbal/ tree	Cotton <i>Ciba mallabarica (bombax ciba)</i>	 <p>18/03/2025 14:26</p>

Caster plant	<i>Ricinus communis</i>	
Jand	<i>Parkinsonia juliflora</i>	
Acacia	<i>Acacia nilotica</i>	

Lantana	<i>Lantana camara</i>	 <p>18/03/2025 18:14</p>
Pepel	<i>Ficus religiosa</i>	 <p>18/03/2025 13:35</p>
Jambolan. Jamin	<i>Syzygium cumini</i>	 <p>18/03/2025 13:30</p>

Ficus	<i>Ficus lecore</i>	
Old felling/ uprooted Ficus Tree along Drain	<i>Ficus sp.</i>	

5.6 Fauna

According to Ecological zone, and habitat type prevailing in sauce type of areas, presence of certain wildlife species is expected. However due to urban conditions none among such wildlife exists now. The major wildlife is of the study area, if would intact its original form, represent sub-tropical to tropical planes of the Punjab, with ungulates and canidae. Such fauna within local ecosystems is supported by the dense flora providing it a suitable habitat for the survival of many wild species in its original condition (i.e. undisturbed condition). However currently it is not a preferred site for such faunal range to exist, but the area has been exceedingly modified based on anthropogenic factors as described in introduction section. Urbanization in past 4 to 5 decades, disrupting the complete habitat of wild life/fauna, which was actually consisting of a number of wild animals and birds within last few decades.

As the disturbances increased to a maximum level with absolute human inhabitation of the study area, both animal abundance and diversity decreased to a minimum degree. Among livestock species only Buffalos were observed in big numbers, in and around villages and unplanned settlements along entire length of the drain .

Originally (undisturbed) in past, species found in the outskirts of Lahore/as reported by the local informants are:

Major Mammalian species include

- ***Canis aureus*** (Asian Jackal)

- *Herpestes javanicus* (Grey Mongoose)
- *Felis chaus* (Jungle Cat)
- *Rattus rattus* (House Rat)
- *Lepus negricollis* (Indian Hare)
- Ed fg (Indian Hedge Hog)
- *Sus scrofa* (Wild Boar)

No noticeable populations, as well as rare or endangered mammalian/ reptile or bird species were observed during the survey, however a few smaller passerines and other bird species are reported which are residing in surrounding greener areas, and visit the project site for food, only in daytime (this is why at Dusk Survey no birds were spotted along the alignment except Crow and Pigeon). However, some of the birds during the survey were spotted by their call/chirp at dawn. Some Crow and pigeons were also observed during survey, and due to this type of bird's presence their predator birds such as small buzzards and hawks as well as kites are also observed. The major Avifauna species which are either resident or passengers in the surrounding areas are listed below.

Note: Identification reference Book used to identify our field photography specimens: Helm Field Guide Birds of Pakistan

Table 5.2: The list of Bird species and Selected Plates of Filed visit describing habitats:

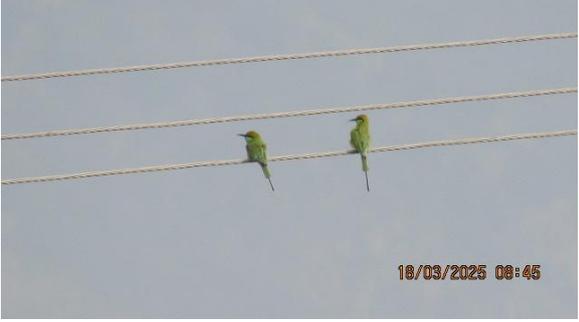
Common name	Biological name	Conservation status as per IUCN red list Status (Additional native or migrant)	Photograph and Identification Reference (Helm Field Guide Birds of Pakistan) Page wise reference given below for each Bird Species.
Red-wattled Lapwing	<i>Vnellus indicus</i>	LC, Increasing population according to IUCN Status of population Resident	 <p data-bbox="949 1780 1177 1818">Page: 106 3a, b</p>

Bulbul	<i>Pycnonotus cafer</i>	LC, stable population according to IUCN Status of population Resident	
House Sparrow	<i>Passer domesticus - indicus</i>	LC, Increasing Population Resident	
Black Kite	<i>Milvus migrans</i>	LC, Increasing population according to IUCN Status of population. Resident	 <p data-bbox="965 1321 1157 1355">118 3a b c d</p>
Red vented Bulbul	<i>Pycnonotus cafer</i>	LC, according to IUCN Status of population is Stable. Wintering	

<p>Rock Pigeon or Rock Dove</p>	<p><i>Columba livia</i></p>	<p>LC, but locally Decreasing Populations Resident</p>	 <p>18/03/2025 18:18</p>
<p>Turtle Dove</p>	<p><i>Streptopelia tranquebarica</i></p>	<p>LC, Stable Population Summer breeding</p>	
<p>House Swift</p>	<p><i>Apus affinis</i></p>	<p>LC, Increasing population according to IUCN Status of population Resident</p>	
<p>Drongo/ King Crow</p>	<p><i>Dicrurus macrocercus</i></p>	<p>Resident</p>	

House Crow	<i>Corvus splendens</i>	Resident	 <p>18/09/2025 08:35</p>
Common Myna	<i>Acridotheres tristis</i>	Resident	 <p>18/09/2025 08:50</p>
Common Babbler	<i>Argya caudata</i>		 <p>18/09/2025 08:58</p>  <p>18/09/2025 08:51</p>
Buzzard	<i>Buteo buteo</i>		 <p>18/09/2025 08:41</p>

<p>Ring-necked dove</p>	<p><i>Streptopelia capicola</i></p>		
<p>Warbler</p>	<p><i>Acrocephalus sp.</i></p>		
			
<p>Common reed Warbler</p>	<p><i>Acrocephalus scirpaceus</i></p>		

<i>Meg Pie</i>			
<i>Green bee-eater</i>	<i>Merops cyanophrys</i>		

Mammals: No native mammals were observed during the survey except the flying fox. i.e common bat

Reference: IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-2. <https://www.iucnredlist.org>. Accessed on [17 03 2025]

5.7 Socio-Economic & Cultural Environment

This section describes the socio-economic and cultural environment of the project area, primarily focusing on the regions along Burki Road, LUMS, and Azam Chowk. The area comprises residential housing societies, villages, and their associated commercial zones.

Population: The project area is home to a diverse population, primarily composed of residents from villages, housing societies, and commercial areas. According to the traffic study and demographic assessment, the region has an estimated population of 1.47 million people, with a growth rate of 2% to 3.5% annually. The population density

and socioeconomic status vary across different communities, with a mix of urban and semi-urban lifestyles.

Ethnic Structure: The population is primarily composed of various ethnic groups, including Punjabis, Pakhtuns, and Baloch. While the majority belong to local ethnicities, the presence of other groups reflects the region's cultural diversity.

- **Pakhtun and Baloch Influence:** These communities have a significant cultural presence in the area, reflected in language, traditions, and lifestyle.
- **Other Communities:** Due to increasing urbanization, there is a blend of people from various parts of Pakistan, contributing to a multicultural environment.

Agriculture: Agriculture is practiced in nearby rural areas; however, the primary focus of the project area is urban development. Small-scale farming for personal use exists, but it does not significantly contribute to the local economy.

Transportation:

- **Public transportation** is common, but the existing road network faces issues of congestion, poor conditions, and unpaved streets, leading to difficulties for commuters.
- Many residents own personal vehicles due to the limitations of public transport, contributing to traffic congestion.
- The road improvement project aims to address these issues by enhancing road quality and connectivity

Education: Educational facilities in the area range from government schools to private institutions. The project area is in proximity to reputable institutions like **LUMS**, known for higher education. However, access to quality education can be limited for residents of nearby villages.

Languages: The primary languages spoken include Punjabi, Urdu, and Pashto, with some Balochi influences. The diversity of languages reflects the multicultural nature of the region.

Public Health: The area has limited healthcare facilities. Access to comprehensive medical services often requires traveling to major hospitals in Lahore. Notable healthcare facilities near the project area include:

- Combined Military Hospital (CMH) Lahore
- Shaukat Khanum Memorial Cancer Hospital
- Bahria Town Hospital

Health concerns in the area include respiratory issues due to dust and air pollution, especially during road construction.

Drinking Water Supply:

- Groundwater is a primary source of drinking water, extracted through borewells.
- In some areas, water quality is a concern due to potential contamination from sewage and agricultural runoff.
- The installation of filtration and treatment systems is recommended to ensure safe drinking water.

Employment:

- The local economy relies on small businesses, agriculture, and self-employment.
- The road improvement project may create temporary employment opportunities during the construction phase for local labor.

- Improved road infrastructure is expected to boost commercial activities, enhancing employment opportunities in the long term.

Communication and Utilities:

- The area is connected to basic utilities like electricity, gas, and telecommunication networks.
- The road development aims to enhance access to services like internet connectivity and waste management.

Type of Housing:

The region consists of a mix of housing styles:

- Traditional village houses made of brick and concrete.
- Urban-style homes in gated housing societies.
- Commercial structures catering to local businesses.

Family System:

Most households follow a traditional family structure, with extended and joint families being common. However, nuclear families are becoming more prevalent due to urbanization.

Community Based Organization (CBOs) and NGOs:

Various local organizations and NGOs operate in the region, focusing on education, healthcare, and community development. These include:

- Punjab Rural Support Program (PRSP) focusing on rural development and women's empowerment.
- Saylani Welfare International Trust — providing food, healthcare, and educational support.
- Bait-ul-Maal — assisting low-income families with financial aid and healthcare.

Cultural Heritage:

The area has a rich cultural background, influenced by Punjabi, Pakhtun, and Balochi traditions. Social gatherings, religious festivities, and cultural events are vital aspects of community life.

Conclusion:

The socio-economic and cultural environment of the project area is dynamic, shaped by its diverse population, economic activities, and urban-rural interaction. The road improvement project is expected to enhance connectivity, improve quality of life, and create new socio-economic opportunities while respecting the cultural fabric of the local community.

Chapter 6: Impact Assessment and Mitigation Measures

6.1 Introduction

The Environmental Impact Assessment (EIA) for the Improvement of Road (15 KM) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan has identified potential environmental and social impacts that may occur during both the construction and operational phases of the project. The ESIA aims to assess these impacts, highlighting both positive and negative effects.

This section outlines the anticipated environmental and social impacts, evaluates their magnitude, and determines their significance. Additionally, it recommends mitigation measures to minimize adverse effects and identifies any residual impacts that may persist after implementing these measures. The extent and significance of potential impacts are influenced by the scale and nature of construction activities, as well as the effectiveness of pollution control measures incorporated into the project's design.

6.2 Project and Study Area (Area of Influence)

Before conducting an environmental analysis for the Improvement of Road (15 KM) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan, it is essential to define the project area and study area to understand the extent of potential impacts.

6.3 Project Area

The project area comprises locations that will be directly affected by construction and development activities. This includes the road alignment, construction sites, material storage areas, borrow pits, and disposal sites for construction waste. Additionally, areas designated for workers' camps, machinery yards, and access routes also fall within this scope.

Direct impacts in this area may include land acquisition, displacement of structures or utilities, and removal of vegetation to facilitate road widening and drainage improvements. Other immediate effects may include soil disturbance, noise, dust emissions, and changes to surface water drainage due to excavation and construction activities. The impact zone width varies, measuring 20 feet in some areas and 16 feet in others.

6.4 Study Area

Beyond the immediate project area, indirect environmental and social impacts may extend to surrounding communities and ecosystems. Traffic-induced air pollution, noise pollution, and vibrations from construction and operational activities can affect areas up to 2 km from the project site.

The study area encompasses both physical and ecological factors, such as changes in air quality, groundwater levels, and biodiversity, as well as socioeconomic aspects, including traffic congestion, access disruptions, and potential economic benefits to nearby businesses. The extent of these impacts depends on terrain conditions, population density, and the mitigation measures employed to minimize adverse effects. The impact zone width varies, measuring 20 feet in some areas and 16 feet in others.

6.5 Impact Assessment Methodology

Qualitative predictive techniques are mainly used for the evaluation of the potential impacts as the exact amounts of materials and resources to be used that may impact the environment are not yet decided upon.

The significance of potential impacts was assessed using assessment methodology that considers impact likelihood and consequence of receptors, described below:

6.5.1 Likelihood and Consequence of Impact

The impact assessment requires assigning a value for both the likelihood and probability of an outcome occurring and the consequence or severity of a potential outcome. Based on the se assigned values, a matrix format is used to place the specific hazard within a specific location of the matrix. This location can then be used to determine impact score for that activity.

The likelihood or probability is given the following types and number:

Sr. No.	Likelihood	Definition
1	Certain	Immediate danger to environment, the health and safety of the public, staff, resources, or property; occurs frequently or continuously.
2	Likely	Probably will occur in time if not corrected, or probably will occur one or more times during the life of the project.
3	Unlikely	Possible to occur in time if not corrected.
4	Rare	Will occur rarely and can be negligible.

Next is the Consequence or severity, presented below:

Sr. No.	Consequence	Definition
A	Catastrophic	Permanent, severe impact/s to land, biodiversity, ecosystem. Complete breakdown of social order. Widespread desecration of items of global cultural significance. Company directly responsible or complicit in severe and widespread long-term impacts on human rights.
B	Major	Significant impact/s land, biodiversity, ecosystem services, water resources or air. A breakdown of social order. Widespread damage to items of global cultural significance. Highly offensive infringements of cultural heritage. Company directly responsible or complicit in severe, long-term impacts on human rights.
C	Moderate	Moderate impact/s land, biodiversity, ecosystem services, water resources or air. Moderate medium-term social impacts or frequent social issues. Moderate damage to structures/items of local cultural heritage significance/sacred locations. Moderate, temporary human rights impacts.
D	Low	Low level impact/s to land, biodiversity, ecosystem services, water resources or air. Low-level social impacts. Low-level infringement of cultural heritage or minimal disturbance to heritage structures. Minimal impact on human rights.

6.5.2 Impact = Likelihood x Consequence

Based on the above classification and values, an impact analysis matrix has been developed and presented in Table 6-1.

Table 6.1: Impact Analysis Matrix

Likelihood	Consequence			
	Catastrophic	Major	Moderate	Low
Value (Likelihood x Consequence)				
Certain	Very High	High	Medium	Low
Likely	High	Medium	Medium	Low
Unlikely	Medium	Medium	Low	Low
Rare	Low	Low	Low	Low

Based on the related values in Table 6-1 the following impact categories are identified.

- **Very High Impact:** Requires more intensive mitigation measures
- **High Impact:** Requires intensive mitigation measures
- **Medium Impact:** Requires comparatively less mitigation measures
- **Low Impact:** Professional judgment

6.5.3 Environmental Screening of the Proposed Project

For or the Improvement of Road (15 KM) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan, potential environmental impacts have been identified and assessed for the pre-construction, construction, and operational phases. These impacts are categorized into physical, biological, and socio-economic aspects, with each category further divided into specific environmental factors.

- High negative (adverse) impact,
- Low negative impact,
- Insignificant impact,
- High positive (beneficial) impact,
- Low positive impact, and
- No impact.

The negative impacts predicted in this manner are the unmitigated impacts, discussed later in the chapter. The screening matrix of unmitigated impacts during the construction and operational phases of the Project is provided in the **Table 6.2**.

Table 6.2 Impact Matrix – Residual Impacts (Un-mitigated)

Project Activities	Physical Environment			Biological Environment		Socio-economic Environment					
	Soil erosion and degradation	Air quality deterioration and dust	Impact on groundwater resources	Loss of vegetation	Damage to wildlife	Solid waste	Noise	Vibration	Traffic congestion	Safety hazards, public health and nuisance issues	Sites of archeological/historical significance
Construction Phase											
Project sitting/demolition/land clearance	-1	-1	-1	-1	-1	0	-1	-1	0	-1	N
Construction of labour camp	-1	-1	-1	N	-1	-1	-1	-1	N	-1	N
Labour camp operation	0	-1	0	N	-1	-2	-1	-1	0	-1	N
Foundations construction	-1	-1	-1	N	N	-1	-1	0	0	-1	N
Construction of building	0	-1	-1	N	N	-1	-1	-1	-1	-1	N
Storage of construction material	N	0	0	N	N	0	0	0	0	N	N
Disposal of construction waste	N	-1	-1	N	N	-1	N	0	0	-1	N
Disposal of wastewater	N	N	-1	N	N	0	0	0	0	0	N
Cleaning and restoration	N	-1	0	N	N	-1	-1	0	0	-1	N
Operation Phase											
Solid waste disposal	-1	-1	0	N	N	-1	N	N	N	-1	N
Wastewater Disposal	0	0	-1	N	N	N	N	N	N	-1	N

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible negative; +1: low positive impact; +2; High positive impact, N: no impact.

6.5.4 Impact Characteristics¹⁵ (Assessment of Significance)

Various aspects of the impact characterization include:

- Nature (direct/indirect)
- Duration of impact (short term, medium term, long term)
- Geographical extent (local, regional)
- Timing (project phase)
- Reversibility of impact (reversible/irreversible)
- Likelihood of the impact (certain, likely, unlikely)
- Impact consequence severity (severe, moderate, mild)
- Signification of impact (high, medium, low)

The above aspects of environmental characterization are defined in Table 6.2.

¹⁵ [Source: Handbook of Environmental Impact Assessment, Volume II, Judith Petts, 1999. Blackwell Science Ltd.](#)

The criteria for determining significance are specific for each environmental and social aspect but generally, the magnitude of each impact is defined along with the sensitivity of the receptor. Generic criteria for defining magnitude and sensitivity are summarized below:

6.5.5 Magnitude

The assessment of magnitude will be undertaken in two steps. Firstly, the key issues associated with the Project are categorized as beneficial or adverse. Secondly, impacts will be categorized as major, moderate, minor, or negligible based on consideration of the parameters such as:

- Duration of the impact
- The spatial extent of the impact
- Reversibility
- Likelihood (something probable)

The magnitude of impacts will generally be identified according to the categories outlined in Table – 6.4.

Table – 6.3: Impact Characteristics Criteria

Category	Characteristics
Nature of the Impact	Direct: The environmental parameter is directly changed by the project. Indirect: The environmental parameter changes as a result of the change in another parameter.
Duration of the impact	Short term: Lasting only till the duration of the project such as noise from the construction activities. Medium-term: Lasting for a period of a few months to a year after the project before naturally reverting to the original condition such as contamination of soil or water by fuels or oil. Long term: Lasting for a period much greater than medium-term impacts before naturally reverting to the original condition such as loss of soil due to soil erosion.
Geographical Location of the impact	Local: Within the area of the project i.e., operation site and access road. Regional: Within the boundaries of the project area. National: Within the boundaries of the country.
Timing	Construction Operation
Reversibility of impact	Reversible: When a receptor resumes its pre-project condition, Irreversible: When a receptor does not or cannot resume its pre-project condition
Likelihood of the impact	Qualitatively measured on a scale of: Almost certain: Impact is expected to occur under most circumstances. Likely: Impact will probably occur under most circumstances. Possibly: Impact may occur at some time. Unlikely: Impact could occur at some time.

	Rare: Impact may occur but only under exceptional circumstances
Impact consequence severity	Major: When an activity causes irreversible damage to a unique environmental feature; affects an entire population or species of flora or fauna in sufficient magnitude so as to cause a decline in abundance or change in distribution over more than one generation; has long-term effects (years) on socio-cultural or economic activities of regional significance. Moderate: When an activity causes long-term (period of years) reversible damage to a unique environmental feature; affects a portion of a population of flora or fauna causing reversible damage or change in abundance or distribution over one generation; has short term effects (months) on socio-cultural or economic activities of regional significance. Minor: When an activity causes short term (period of few months) reversible damage to an environmental feature; slight reversible damage to a few species of flora or fauna within a population over a short period of time; has short-term (months) effects on socio-cultural or economic activities of local significance. Negligible: When no measurable damage to the physical, socio-economic, or biological environment above the existing level of impacts occurs.
Significance of the impact	Categorized as High, Medium, or Low Based on the consequence, likelihood, reversibility, geographical extent, duration, level of public concern and conformance with legislative or statutory requirements.

6.5.6 Sensitivity

The sensitivity of a receptor will be determined based on the review of the population (including proximity/numbers/vulnerability) and the presence of strategic/sensitive features on the site or in the surrounding area. Criteria for determining the sensitivity of receptors are outlined in Table 6.2. Each assessment will define sensitivity about the topic.

6.6 Screening Environmental Impacts for Pre-construction Phase

The pre-construction phase primarily involves planning, surveying, site clearance, and preparatory work before the actual construction begins. Although this phase has relatively fewer physical activities, it can still lead to significant environmental impacts that require assessment and mitigation.

- Project sitting impacts
- Energy efficient building envelope
- Insulation strategies
- Interior finishes
- Lightning system
- Fire protection

6.6.1 Potential Environmental Impacts:

1. Land Use and Site Clearance:

- Impact:

- Removal of vegetation and possible displacement of natural habitats.
- Temporary loss of agricultural or green areas.
- Change in land use patterns in areas designated for construction camps and material storage.
- **Severity: Moderate**
- **Reversibility: Reversible**
- **Likelihood: Certain**

Mitigation Measures

- Limit site clearance to the minimum required for construction.
- Replant native vegetation in non-construction areas to restore greenery.
- Mark boundaries clearly to avoid unnecessary clearing.

2. Soil Erosion and Degradation:

- **Impact:**
 - Soil erosion due to site clearance, removal of vegetation, and topsoil exposure.
 - Soil compaction by movement of heavy machinery.
- **Severity: Moderate**
- **Reversibility: Reversible**
- **Likelihood: Likely**

Mitigation Measures:

- Use silt fences and soil stabilization techniques to prevent erosion.
- Minimize the use of heavy machinery to reduce soil compaction.
- Store topsoil separately for future use during site rehabilitation

3. Air Quality Deterioration:

- **Impact:**
 - Increased dust and particulate matter from land clearing and movement of machinery.
 - Emissions from survey vehicles and machinery.
- **Severity: Low to Moderate**
- **Reversibility: Reversible**
- **Likelihood: Likely**

Mitigation Measures:

- Regular water sprinkling on unpaved surfaces to control dust.
- Use well-maintained vehicles to minimize emissions.
- Implement dust screens or barriers in populated areas

4. Noise Pollution:

- **Impact:**
 - Elevated noise levels from machinery, survey equipment, and transportation.
 - Potential disturbance to nearby residential areas, schools, and businesses.
- **Severity: Low**

- **Reversibility:** Reversible
- **Likelihood:** Likely

Mitigation Measures:

- Limit noisy activities to daytime working hours.
- Use noise-dampening equipment and well-maintained machinery.
- Provide ear protection to workers operating in high-noise zones

5. Water Resource Impact:

- Impact:
 - Possible contamination of water bodies due to improper disposal of waste and wastewater.
 - Risk of sediment runoff into Rohi Nala during site clearance
- Severity: Moderate
- Reversibility: Reversible
- Likelihood: Possible

Mitigation Measures:

- Ensure proper waste disposal and prohibit discharge into Rohi Nala.
- Use sediment barriers to prevent runoff into water bodies.
- Create designated washing and refueling areas for machinery

6. Waste Generation:

- Impact:
 - Possible contamination of water bodies due to improper disposal of waste and wastewater.
 - Risk of sediment runoff into Rohi Nala during site clearance
- Severity: Moderate
- Reversibility: Reversible
- Likelihood: Possible

Mitigation Measures:

- Implement proper waste segregation (organic, recyclable, non-recyclable).
- Provide waste bins at designated points to prevent littering.
- Dispose of waste at approved landfill sites or through local waste management systems.

7. Socio-Economic and Cultural Impacts:

- Impact:
 - Disruption to local communities, including traffic congestion and restricted access.
 - Possible damage to cultural or historical sites during site preparation.
- Severity: Moderate
- Reversibility: Reversible
- Likelihood: Possible

Mitigation Measures:

- Engage with local communities and inform them about construction schedules.
- Implement a traffic management plan to minimize congestion.
- Conduct surveys to identify and protect cultural or historical sites

8. Health and Safety Hazards:

- Impact:
 - Accidents and injuries due to inadequate safety measures during site preparation.
 - Exposure to dust and noise, impacting workers' health
- Severity: Moderate
- Reversibility: Reversible
- Likelihood: Possible

Mitigation Measures:

- Provide safety training and appropriate PPE (helmets, masks, gloves) to workers.
- Display clear signage and barricades to prevent unauthorized access to hazardous areas.
- Ensure first aid facilities are available on-site.

Conclusion:

The pre-construction phase has moderate environmental impacts that are mostly reversible with proper planning, monitoring, and implementation of mitigation measures. Effective coordination with local authorities and stakeholders is crucial to minimizing adverse impacts and ensure compliance with environmental standards

6.7 Screening of Environmental Impacts for Construction Phase

The construction phase will have the most significant environmental implications, as various activities will lead to physical, biological, and socio-economic disturbances. The potential impacts include:

Physical Environment

- Soil erosion and degradation
- Air quality deterioration and dust pollution
- Contamination of surface and groundwater

Biological Environment

- Loss of vegetation
- Damage to wildlife and habitat

Socio-Economic Environment

- Generation of solid waste
- Noise pollution
- Vibrations from machinery
- Traffic congestion
- Safety hazards, public health, and nuisance issues
- Potential impact on sites of archaeological or historical significance

These impacts and their respective mitigation measures are discussed below.

6.8 Soil Erosion and Degradation

The soil-related issues include erosion, slope instability, and contamination due to construction activities. The reduction of vegetation cover, excavation, and land clearing will increase rainwater runoff, which can contribute to soil degradation.

Potential Impacts:

- Impact on road stability
- Increased risk of flooding
- Silting of drainage systems and nearby water bodies
- Safety hazards due to unstable ground conditions

Nature:	Direct
Duration:	Medium term
Geo extent:	Local
Reversibility:	Reversible
Likelihood:	Certain
Consequence:	Severe
Impact significance:	High

Mitigation Measures

- Implement proper topsoil management for reuse in re-vegetation efforts.
- Adopt slope stabilization techniques such as stone pitching, riprap, and geotextiles.
- Use terracing and fast-growing vegetation on embankments to prevent scouring.
- Prevent soil contamination by storing fuels, chemicals, and bitumen on impervious bases.
- Ensure proper drainage systems to control runoff and reduce erosion.
- Establish designated vehicle and machinery maintenance zones to avoid soil contamination.
- Restore construction sites after project completion, ensuring proper waste disposal and landscaping.

6.9 Air Quality Deterioration and Dust

Construction machinery and vehicle emissions will contribute to air pollution, releasing CO, CO₂, SO₂, NO_x, and particulate matter (PM). Additionally, excavation and movement of construction materials may result in fugitive dust emissions.

Nature:	Direct
Duration:	Medium term
Geo Extent:	Local
Reversibility:	Reversible
Likelihood:	Certain
Consequence:	Moderate
Impact Significance:	High

Mitigation Measures

- Ensure regular maintenance of construction machinery and vehicles.
- Minimize dust emissions by spraying water on unpaved surfaces.
- Require tarpaulin covers on trucks transporting construction materials.
- Provide Personal Protective Equipment (PPE) for workers.

- Monitor air quality compliance to ensure adherence to environmental standards.

6.10 Contamination of Surface and ground water

Construction activities may lead to contamination due to improper disposal of solid waste, wastewater, and vehicle maintenance-related spills

Nature:	Direct
Duration:	Medium term
Geo Extent:	Local
Reversibility:	Partially
Likelihood:	Likely
Consequence:	Severe
Impact Significance:	High

Mitigation Measures:

- Ensure proper disposal of construction and domestic waste.
- Designate maintenance areas for vehicles and equipment away from water sources.
- Collect waste oils and lubricants for recycling.
- Install drainage systems to prevent runoff contamination.

6.11 Loss of Vegetation

The construction process may require the removal of vegetation along road alignments, culverts, and embankments, affecting local flora.

Nature:	Direct
Duration:	Medium term
Geographical Extent:	Local
Reversibility:	Partially Reversible
Likelihood:	Certain
Consequence:	Moderate
Impact Significance:	Medium

Mitigation Measures

- Plant indigenous tree and grass species along the roadside and in open spaces.
- Prohibit cutting of trees for firewood, providing LPG as an alternative for cooking.
- Implement soil conservation techniques to support vegetation regrowth.
- Introduce grass species with soil-binding capacity to prevent erosion.

6.12 Impact on Faunal Resources

The project site provides a habitat for various animal species. Construction activities, including noise, vibration, lighting, and vehicular movement, may disturb local wildlife.

Nature:	Direct
Duration:	Medium term
Geographical Extent:	Local
Reversibility:	Partially Reversible
Likelihood:	Likely
Consequence:	Moderate
Impact Significance:	Medium

Mitigation Measures

- Avoid construction during nighttime to minimize disturbance to nocturnal species.
- Reduce noise and light pollution by limiting excessive illumination.
- Prohibit hunting, poaching, and trapping of local wildlife.
- Ensure proper waste management to prevent wildlife attraction to human settlements.
- Restore natural vegetation to provide an improved habitat for displaced fauna.

6.13 Noise and Vibration

Heavy machinery and construction activities will generate noise and vibrations that may disturb local communities.

Nature:	Direct
Duration:	Medium term
Geo Extent:	Local
Reversibility:	Reversible
Likelihood:	Certain
Consequence:	Moderate
Impact Significance:	High

Mitigation Measures

- Limit high-noise activities to daylight hours.
- Provide PPE (earplugs/muffs) to workers exposed to high noise levels.
- Use low-noise machinery where possible.
- Install noise barriers around high-activity zones.

6.14 Dismantled material

The dismantling of the existing road surface, covering a total volume of 6,435 m³, will have several potential environmental and social impacts, including:

Nature:	Direct
Duration:	Medium term
Geo extent:	Local
Reversibility:	Reversible
Likelihood:	Certain
Consequence:	Severe
Impact significance:	High

Mitigation Measures

Dismantling material shall be disposed off to the Mehmood Boti dumping site. To eliminate the adverse impacts associated with the dismantling of the road surface, the following mitigation measures are proposed:

- Water sprinkling suppresses dust emissions during dismantling activities, especially in dry and windy conditions.
- Regular maintenance of construction equipment to ensure optimal performance and minimize emissions.
- Use of dust screens and barriers in sensitive areas, particularly near residential areas and schools.
- Limiting dismantling activities to designated hours (daytime) to reduce disturbance.
- Installing noise barriers around high-noise machinery, where feasible.

- Use of low-noise machinery and ensuring proper maintenance.
- Providing ear protection to workers and maintaining a safe distance from noisy equipment.
- Proper segregation of C&D waste to identify recyclable materials (asphalt and concrete).
- Disposal of non-recyclable waste to approved landfill sites.
- Reuse of broken concrete and asphalt as sub-base material for the new road, if feasible.
- Regular monitoring and recording of waste disposal activities.
- Installation of temporary sediment traps to prevent blockages and contamination of drainage channels.
- Designated areas for refueling and maintenance of machinery to prevent oil leakage.
- Immediate cleaning of accidental spills using absorbent materials.
- Use of personal protective equipment (PPE) like helmets, gloves, goggles, dust masks, and earplugs for workers.
- Training sessions for workers on safe dismantling practices and handling of hazardous materials.
- Proper signage and barricading of the work zone to restrict unauthorized access.
- First aid facilities and emergency contact numbers readily available at the construction site.
- Regular monitoring of air quality, noise levels, and waste disposal practices.
- Compliance with relevant environmental standards and guidelines set by local authorities.
- Continuous engagement with the local community to address concerns related to dismantling activities.

6.15 Traffic Congestion

Impact Assessment and Mitigation Measures for Traffic Congestion

Impact Assessment:

The road improvement project, including the establishment of construction camps and dismantling of existing road surfaces, may lead to traffic congestion in the vicinity of Burki Road, LUMS, and Azam Chowk.

The unmitigated impacts related to traffic congestion are characterized below.

Nature:	Direct
Duration:	Medium term
Geographical Extent:	Local
Reversibility:	Reversible
Likelihood:	Certain
Consequence:	Severe
Impact Significance:	High

Mitigation Measures

- Develop a comprehensive Traffic Management Plan (TMP) in coordination with local traffic authorities before starting construction activities.

- Designate specific entry and exit points for construction vehicles to minimize disruption.
- Ensure appropriate signages and markings to guide traffic flow, indicating detours, speed limits, and alternate routes.
- Schedule construction activities during off-peak hours to minimize disruption to regular traffic.
- Limit road closures to smaller sections and avoid working during peak traffic hours.
- Notify the public in advance about road closures and construction schedules through local media, signboards, and online platforms.
- Identify and develop alternative routes for regular traffic, public transport, and emergency vehicles.
- Collaborate with local authorities to optimize traffic signal timings to reduce delays.
- Clearly mark alternative routes with directional signs and reflective markings.
- Install warning signs at least 200 meters before construction zones to alert drivers.
- Use reflective markings and temporary lane dividers to enhance visibility during nighttime.
- Display cautionary signage for speed reduction, narrow roads, and construction areas.
- Mark pedestrian crossings clearly and install traffic cones to guide safe pedestrian movement.
- Place signboards at key intersections to communicate construction updates and detours.
- Conduct public awareness campaigns to inform the community about construction activities, traffic changes, and alternate routes.
- Establish a helpline or contact number for traffic-related inquiries and grievances.
- Distribute pamphlets or use digital platforms to inform about traffic management plans.

6.16 Residual Impacts

- With proper implementation of mitigation measures, the overall residual impacts of the project will be significantly minimized. The significance of impacts on soil, air, water, and biological resources is expected to be low to moderate, while socio-economic impacts will be managed through community engagement and responsible project execution.
- This approach ensures that the Improvement of Road (15 KM) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan is carried out in an environmentally sustainable manner while minimizing disruption to local communities and ecosystems.

6.17 Safety Hazards, Public Health and Nuisance

The project is located near residential and commercial areas, posing potential safety hazards to the local population. Public health concerns include dust emissions, air pollution, and contamination of local water resources during construction.

Potential Health Impacts:

Dust Allergy: Increased dust levels may cause respiratory issues among nearby residents and workers.

Eye and Respiratory Diseases: Construction workers will be exposed to dust and vehicle emissions, increasing the risk of eye and lung diseases.

Accidents: Increased traffic during and after construction may lead to road accidents.

Light Pollution: Excessive illumination at construction sites can cause nuisance to local communities.

Nature:	Direct
Duration:	Medium term
Geo Extent:	Local
Reversibility:	Partially Reversible
Likelihood:	Likely
Consequence:	Severe
Impact Significance:	High

Mitigation Measures

- Implement strict dust control measures, including regular water sprinkling and dust suppression systems.
- Conduct routine health screening and provide workers with protective gear (e.g., face masks and goggles).
- Establish emergency response procedures for occupational accidents.
- Ensure defensive driving training for all project vehicle operators.
- Use light diffusers and reflectors to reduce glare and minimize public nuisance.
- Implement a traffic management plan to control vehicle movement and prevent road accidents.

6.18 Sites of Archaeological/ Historical Significance

There are no reported archaeological or historical sites in the project area. However, if any artifacts or remains are discovered during construction, the **Archaeology Department** will be contacted immediately.

Mitigation Measures

- Any archaeological findings will be reported to the relevant authorities.
- The graveyards or other culturally significant sites, if affected, will be managed in consultation with the local community.
- Compensation will be provided as per applicable laws to affected residents.

6.19 Screening of Environmental Impacts for Operational Phase

Once the project is completed and becomes operational, environmental concerns will shift to long-term maintenance and management of the infrastructure. The major environmental risks include:

- Contamination of surface and groundwater
- Damage to flora and fauna
- Soil contamination due to improper waste disposal

6.20 Surface and Groundwater Contamination

Water contamination risks will be lower than during the construction phase but may still occur due to road runoff, improper sewage disposal, and chemical leaks from vehicles.

Nature:	Indirect
Duration:	Long term
Geo Extent:	Local
Reversibility:	Partially Reversible
Likelihood:	Possible
Consequence:	Moderate
Impact Significance:	Medium

Mitigation Measures

- Install stormwater drainage systems to prevent waterlogging and contamination.
- Regular maintenance of drainage and sewerage infrastructure to prevent leakage.
- Encourage rainwater harvesting to utilize excess runoff for landscaping and irrigation.

6.21 Damage to Flora and Fauna

Although construction will result in some loss of vegetation, operational activities such as road traffic and urbanization may continue to affect local biodiversity.

Nature:	Indirect
Duration:	Long term
Geo Extent:	Local
Reversibility:	Partially Reversible
Likelihood:	Possible
Consequence:	Moderate
Impact Significance:	Medium

Mitigation Measures

- Implement tree plantation programs along roadsides to improve air quality and provide habitat for wildlife.
- Regular monitoring of environmental conditions to assess the impact on biodiversity.
- Noise reduction measures to minimize disturbance to local fauna.

6.22 Soil Contamination

Improper disposal of solid and liquid waste can degrade soil quality and lead to long-term contamination.

Nature:	Indirect
Duration:	Long term
Geo Extent:	Local
Reversibility:	Partially Reversible
Likelihood:	Possible
Consequence:	Moderate
Impact Significance:	Medium

Mitigation Measures

- Waste collection bins should be placed at designated locations for proper waste disposal.
- Street sweeping and regular waste collection should be conducted to prevent accumulation of pollutants.
- A solid waste management plan should be developed to handle waste effectively.
- Sewage treatment facilities should be installed to process wastewater before discharge.

6.23 Residual Impacts

After implementing the recommended mitigation measures, the residual impacts of the road improvement project are expected to be low to moderate. Continuous environmental monitoring and proper maintenance will help minimize any long-term negative effects.

6.24 Solid Waste Management

Solid waste generated during the construction phase of the Improvement of Road (15 KM) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan shall be safely disposed of at an approved waste disposal site. A Solid Waste Management Plan will be developed to ensure proper collection, segregation, and disposal of waste while promoting recycling and environmental sustainability.

Unmitigated Impacts Related to Solid Waste Management

Nature: Direct to indirect
Duration: Medium term
Geographical Extent: Local
Reversibility: Reversible
Likelihood: Certain
Consequence: Moderate
Impact significance: High

Solid waste management will also be a key concern during the operational phase of the road network. A well-structured waste collection and disposal system will be established in collaboration with municipal authorities. Proper placement of waste bins, periodic collection, and transportation of waste to designated disposal sites will be ensured to maintain environmental hygiene.

6.25 Environmental Assessment (EA) Checklists

An environmental assessment of the project area was conducted to evaluate potential impacts and mitigation strategies, as depicted in Table 6.3.

Table 6.4 Environmental Screening Checklist

Screening Criteria	Screening Status	Remarks
A. Environmental Screening	Completed	The road improvement project along Rohi Nala is environmentally feasible.

Will the project impact environmentally sensitive areas (e.g., wetlands, forests, protected areas)?	No	The project area is not within or near any environmentally sensitive or protected zones.
Does the project involve significant land clearing or deforestation?	No	Some vegetation clearance is required, but compensatory planting and restoration measures are planned.
Will the project cause air pollution due to construction activities?	Yes (Mitigated)	Dust suppression measures, including water sprinkling, and emission controls for machinery will be implemented.
Will the project generate hazardous waste or toxic substances?	Yes (Mitigated)	Proper hazardous waste management, storage, and disposal protocols are in place.
Is there a risk of groundwater contamination from construction runoff?	Yes (Mitigated)	Adequate stormwater drainage systems and spill containment measures are planned to minimize contamination risks.
Will the project impact local biodiversity and wildlife habitats?	Yes (Mitigated)	Habitat disturbance is possible, but construction will avoid breeding seasons, and wildlife-safe passages will be established.
Are there adequate provisions for wastewater treatment and solid waste management?	Yes	Dedicated drainage systems and solid waste management plans are in place to prevent environmental degradation.
Will the project result in significant noise pollution affecting nearby communities?	Yes (Mitigated)	Noise barriers, restricted working hours, and well-maintained machinery will help control noise levels.
Are climate change mitigation measures incorporated into the project?	Yes	Green infrastructure, energy-efficient construction practices, and reforestation efforts are included.

6.26 Cumulative Impact Analysis

Cumulative impacts of the road improvement project may arise from urban development, increased traffic, and construction activities. These land use changes may contribute to habitat modification, alteration of hydrology, contamination risks, and

disruption of local communities. Effective mitigation strategies will be essential to address these concerns.

Table 6.5: Cumulative Impact Analysis

Resources	Potential Adverse Effects	Potential Cumulative Effects
Transportation	Increased traffic congestion during construction and operational phases	Long-term impact on regional traffic patterns; potential for increased air pollution due to higher vehicle emissions.
Community Character	Temporary disruption to local communities due to construction activities	Increased urbanization, enhanced local business opportunities, but potential strain on public services and infrastructure.
Land Acquisition and Relocation	No land acquisition involved	No cumulative effects due to the use of existing roadways.
Recreational Resources	Restricted access to recreational spaces during construction	Temporary disruption, but improved road access may enhance accessibility post-construction.
Air Quality	Temporary dust and emissions from construction machinery and vehicles	Long-term air quality concerns if vehicle emissions increase due to higher traffic volumes.
Noise	Increased noise from construction machinery and traffic	Gradual rise in ambient noise levels; potential disturbance to residential and educational areas.
Water Resources	Increased stormwater runoff and potential contamination from spills	Enhanced drainage systems and better water management practices could lead to improved flood control and reduced waterlogging issues, positively impacting water quality
Ecology	Minimum/ negligible Loss of vegetation and habitat disturbance during construction	Local biodiversity will flourish significantly as a result of implementation plantation plan

6.27 Positive Impacts of the Project

- Improved Transportation Infrastructure: The project will enhance road conditions, reducing travel time and congestion.
- Economic Growth: Improved roads facilitate trade and connectivity, boosting local and regional economies.
- Job Creation: Construction and maintenance activities will provide employment opportunities.
- Better Access to Services: The improved road network will enhance access to healthcare, education, and markets.
- Enhanced Safety: Modernized road design will include better traffic management, lighting, and pedestrian crossings.
- Environmental Sustainability: Implementation of green infrastructure such as tree plantations and efficient drainage will support environmental conservation.

6.28 Summary of Impacts and Mitigation Measures

The following table summarizes the potential environmental impacts and the proposed mitigation strategies

Table 6.6: Summary of Impacts and Mitigation Measures

Impact	Mitigation Measures
Air Pollution	Regular water sprinkling, emission control on machinery, and use of dust barriers
Noise Pollution	Use of low-noise equipment, noise barriers, and limited construction hours
Soil Erosion	Proper grading, erosion control measures, and re-vegetation
Water Contamination	Stormwater drainage systems, sediment control, and wastewater treatment
Traffic Disruptions	Traffic management plans, alternate routes, and community engagement
Loss of Vegetation	Replantation program and preservation of green spaces
Safety Hazards	Worker safety training, proper road signage, and enforcement of safety protocols

Chapter 7: Environmental Monitoring Management Plan

7.1 Introduction

The Environmental Impact Assessment (EIA) report comprehensively identifies potential environmental and social impacts associated with the Improvement of Road (15 KM) Including Link Streets and Raising of Safety Wall of Charrar Drain from Barki Road to Kamahan project. These impacts encompass both positive and negative effects at various stages of the project.

To mitigate adverse impacts, the EIA recommends measures based on an understanding of environmental sensitivity in the project area, relevant legislation, and best practices in road construction and environmental management. For residual impacts or those with uncertain predictions, monitoring measures have been proposed to assess and address them during the project's implementation.

An Environmental Monitoring and Management Plan (EMMP) has been developed to ensure effective implementation and management of mitigation measures, aligning with the requirements of the Pakistan Environmental Protection Act, 1997 and Punjab Environmental Protection Act, 2012. This chapter outlines the implementation framework for the EMMP, defining institutional arrangements necessary for its execution.

7.2 Purpose and Objectives of EMMP

The Environmental Monitoring and Management Plan (EMMP) provides a structured framework to mitigate environmental and social impacts throughout the road improvement project's lifecycle. It ensures compliance with national regulations, enhances environmental sustainability, and integrates best construction practices

Primary Objectives of the EMMP:

- Ensure compliance with national and provincial environmental regulations governing road infrastructure projects.
- Facilitate the implementation of mitigation measures to minimize environmental and social impacts.
- Develop a comprehensive environmental and social monitoring mechanism to assess the effectiveness of mitigation strategies.
- Establish clear roles and responsibilities for the project proponents, contractors, consultants, and regulatory authorities.
- Promote effective communication with local communities and stakeholders to ensure transparency and address concerns.
- Implement sustainable road construction practices, including stormwater management, dust control, and vegetation restoration.
- Ensure worker health and safety measures to prevent occupational hazards.

1. Management Approach

Pre-Construction and Construction Phase

The organizational roles and responsibilities are summarized below:

a) **Project Proponent**

The overall responsibility for ESMP compliance rests with the project proponent, relevant government authorities overseeing road infrastructure projects.

b) **Engineers, Contractors/Sub Contractors**

- Contractors are responsible for implementing field activities as per their contract agreements.
- The Project Engineer will monitor contractor compliance with the ESMP.
- The Environmental Consultant will conduct periodic audits to ensure adherence to environmental best practices.

Operational Phase

During the operational phase, environmental management will focus on routine maintenance, stormwater drainage, and pollution control. The relevant municipal or highway authorities will oversee monitoring and compliance with environmental standards.

7.3 Organizational Structure and Responsibilities

7.4.1 Construction Phase

Primary Responsibilities:

- The Project Manager is responsible for overall compliance with the ESMP.
- The Project Engineer will ensure implementation and monitoring of ESMP measures.
- The Site Engineer will implement the ESMP at the construction site, ensuring adherence to best practices.
- Environmental Monitoring will track key environmental indicators such as air quality, water usage, waste disposal, and traffic management.

7.4.2 Operational Phase

- Key environmental parameters such as noise levels, drainage efficiency, and vegetation cover will be monitored.
- Regular reports will be submitted to relevant environmental authorities.
- The Project Manager will coordinate with environmental agencies for compliance monitoring.

7.5. Legislation and Guidelines

The ESIA discusses national and international legislation relevant to road improvement projects. The Baluchistan Environmental Protection Act, 2012 will serve as the primary environmental framework, ensuring compliance with environmental quality standards.

7.6 Environmental Improvement Cell and Responsibilities

A dedicated Environmental Improvement Cell (EIC) will oversee environmental management during the construction and operational phases of the project.

Responsibilities of the Environmental Improvement Cell:

- Ensure implementation of all mitigation measures.
- Conduct capacity-building programs for staff and workers.
- Develop operational guidelines and schedules for environmental management.
- Address public complaints and coordinate with local environmental authorities.
- Monitor environmental performance, including dust control, waste management, and biodiversity conservation.

7.6.1 Approvals

The project management and contractors must obtain all necessary environmental approvals from the Punjab Environment Protection and Climate Change Department (EP & CCD), before commencing construction.

7.6.2 Contractual Provisions

- Compliance with EIA and EMMP requirements will be mandatory for all contractors.
- Contractors must implement mitigation measures and monitor environmental parameters.
- Project management will audit contractor compliance with the EMMP

7.7 Environmental Mitigation Matrix

Environmental monitoring will be undertaken during both the construction and operational phases to ensure the effectiveness of mitigation measures.

Purposes of Environmental Monitoring:

The various purposes of the environmental monitoring plan are:

- Evaluate the effectiveness of mitigation strategies.
- Address unanticipated environmental concerns.
- Improve management and environmental controls based on monitoring data.

A detailed Environmental and Social Monitoring Plan has been provided in Table 7.1, outlining mitigation measures required for the road improvement project.

This revised EMMP ensures that the road improvement project is implemented sustainably, in compliance with environmental laws, and with minimal adverse impact on local communities and ecosystems.

Table 7.1 Environmental and Social Mitigation Matrix

Project Activities	Type(s) of Impact	Potential Impacts on Environment	Where the Impact is Likely to Happen	When the Impact is Likely to Occur	Magnitude of Impact	Mitigation Measures	Institutional Responsibility	Parameters for Monitoring
Pre-construction/Design Stage								
Drainage	Environmental	Aesthetic, water ponding, breeding ground for mosquitoes	At project site	During and after rains	Major	Properly designed drainage system along roads to avoid stagnant water.	Engineering Consultant	Stormwater runoff monitoring
Cultural Properties	Social	Impact on religious or historical sites	To be assessed at project site	At planning stage	Moderate	Avoid interference with cultural heritage sites, develop alternate routes if needed.	Design & Supervision Consultant	Social issues monitoring
Seismic Activity	Environmental & Safety	Structural damage, environmental risk, safety concerns	At project site	Post-earthquake	High	Road design should comply with updated seismic codes and safety standards.	Engineering Consultant	Seismic risk compliance
Construction Phase								

Site Office and Construction Works	Socio-cultural, environmental	Sanitation issues, solid waste disposal, fuel spillage, noise, additional traffic	Contractor's Site	Throughout construction	Minor if mitigations followed	Supervised camp setup, proper hazardous material storage, designated vehicle parking areas.	Contractor	Site compliance monitoring
Sanitation & Waste Disposal	Health & Environment	Poor sanitation, waste accumulation impacting worker health & project progress	Construction sites & worker camps	Throughout construction	Moderate	Develop waste management plan, install septic tanks with soakage pits, proper waste segregation.	Contractor	Waste management compliance
Vehicular Movement at Construction Site	Environmental	Soil compaction, dust emissions, vegetation loss	Throughout project site	Construction phase	Low	Use designated haul routes, regular water spraying, air quality monitoring.	Contractor	Air & soil quality monitoring
Waste Generation & Burning	Environmental	Solid waste accumulation, air pollution	Construction sites & worker camps	Construction phase	Moderate	Develop waste handling plan, prohibit burning of waste, promote reuse/recycling.	Contractor	Waste management compliance

Machinery & Vehicle Maintenance	Environmental	Soil & water contamination from fuel, lubricants	Construction sites & vehicle fueling stations	Construction phase	Low	Maintain vehicles properly, use oil & grease traps, keep refueling areas away from water bodies.	Contractor	Air, soil & water quality monitoring
Worker Health & Safety	Social	Injuries, occupational health risks	Entire construction site	Throughout construction	High	Provide safety gear, medical facilities, insurance, pest control measures.	Contractor	Worker health compliance
Soil & Burrow Material Management	Environmental	Soil erosion, loss of productive land, dust pollution	Throughout construction sites & embankments	Construction phase	Medium	Preserve topsoil, use retaining walls, stabilize slopes, replant vegetation.	Contractor	Soil erosion control
Hazardous Material Handling	Health & Safety	Worker exposure risks	Construction storage areas	Construction phase	Low	Provide PPE, train workers, store hazardous materials securely.	Contractor	Material safety compliance
Transportation of Materials	Environmental & Social	Noise, air pollution, traffic congestion	Throughout project route	Construction phase	Medium	Cover loose materials, limit movement	Contractor	Noise & air quality monitoring

						during peak hours.		
Construction Waste Management	Environmental	Soil & water contamination, landscape degradation	Construction sites & disposal areas	Construction phase	High	Implement waste segregation, restore disposal sites after use.	Contractor	Waste compliance monitoring
Plantation	Environmental	Dust & noise reduction, ecological balance	Designated green areas & road corridors	Post-construction	Medium	Implement roadside tree planting, use native species.	Contractor	Plantation success rate
Operation Phase								
Road Drainage & Runoff	Environmental	Localized flooding, erosion, water contamination	Drainage points along the road	Rainy season	Medium	Regular drainage maintenance, debris removal, performance-based contracts.	Road Management Authority	Stormwater runoff control
Vehicular Spillage & Accidents	Environmental & Social	Soil & water contamination, road safety hazards	Throughout road network	As incidents occur	Medium	Emergency spill response plan, traffic enforcement.	Road Management Authority	Road safety compliance
Roadside Vegetation	Environmental & Social	Soil erosion, air quality, aesthetic enhancement	Roadside right-of-way areas	Operational stage	Low	Maintain vegetative cover, periodic monitoring of	Road Management Authority	Plantation maintenance

						tree survival rates.		
Road Safety & Traffic Management	Social	Accidents, congestion, pedestrian safety	High-traffic zones & populated areas	Operational stage	Medium	Implement traffic signage, speed limits, public awareness campaigns.	Road Management Authority	Traffic safety compliance
Air Quality	Environmental	Emissions from vehicles affecting health & environment	Along project road	Operational stage	Medium	Roadside plantation, vehicle emission checks, regular road maintenance.	Road Management Authority	Air quality monitoring
Noise & Vibrations	Environmental & Social	Noise pollution from vehicular traffic	Project area	Operational stage	Medium	Speed limit enforcement, periodic noise level assessments.	Road Management Authority	Noise monitoring

7.8 Solid Waste Management Plan

Construction Phase:

- **Waste Collection & Segregation:**
 - Adequate solid waste bins will be placed at construction zones, site camps, and worker accommodations.
 - Separate bins will be designated for biodegradable, non-biodegradable, recyclable, and hazardous waste.
 - Construction debris (concrete, bricks, and metal scraps) will be collected separately for reuse or recycling.
- **Storage & Disposal:**
 - Coordination with local municipal authorities for timely collection, transportation, and disposal of non-recyclable waste.
 - Hazardous waste (e.g., chemical containers, paint cans, and fuel drums) will be stored in designated hazardous waste areas and disposed of by licensed contractors.
 - Recyclable materials will be periodically sold to authorized recycling contractors.
 - Open burning of waste will be strictly prohibited to mitigate air pollution and public health risks.
- **Minimizing Waste Generation:**
 - Efficient use of materials to minimize waste.
 - Reuse of construction materials wherever feasible.
 - Promotion of eco-friendly packaging among suppliers.
 - On-site composting of organic waste from worker camps where feasible
- **Monitoring & Compliance:**
 - Implementation of a waste tracking system.
 - Regular audits to ensure compliance with waste management guidelines.
 - Training programs for workers on proper waste handling and disposal.

Operational Phase:

- **Waste Collection & Segregation:**
 - Designated waste collection points will be established throughout the project area.
 - Waste will be segregated into: Waste will be segregated at source into:
 1. Recyclables (e.g., paper, plastics, metals, glass)
 2. Non-recyclables (e.g., general waste, contaminated materials)
 3. Organic waste (food and biodegradable waste)
 4. Hazardous waste (e-waste, chemical waste, medical waste, etc.)
- **Storage & Disposal:**
 - A temporary solid waste storage facility will be established for sorting and holding waste before final disposal.
 - Non-recyclable waste will be transferred to municipal authorities for landfill disposal.
 - Organic waste will be processed through composting or bio-digestion.

- Hazardous waste will be managed as per national environmental regulations.
- **Awareness & Monitoring:**
 - Periodic waste audits to track trends and improve management practices.
 - Training sessions for stakeholders on waste segregation and disposal.
 - Public awareness programs for waste reduction and recycling.
 - Penalties and incentives for compliance with waste management protocols.

7.9 HSE Management Plan

General HSE Measures:

■ HSE Induction & Orientation:

- Comprehensive HSE induction for all workforce members covering PPE use, fire safety, waste management, and emergency response

■ HSE Meetings & Inspections:

- Daily Toolbox Talks (TBTs) at designated assembly points.
- Weekly safety meetings for hazard identification and corrective actions
- Regular inspections of equipment, scaffolding, and fall protection systems.

■ HSE Policy & Responsibilities

The **contractor** will be required to:

- Develop a comprehensive HSE policy outlining roles and responsibilities of the HSE Manager and staff.
- Implement first aid training, risk assessments, and safety documentation procedures.
- Maintain detailed records of accidents, near misses, and corrective actions.

■ PPE Implementation:

- Mandatory use of PPE (helmets, gloves, safety vests, dust masks, ear protection).
- Safety officers to monitor PPE compliance.

■ Fire & Emergency Preparedness:

- Fire extinguishers and fire blankets at strategic locations.
- Regular fire drills and emergency response training.
- Designated first aid centers with 24/7 medical staff.

■ Workplace Comfort & Health Facilities:

- Designated rest areas and medical dispensaries.
- On-site ambulance for emergencies.

■ Waste Management & Environmental Protection:

- Waste disposal will be systematically managed with separate collection bins for general, recyclable, and hazardous waste.
- Open burning of waste will be strictly prohibited.
- Dust suppression through water sprinkling will be conducted regularly to control air pollution.
- Barricading with proper warning tape will be implemented to restrict access to hazardous areas.

■ Safety Signage & Awareness:

- Relevant safety signboards will be installed at worksites and labor camps to educate workers on safety protocols, speed limits, electrical hazards, and emergency procedures.
- **Daily Safety Measures:**
 - **Toolbox Talks (TBTs):** Conducted before any new work activity (e.g., shattering, steel fixing, welding, concrete pouring, electrical works).
 - **Water Sprinkling:** Regular water sprinkling will be carried out to control dust pollution while avoiding excessive water accumulation (slush).
 - **Barricading & Hazard Management:** Hard barricading (scaffolding pipes) will be used for excavation areas deeper than 10 feet.
- **Training & Capacity Building:**
 - The HSE Manager will conduct regular training sessions for all employees, subcontractors, and workers to ensure compliance with emergency response protocols.
 - Training will include hazard identification, PPE usage, fire drills, first aid, and environmental safety measures.

Table 7.2 Estimated Cost for the Implementation of Environmental Monitoring & Management Plan

Sr	Item	Quantity	Unit Cost (Rs.)	Total Cost (Rs.)
Personal Protective Equipment (A)				
1	Dust Masks	4,500	10	45,000
2	Safety Shoes	100	2,000	200,000
3	Gloves	1,200	200	240,000
4	First Aid Box	1	3,000	3,000
5	Ear Plugs	1,200	50	60,000
6	Safety Helmets	100	1,000	100,000
7	Safety Jackets (Hi-Vis)	100	500	50,000
Other Safety Measures (B)				
8	Provision of Dust Bins	5	1,000	5,000
9	Warning Tape	5	500	2,500
10	Safety Cones	5	1,000	5,000
11	Safety Sign Boards	5	1,000	5,000
12	Raincoat	50	1,000	50,000
Total Cost (A + B)			765,500	

Time Required for Construction = 18 months

Number of Labor Required for Construction = 100

Personal Protective Equipment PPEs

Dust Mask: 1 Dust Mask to be used in a week by each labourer

Safety Shoes : 1 Safety shoe for twelve months for each labourer

Gloves : A pair of gloves for each labourer for a month

First Aid Box 1 first aid box for every 50 labourers

Ear Plug 1 set of the earplug to be used for 2 months for each labourer
Safety Helmet 1 safety helmet for each labourer for 18 months
Safety Jackets 1 safety Jacket (Hi-Vis) for each labourer for 18 months
Dust Bin : Rough estimate
Water Sprinkling the whole construction period
Rain Coat : 1 Rain Coat for each labourer

(The calculations are made by considering the average number of workers working at a time)

7.10 Traffic Management and Construction Material Transportation Plan

■ Construction Materials Transportation:

- Approved routes for transportation, avoiding peak hours.
- Speed limits enforced within the project site.
- Parking and designated entry/exit points for vehicles.

■ Driver & Operator Requirements:

- Only experienced and licensed drivers/operators will be hired for material transportation and heavy machinery operation.
- Drivers will undergo regular training on road safety, hazard identification, and emergency response.

■ Emergency Preparedness:

- Trained response teams and standby recovery vehicles.
- Emergency contact numbers displayed prominently.

■ Vehicle & Machinery Inspection:

- All heavy machinery and transport vehicles will be inspected regularly for safety compliance.
- Daily vehicle checklists will be maintained to ensure roadworthiness.
- All vehicles must have functioning headlights, taillights, indicators, and reflectors for safe operation.

■ Safety Signage & Warnings:

- Speed limit signboards have been installed at key locations.
- Reflective road signs will be placed at night-time hazard zones.
- Warning lights and reverse alarms will be checked and maintained regularly.

■ Designated Routes & Traffic Markings:

- All internal roads within the project site will be clearly marked and designated.
- Separate lanes for heavy and light vehicles will be established where possible.
- Pedestrian pathways will be designated and secured to prevent accidents.

7.11 Emergency Preparedness, Response and Site Evacuation Plan

■ General Preparedness:

- Development and periodic updating of an Emergency Response Plan (ERP).
- A trained Emergency Response Team (ERT) for handling emergencies.

■ Evacuation Procedures:

- Clearly marked assembly points with access from all site locations.
- Regular site-wide alarm and evacuation drills.

■ Emergency Medical Facilities:

- 24/7 first aid centers and ambulance services.
- Qualified paramedics on-site.

■ Fire Prevention & Response:

- Fire extinguishers and automatic fire suppression systems.
- Fire response training for designated personnel.

- **Environmental Safety Measures:**
 - Dust suppression through water sprinkling.
 - Spill control for hazardous materials.
- **Incident Review & Compliance:**
 - Post-incident investigations for corrective actions.
 - Adherence to international safety standards (ISO 45001, OSHA).
- **Environmental Considerations:**
 - Regular water sprinkling will be carried out on service roads and construction zones to minimize dust pollution.
 - Spill control measures will be in place for handling hazardous materials.
- **Emergency Response Review & Compliance:**
 - Incident investigations will be conducted for every emergency or accident to prevent recurrence.
 - Corrective actions and safety measures will be implemented based on post-incident reports.
 - Compliance with international safety standards (ISO 45001, OSHA guidelines) will be ensured.

7.12 Fire Fighting Plan

- **Fire Safety Equipment & Readiness**
 - The construction site and worker accommodations will be equipped with fire extinguishers, fire hoses, and fire blankets at strategic locations.
 - Fire alarms and smoke detectors will be installed throughout the site, including:
 - Office buildings
 - Worker accommodations
 - Fuel and chemical storage areas
 - Electrical panels and high-risk zones
 - Dedicated fire response teams will be trained to handle different fire situations
- **Emergency Communication & Alarm System**
 - Emergency alarms will be installed across the site, and designated personnel will be responsible for activating them in case of fire.
 - Workers and residents will be trained on the meaning of different alarm signals, as follows:
 - Single 20-second alarm: Minor emergency (alert status, remain cautious).
 - Three 20-second alarms with intervals: Medium to high severity; be ready for evacuation.
 - Continuous 60-second alarm: Severe emergency – Immediate evacuation required.
 - Emergency contact numbers will be displayed at all key locations, including security posts, accommodation areas, and work zones
- 1. **Fire Response & Evacuation Procedures**
 - Evacuation routes will be clearly designated and marked with glow-in-the-dark signage.
 - All workers and camp residents will be trained on emergency evacuation procedures and must follow the assigned escape routes to reach the nearest assembly point.

- A Fire Warden Team will be appointed to assist with safe evacuations and ensure no one is left behind.
 - Drills will be conducted every month to ensure everyone knows their roles in case of a fire emergency.
- 2. Fire Prevention Measures**
- Flammable materials and chemicals will be stored in fireproof, well-ventilated enclosures with proper labeling.
 - No smoking zones will be enforced near fuel storage areas, electrical rooms, and high-risk zones.
 - Electrical equipment and wiring will be inspected regularly to prevent short circuits.
 - Firewatch teams will be deployed during hot work operations (welding, cutting, grinding).
 - Diesel generators and fuel storage tanks will be placed at a safe distance from worker accommodations.
- 3. Training & Awareness Programs**
- Regular fire drills and training sessions will be conducted to ensure all workers and camp residents understand emergency procedures.
 - Specialized fire extinguisher training will be provided for key personnel.
 - Fire prevention and response guidelines will be included in the induction training for all new workers
- 4. Fire Emergency Coordination & Response**
- Dedicated fire emergency response teams will be on standby 24/7.
 - Close coordination will be maintained with local fire brigades, Rescue 1122, and emergency services for immediate assistance.
 - A fully equipped fire truck will be stationed on-site for large-scale fire emergencies (if feasible).
- 5. Compliance & Monitoring**
- Fire safety audits and routine inspections will be conducted to ensure compliance with safety regulations.
 - A fire incident logbook will be maintained for reporting and investigating fire-related incidents.

7.13 Plantation Plan

Introduction

This plantation plan is designed to mitigate environmental impacts associated with the road construction project from Barki Road to Kamahan. The plan is prepared keeping in view the current situation that Conocarpus hedge plants and bougainvillea creepers are present in sufficient quantities along the Nallah banks, providing an aesthetically pleasing view. This plan includes an expanded list of species to improve air quality, enhance the aesthetic appeal of the area, prevent soil erosion, and support biodiversity. The usual purpose of vegetation is to provide ground cover, shade, and aesthetic beauty, but this project prioritizes the establishment of a robust visual barrier to conceal the drain. Additionally, the inclusion of fragrant flowering plants is essential to mitigate and potentially suppress the drain's foul. The objectives for this plan are devised accordingly and are given below;

Objectives

- To create visual barrier to conceal the drain and assure scenic beauty.
- To mitigate and suppress the drain's foul.
- Improve air quality by absorbing pollutants and providing oxygen.
- Reduce the urban heat island effect by increasing green cover.
- Strengthen embankments to prevent soil erosion and flooding.
- Promote biodiversity through the planting of diverse native species.
- Provide shade along the road.
- Encourage community participation in environmental conservation

Plantation Zones

Ratio of unpaved area is very less in the project because of its nature. The project area is mainly distributed among paved surface of road and right of way of trunk sewer. The areas available for plantation are in the shape of narrow strips. In addition to these strips, plantation will also be carried out in the form of planters placed on suitable paved areas without distracting traffic flow. Plantation will be carried out in the following key areas:

- **Roadside Margins:** Large shade trees at 3–5-meter intervals.
- **Medians:** Smaller, decorative trees and shrubs.
- **Embankments:** Deep-rooted trees and erosion-control vegetation.
- **Public Spaces & Junctions:** Flowering trees and bushes for visual appeal.
- **Planters placed on paved areas;** large, medium and small planters

Selection of Tree Species

The species have been carefully selected based on their suitability for the local climate, low maintenance needs, high pollution absorption, and resilience.

A. Large Shade Trees (For Roadside & Embankments)

1. *Neem (Azadirachta indica)* – Air purification, medicinal benefits.
2. *Sukh Chain (Pongamia pinnata)* – Drought-resistant, shade provider.
3. *Peepal (Ficus religiosa)* – High oxygen release, cultural significance.
4. *Banyan (Ficus benghalensis)* – Long lifespan, excellent shade.
5. *Siris (Albizia lebbek)* – Fast-growing, pollution control.
6. *Sheesham (Dalbergia sissoo)* – Strong, wind-resistant, good for soil stability.
7. *Arjun (Terminalia arjuna)* – Improves soil health, medicinal properties.
8. *Kurrajong (Brachychiton paulinum)*
9. *Eucalyptus (Eucalyptus camaldulensis)* – Fast-growing, high carbon absorption.

B. Flowering & Ornamental Trees (For Medians & Junctions)

1. *Gulmohar (Delonix regia)* – Bright red flowers, aesthetic appeal.
2. *Jacaranda (Jacaranda mimosifolia)* – Purple flowers, enhances landscape.
3. *Amaltas (Cassia fistula)* – Yellow flowering, heat-tolerant.
4. *Kachnar (Bauhinia variegata)* – Pink flowers, urban landscaping.
5. *Bottlebrush (Callistemon citrinus)* – Red cylindrical flowers, attracts birds.
6. *Silk Cotton Tree (Bombax ceiba)* – Large red flowers, fast-growing.
7. *Golden Shower Tree (Cassia nodosa)* – Beautiful pink and yellow flowers.

C. Fruit-Bearing Trees (For Community Benefits & Biodiversity)

1. *Mango (Mangifera indica)* – Provides shade and economic benefits.
2. *Jamun (Syzygium cumini)* – Hardy, air-purifying properties.
3. *Guava (Psidium guajava)* – Pollution-resistant, attracts pollinators.

4. *Pomegranate (Punica granatum)* – Drought-resistant, medicinal value.
5. *Ber (Indian Jujube) (Ziziphus mauritiana)* – Hardy, useful for local communities.
6. *Chikoo (Sapodilla) (Manilkara zapota)* – Low maintenance, rich canopy.

D. Shrubs & Bushes (For Soil Conservation & Landscaping)

1. *Bougainvillea (Bougainvillea spp.)* – Low maintenance, vibrant colors.
2. *Railway Hedge Plant (Ipomea cornia)* – Aromatic, natural insect repellent.
3. *Moringa (Moringa oleifera)* – Fast-growing, medicinal use.
4. *Jasmine (Jasminum officinale)* – Fragrant, enhances biodiversity.
5. *Lantana (Lantana camara)* – Attracts butterflies, resilient.
6. *Hibiscus (Hibiscus rosa-sinensis)* – Pollinator-friendly, ornamental value.
7. *Aloe Vera (Aloe barbadensis miller)* – Drought-tolerant, medicinal.
8. *Rosemary (Salvia rosmarinus)* – Aromatic, natural insect repellent.

E. Grass & Ground Cover (For Erosion Control)

1. *Vetiver Grass (Chrysopogon zizanioides)* – Strong root system, prevents soil erosion.
2. *Lemon Grass (Cymbopogon citratus)* – Fragrant, insect-repellent.
3. *Creeping Fig (Ficus pumila)* – Ground cover, binds soil effectively.
4. *Periwinkle (Catharanthus roseus)* – Medicinal, drought-resistant.
5. *Dichondra (Dichondra repens)* – Fast-spreading, prevents soil displacement.

F. Plants for Planters in Paved Areas

1. **Small Ornamental Trees (For Large Planters)** - Ideal for roadside aesthetics shade, and air purification.
 - **Plumeria (Frangipani) –Plumeria rubra** → Fragrant flowers, drought-tolerant.
 - **Indian Lilac (Pride of India) –Lagerstroemia indica** → Beautiful purple/pink flowers.
 - **Silver Oak –Grevillea robusta** → Tall, elegant, pollution-resistant.
 - **Chinese Fan Palm –Livistona chinensis** → Thrives in pots, adds tropical greenery.
2. **Flowering Shrubs (For Medium Planters) - Provide seasonal color and require minimal care**
 - **Bougainvillea –Bougainvillea glabra** → Hardy, vibrant pink/purple/orange flowers.
 - **Ixora –Ixora coccinea** → Clusters of red, orange, and yellow flowers.
 - **Hibiscus –Hibiscus rosa-sinensis** → Large, showy flowers, attracts pollinators.
 - **Jasmine –Jasminum sambac** → Fragrant white flowers, air-purifying.
3. **Drought-Resistant Foliage Plants (For Urban Heat Resistance) - Enhance greenery without frequent watering needs.**
 - Snake Plant –**Sansevieria trifasciata** → Absorbs toxins, thrives in harsh conditions.
 - ZZ Plant –**Zamioculcas zamiifolia** → Low maintenance, perfect for urban areas.
 - Dwarf Date Palm –**Phoenix roebelenii** → Compact palm, thrives in planters.

- Croton –*Codiaeum variegatum* → Brightly colored foliage, adds contrast.
- Aloe Vera –*Aloe barbadensis* → Medicinal, air-purifying.
- Agave –*Agave americana* → Large, sculptural, drought-resistant.
- ****Sedum (Stonecrop) –*Sedum spp.* ****→ Spreads across planters, reduces heat.
- Portulaca (Moss Rose) –*Portulaca grandiflora* → Colorful, grows in poor soil.

Plantation Methodology

- **Soil Preparation & Planting**
 - **Tree Pits:** 3ft x 3ft x 3ft holes filled with compost, organic manure, and soil mix.
 - **Spacing:**
 - **Large trees:** 3–5 meters apart.
 - **Shrubs:** 2 meters apart.
 - **Ground cover:** Dense planting for maximum erosion control.
- **Watering Regime:**
 - First 6 months: Twice weekly.
 - After establishment: Weekly, reduced gradually.
- **Fertilization:** Organic compost every 3 months.

Maintenance Plan

- **Weeding & Mulching:** Biannual weeding and organic mulching.
- **Pruning & Disease Control:** Regular monitoring for pest attacks and deadwood removal.
- **Survival Rate Monitoring:** Replacement of dead plants to ensure at least 80% survival.
- **Protection Measures:** Use of tree guards and fencing for vulnerable areas.

Monitoring & Reporting

- **Quarterly Assessments:** Evaluation of tree growth and survival rate.
- **Biodiversity Survey:** Monitoring of bird and insect species attracted to the new green spaces.
- **Community Involvement:** Local awareness programs to engage schools and residents.

7.13.1 Plantation Plan Cost

The following cost estimation has been prepared for the plantation plan along the Charar Drain. This detailed breakdown covers the expenses associated with acquiring and planting tree saplings, shrubs, and ground covers, as well as the necessary soil preparation, labor, and planters. The aim is to enhance the ecological value, beautify the area, and promote a healthier environment around the Charar Drain.

Table 7.3 Estimated Cost of Plantation

Component	Unit Cost (PKR)	Quantity	Total Cost (PKR)		Quantity	Total Cost (PKR)
Tree Saplings (Large Trees)	500/tree	3,000	1,500,000		1500	750,000

Shrubs & Bushes	200/shrub	7,500	1,500,000		750	150000
Ground Cover (Grass, Creepers)	50/m ²	30,000	1,500,000		3000	150000
Soil Preparation (Pit Digging, Fertilizer, Mulching)	300/tree	3,000	900,000		300	90000
Shrub Preparation	150/shrub	7,500	1,125,000		750	112500
Grass Preparation	20/m ²	30,000	600,000		3000	60000
Labor for Plantation	500/tree	3,000	1,500,000		300	150000
Labor for Shrubs	250/shrub	7,500	1,875,000		750	187500
Cost of Planters	15000/Planter				20	300000
Total						1950000

The estimated total cost for implementing this plantation plan is PKR 1,950,000. The project falls under the jurisdiction of two administrative institutions. The portion from Barki Road to Badian Road lies within the territory of the Lahore Cantonment Board, while the section from Badian Road to Azam Chowk falls under the executive control of Walton Cantonment. After the first year of implementation, each respective authority will assume responsibility for maintaining and nurturing the plants within their designated areas to ensure the project's sustainability.

The estimated total cost for implementing this plantation plan is PKR 1,950,000. By investing in this initiative, the Charar Drain area will not only gain aesthetic and environmental benefits but also contribute to reducing pollution and improving the overall quality of life for the community. Continued collaboration between the Lahore Cantonment Board and Walton Cantonment, along with community involvement, will be essential for the long-term success of this plantation project.

7.14 Restoration and Rehabilitation Plan

Restoration of the project site, including access roads, contractor camps, and construction areas, is crucial to ensure minimal long-term environmental impact. Improper waste disposal and site neglect can lead to soil degradation, water contamination, and habitat destruction. The following measures will be adopted to ensure effective site restoration and rehabilitation:

Demobilization of Equipment and Machinery:

- All construction machinery, vehicles, and temporary structures will be removed from the site after completion of work.
- Any hazardous materials (fuels, lubricants, chemicals) will be safely transported off-site following environmental regulations.

Waste Management and Disposal:

- All construction and demolition waste will be segregated and disposed of according to Environmental Impact Assessment (EIA) guidelines.
- Recyclable materials (e.g., metal, wood, plastic) will be handed over to designated recycling facilities.
- Non-recyclable and hazardous waste will be disposed of at authorized landfill sites.

Sanitation Facilities Restoration:

- Temporary sanitation units, including septic tanks and soakage pits, will be properly dismantled and decontaminated before removal.
- Any residual sludge will be treated according to environmental safety standards before disposal.

Dismantling of Temporary Structures:

- All temporary concrete structures (e.g., worker camps, storage units) will be demolished, and reusable material will be transferred to Military Cantonment Quarters (MCQ) for reuse or safe disposal.
- Foundations will be removed, and the area will be leveled and compacted to match the natural terrain.

Backfilling and Land Restoration:

- Unnecessary pits, borrow areas, and excavations will be backfilled using suitable soil material to restore the land to its natural topography.
- Erosion-prone areas will be stabilized using appropriate soil compaction techniques and bioengineering measures.

Revegetation and Landscaping:

- Native vegetation will be replanted in disturbed areas to restore ecological balance and prevent soil erosion.
- Trees, shrubs, and grasses from the Plantation Plan will be introduced in restored zones to enhance green cover and biodiversity.

Site Inspection and Compliance Verification:

- A post-construction environmental audit will be conducted to ensure compliance with restoration commitments.
- Any remaining construction residue or site damage will be addressed before the final site handover.

By implementing these measures, the environmental integrity of the project area will be preserved, ensuring a sustainable post-construction landscape.

Rehabilitation of Construction Camps

After the completion of the construction phase, proper rehabilitation of construction camps is essential to restore the site to its original or improved condition. The following rehabilitation measures should be implemented:

- **Site Clearance and Waste Removal:**
 - Dismantle all temporary structures, including worker accommodation, storage areas, and machinery.
 - Remove construction debris, solid waste, and any hazardous materials from the site.
 - Properly dispose of waste at approved landfill sites or designated waste disposal areas.
- **Soil Restoration:**
 - Decompact the soil in areas where heavy machinery was used.
 - Restore the soil's natural texture and fertility by adding topsoil and organic matter.
 - Avoid further erosion by stabilizing the soil using mulch or vegetation.
- **Vegetation Restoration:**

- Replant native vegetation and trees to restore the natural landscape.
- Use appropriate plant species that are well-suited to the local environment.
- Monitor vegetation growth periodically and replace damaged or dead plants.
- **Water Resource Management:**
 - Remove temporary drainage systems or sediment traps that were installed during construction.
 - Restore any disrupted natural water channels to prevent waterlogging.
 - Ensure no remaining contaminants can affect nearby water bodies.
- **Community Engagement:**
 - Inform the local community about the rehabilitation process and involve them in monitoring efforts.
 - Address any concerns raised by the community during the rehabilitation phase.
- **Post-Rehabilitation Monitoring:**

Regular monitoring for a defined period to ensure that the site remains stable and free from environmental hazards.

If necessary, take corrective measures to address any residual impacts.

7.15 Project Monitoring

The Lahore Cantonment Board (LCB) will ensure the monitoring of key environmental and social indicators during both the construction and operational phases of the project. Key aspects to be monitored include:

Tree plantation and removal: Number of trees planted and cut as part of the project.

Water usage: Quantity of water utilized for construction and plantation.

Waste management: Record of waste generation, disposal, and recycling.

Air and noise pollution: Monitoring vehicular emissions and noise levels.

Traffic flow and safety: Record of construction-related traffic movement.

The Project Director of LCB will oversee project activities in the designated areas. The Project Director will:

- Document and report all non-conformance observed during monitoring.
- Recommend corrective actions to mitigate environmental and social impacts.
- Ensure compliance with the Environmental Impact Assessment (EIA) and Punjab Environmental Quality Standards (PEQS).

7.16 Environmental Monitoring and Management Plan

Environmental monitoring will be conducted during both the construction and operational phases to ensure the effectiveness of mitigation measures.

The objectives of the monitoring plan include:

- Evaluating the effectiveness of mitigation measures implemented.
- Identifying and responding to unanticipated environmental impacts.
- Establishing a data-driven approach to improve environmental management.
- Ensuring compliance with Environment Protection & Climate Change Department (EP & CCD) and Punjab Environmental Quality Standards (PEQS).

The following Environmental Monitoring and Management Plan will be implemented for the Barki Road to Kamahan Road Project:

Table 7.4 EMMP Plan for construction of a Road Along Charrar Drain (15 kms) From Burki Road to Kamahan Road, Lahore

Environmental Component	Project Phase	Parameters	Locations	Frequency	Standards	Implementing Agency	Supervision
Air Quality Monitoring	Construction	SO ₂ , NO _x , CO, PM ₁₀ , PM _{2.5} , Pb, O ₃	Project site and surrounding communities	Monthly	PEQS	Contractor	Lahore Cantonment Board (LCB)
Water Quality Monitoring	Construction	pH, TDS, TSS, BOD, COD, DO, hydrocarbon, coliforms, nitrates, chloride, sulphates	At key construction sites and groundwater sources	Quarterly	PEQS	Contractor	LCB
Noise Levels	Construction	dB(A)	At construction sites and nearby residential areas	Quarterly, at selected sites during peak and non-peak hours	PEQS	Contractor	LCB
Tree Plantation and Survival Rate	Construction & Operational	Visual inspection of tree growth and health	At plantation sites along roadsides and medians	(1) Monthly for the first 6 months, (2) 1 year after plantation, (3) 2.5 years after plantation	80% survival rate	Contractor	LCB
Tree Cutting and Compensation	Construction	Record of trees removed and replanted	Throughout the project site	Before and after tree removal decisions	EIA requirements	Construction Team	LCB
Solid Waste Management	Construction	Segregation and disposal of construction waste	At construction sites and	Monthly audit	EIA guidelines	Contractor	LCB

			temporary storage areas				
Vehicular Traffic and Road Safety Compliance	Construction & Operational	Overloaded and high-speed vehicles, inspection of signage and safety compliance	Project route with focus on accident-prone areas	Quarterly for 2 years	National Highway & Traffic Safety Standards	Project Manager	LCB
Wastewater and Drainage Management	Operational	PEQS parameters for liquid effluents	Designated drainage points and treatment facilities	Monthly	PEQS	Project Manager	LCB
Soil Erosion and Embankment Stability	Operational	Visual assessment of erosion-prone areas	Embankments along the road	Bi-annually	ESIA requirements	Contractor	LCB
Public Complaints and Grievance Monitoring	Operational	Record of complaints and resolutions	Throughout project-affected communities	Continuous monitoring	Stakeholder engagement plan	Project Management Team	LCB

Key:

db = decibels (measured in the audible range)
PEQS = Punjab Environmental Quality Standards
ROW = Right-of-Way
TSS = Total Suspended Solids

EP & CCD = Environment Protection and Climate Change Department,
PM10 = Particulate Matter smaller than about 10 micrometers,
SPM = Suspended Particulate Matter

The estimated cost for the environmental monitoring of the project during construction phase is shown in Table 7.5.

Table 7.5 Cost Estimates for Environmental Monitoring During the Construction Phase

Activity	No. of Samples / Months	Unit Cost (PKR)	Total Cost (PKR)
Construction Phase (18 Months)			
Ambient Air Quality Monitoring (Quarterly)	6	@ 30,000 per sample	180,000
Ambient Water Quality Monitoring (Quarterly)	12	@ 15,000 per sample	180,000
Noise Level Monitoring (Quarterly)	18	@ 1,000 per sample	18,000
Environmental, Health & Safety (EHS) Specialist	18 months	@ 50,000 per month	900,000
Sub-Total (Construction Phase)		1,278,000	

Source: Estimates, 2025

7.17 Training Program

Training programs are an essential component of the Environmental Monitoring & Management Plan (EMMP). These training sessions will ensure that all project personnel understand and comply with the Environmental & Social Management Plan (ESMP) throughout the project lifecycle.

The Environment, Health & Safety (EHS) Officer will be responsible for delivering training to the contractor's staff, while Supervision and Design Management Teams will oversee the implementation of training across all project phases.

Objectives of the Training Program

The primary goal of the training program is to:

- Ensure that ESMP requirements are understood and consistently implemented.
- Equip staff with technical knowledge and safety procedures.
- Improve environmental protection and minimize ecological impact.
- Enhance worker safety, compliance, and site sustainability.

Key Areas Covered in Training Sessions

The training program will include the following topics:

1. **Environmental Sensitivity of the Project Area**
 - Importance of roadside green belts, water bodies, and wildlife protection.
 - Mitigation of environmental disturbance and pollution.
2. **EMMP Communication and Documentation Requirements**
 - Proper record-keeping of environmental incidents and safety reports.
 - Reporting procedures for non-compliance and environmental concerns.
3. **Vegetation and Community Issues & Their Mitigation Measures**
 - Preservation of existing trees and green areas.
 - Managing community engagement and resolving grievances.

4. **Safe Construction Practices**
 - Hazard-resistant construction techniques.
 - Emergency response protocols in case of workplace accidents.
5. **Use of Personal Protective Equipment (PPEs)**
 - Correct use of helmets, gloves, safety harnesses, and eye protection.
 - Ensuring compliance with occupational safety standards.
6. **Environmentally Sound Construction Practices**
 - Minimizing dust, noise, and emissions during construction.
 - Proper storage and handling of construction materials.
7. **Vehicular Safety & Traffic Management**
 - Training for drivers and equipment operators on speed limits and road safety.
 - Accident prevention measures at construction zones.
8. **Site Restoration Requirements**
 - Post-construction land rehabilitation and landscaping.
 - Proper disposal of construction debris and waste materials.
9. **Solid Waste Management & Disposal**
 - Segregation of hazardous and non-hazardous waste.
 - Proper disposal techniques following EMMP and local regulations
10. **Training Implementation & Budget**
 - Training will be conducted before project commencement and refresher training will be held every 6 months during construction.
 - Training will be delivered by the EHS Officer with support from external experts for specialized topics.
 - A lump-sum budget of Rs. 300,000/- will be allocated for training management, covering:
 - Training materials (guidelines, handbooks, posters).
 - Venue and logistics arrangements.
 - Expert trainer fees (if required).

Framework for the environmental monitoring and management training program is being provided in **Table 7.6**

Table 7.6 Framework for Environmental Monitoring & Management Training Program

Type of Training	Training Description	Period	Duration	Training By	Trainees
Occupational Health and Safety (OHS) for Staff	Training on workplace safety, hazard identification, emergency response, and compliance with safety codes.	Before commencement of construction activities	Full day	External Safety Experts	EHS Manager, Site Supervisors, Engineers
Environmental Monitoring & Management Laws, Regulations, and Guidelines	Overview of national environmental laws, labor laws, PEQS compliance, and best international practices.	Before commencement of project activities	Full day	External Legal & Environmental Consultants	EHS Staff, Site Supervisors, Engineers
Occupational Health & Safety (OHS) for Workers	Training in workplace hygiene, Personal Protective Equipment (PPE) usage, first aid, and confined space work safety.	Before construction activities begin	Full day	EHS Manager	Construction Workers, Laborers
Solid Waste Management (SWM)	Training on waste segregation, hazardous waste identification, PPE usage for waste handling, and disposal compliance.	Before commencement of project activities	Half day	Waste Management Experts	Relevant workers and site staff
Vehicular Safety & Traffic Management	Safe operation and maintenance of vehicles, compliance with traffic laws, accident prevention.	Before commencement of construction activities	Half day	Traffic Safety Experts	Drivers, Equipment Operators, Project Staff
Biodiversity & Community Relations	Understanding community concerns, vegetation impact, and mitigation strategies for agricultural and green areas.	Before project initiation	Half day	Environmental & Social Experts	EHS Staff, Site Supervisors, Community Liaison Officers
Safe Construction Practices	Training on quality construction, hazard-resistant techniques, and skill-building for local workers.	Before commencement of construction activities	Full day	Civil Engineering Experts	Skilled and Unskilled Workers

Health, Safety, and Environmental (HSE) Auditing	Conducting HSE audits, monitoring compliance, and reporting environmental non-conformance.	Before construction starts	Full day	External HSE Auditors	EHS Staff, Project Managers
Implementation of Environmental Management & Monitoring Plan	Explanation of project-specific Environmental Management and Monitoring Plan (EMMP), compliance requirements, and corrective actions.	Quarterly (once project activities begin)	Full day	Environmental Consultants	EHS Staff, Site Supervisors, Engineers

7.18 Environmental Monitoring & Mitigation Cost

The cost required to implement the mitigation measures effectively is important for the sustainability of the project both in the construction and operational phases of the project. The summary of the cost of monitoring the environment and mitigation cost is shown in Table 7.7

Table 7.7 Summary of Environmental Monitoring & Management Mitigation-Monitoring Cost

Activity	Basis	Cost (Rs)
Environmental Monitoring Cost	Ambient Air, Noise and Water Quality Monitoring & Cost of Hiring Environmental Engineer for 36 Months	1,278,000
Plantation Plan	Implementation of plantation plan	1,950,000
Health & Safety of Workers	For 100 Employees for the provision of dust masks, safety shoes, gloves, first aid box, ear plugs, safety helmets and safety jackets (Hi-Vis) and Provision of dustbins, warning tap, safety cones, safety signboards and water sprinkling	765,500
Cost of Environmental Training	For the whole construction period	300,000
Grand Total		4,293,500

7.19 Communication and Documentation

An effective program for storing and communicating environmental information during the project is an essential requirement of an EMMP. This activity will be done by an independent monitoring consultant. The key features of such a mechanism are:

- Precise recording and maintenance of all information generated during the monitoring in a predetermined format.
- Communicating the information to a central location
- Storing the raw information in a central database
- Processing the information to produce periodic reports

Data recording and maintenance: All forms will be numbered, and a tracking system will be developed for each. Whenever a form is released for use in the field, its number will be recorded. The monitors will be required to account for each form after completion. In this manner, it will be ensured that all forms are returned to the office, be they filled, unused or discarded.

Storage of information: A database for information collected during the project will be prepared. The database may include information on training programs, staff deployment, non-compliance, corrective actions, water resources, results of effects monitoring.

Meeting: For effective monitoring, management and documentation, of the environmental performance during the operation, environmental matters will be discussed

during a daily meeting held on-site. Environmental concerns raised during the meetings will be mitigated after discussions with the proponent site representatives.

Reporting: Monitoring body will produce daily, weekly, monthly and another periodic report, as well as a final report of the project based on the information collected. The proponent site representative and the contractors will also prepare a weekly environmental report. Copies of the proponent will be provided to the proponent and contractor's higher management.

7.20 Post Project Monitoring

The Project Director of the Lahore Cantonment Board or his representative shall prepare a brief post-project report describing the conduct of the actual operation, any changes from the operation for which approval was obtained, the degree to which the recommendations of the EIA were adhered to, any damages to the environment and the mitigation or compensation provided and monitoring information of scientific or environmental interest that is not propriety in nature. This report should be submitted to the Punjab Environment Protection and Climate Change Department (EP & CCD)

Chapter 8: Stakeholder Consultations

8.1 Introduction

The consultation process for the Charrar Drain Road Improvement Project was conducted to engage the local community, key stakeholders, and relevant authorities to assess their perspectives, concerns, and suggestions regarding the proposed infrastructure development. The project aims to enhance transportation efficiency, promote economic development, and improve environmental sustainability while addressing safety concerns.

The consultation was designed to ensure inclusivity, transparency, and participation, gathering input from diverse groups, including residents, business owners, transportation service providers, and local government representatives

8.2 Public Consultation

Public Participation is a mandatory requirement of the Environmental Impact Assessment exercise under Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulation 2022. The public consultation & participation process provides an opportunity for those directly & indirectly affected by the project to express their concerns during the feasibility phase before the finalization of the project design. It aims to ensure that the EIA process is transparent and robust and enables sustainability in the design, implementation, operation & management of development projects.

The proposed project will create both positive and negative impacts in the project area that may affect the local population and other stakeholders both directly and indirectly. Therefore, public consultation with the community and stakeholder meetings were carried out. Different aspects and impacts of the proposed project were highlighted regarding their impacts on the physical, biological, and socio-economic environment of the project area.

8.3 Objectives of Consultation

The primary objectives of the stakeholder and public consultation were:

To inform the community and stakeholders about the project scope, objectives, and expected benefits.

- To assess the socio-economic and environmental concerns of the affected populations.
- To gather recommendations to improve project planning and execution.
- To identify potential risks and mitigation measures.
- To ensure that all voices, particularly vulnerable groups, are heard and considered.

8.4 Methodology

The consultation was conducted through

- Roadside Interviews with residents, business owners, transport operators, business owners and commuters.
- Public Meetings with local government representatives and community elders.
- Questionnaire Surveys collect data on socio-economic perceptions.

- Environmental Impact Assessment Feedback to address concerns about sustainability and mitigation measures

8.5 Stakeholders Identification

The following stakeholders were identified and consulted

Primary Stakeholders

1. **Local Residents:** Individuals living in the areas adjacent to the road project, including villages such as Malikpur, Sajpal, Baowala, Chungh, and Alfalah Town.
2. **Business Owners:** Small and medium-sized enterprises along the project route.
3. **Transport Operators:** Public and private transport drivers, including buses and rickshaws.
4. **Landowners:** Property owners who may be affected by the road expansion.
5. **Commuters:** Daily road users who rely on the route for work, education, and other activities.

Secondary Stakeholders

1. **Lahore Cantonment Board (LCB):** Responsible for executing the project.
2. **Ministry of Defense:** Overseeing infrastructure development in the cantonment area.
3. **Local Government Representatives:** Union council and district government officials.
4. **Environmental and Social Experts:** Consultants assessing the project's impact.
5. **Educational Institutions:** Schools and universities (e.g., LUMS, LGS) near the project area.
6. **Non-Governmental Organizations (NGOs):** Working in urban development and environmental conservation.

8.6 Issues Discussed

Following issues were discussed during the stakeholder consultation. Performa used for stakeholder's consultation is attached at Annexure - while list of respondents is attached at Annexure -

- Overall activities of the project and their possible impacts;
- Possible impacts on natural vegetation, flora and fauna;
- Possible mitigation measures and
- Beneficial factors and involvement opportunities for the local people in the set of activities of Project.

8.7 Key Findings from Public Consultation

Socio-Economic Impacts

- **Improved Property Values:** A significant number of respondents believe that the road improvement will increase land and property values in adjacent areas.
- **Economic Opportunities:** Business owners expect higher customer traffic, while some foresee new commercial activities emerging along the improved road.
- **Job Creation:** The construction phase is expected to create temporary employment opportunities, while improved connectivity may lead to long-term economic benefits.

Transportation & Accessibility

- Reduced Travel Time: Commuters anticipate a 30-50% decrease in travel time due to smoother roads and improved connectivity between key locations such as Barki, Eden City, DHA, and Bedian Road.
- Better Public Transport Access: Rickshaw and bus drivers highlighted that road rehabilitation will allow easier and safer vehicle movement, reducing maintenance costs and improving passenger comfort.
- Improved Safety: Pedestrians and cyclists noted that proper road markings and pedestrian walkways should be included to enhance safety.

Social & Community Well-being

- Better Access to Services: The project will improve accessibility to schools, hospitals, and markets, benefiting women, children, and the elderly.
- Community Integration: Residents anticipate stronger social connections due to easier mobility between villages and urban centers.
- Concerns About Displacement: Some landowners worry about partial land acquisition for road widening, requesting fair compensation and relocation assistance.

Environmental Concerns

- Dust & Air Pollution: Construction activities may cause temporary air pollution, affecting nearby homes, schools, and businesses.
- Drainage & Flooding Issues: Stakeholders emphasized the need for a proper drainage system to prevent waterlogging, particularly in Chung and Baowala villages.
- Noise Pollution: Concerns were raised about potential high noise levels during construction, particularly near residential areas and schools.
- Greenery & Aesthetics: Some participants suggested planting trees along the roads to reduce heat impact and improve aesthetics.

8.8 Stakeholder Recommendations

The consultation process generated several recommendations for project improvement:

Engineering & Design Recommendations

- Ensure durable road materials are used to minimize frequent repairs.
- Include dedicated pedestrian paths and cycle lanes to promote non-motorized transport.
- Install adequate street lighting to enhance nighttime safety.
- Implement a speed management system (speed breakers, traffic signals) in populated areas.

Economic & Social Recommendations

- Provide local employment opportunities, prioritizing labor from affected communities.
- Develop commercial zones along the new road to attract businesses and investments.
- Ensure transparent compensation for landowners in case of displacement.

Environmental & Safety Recommendations

- Implement dust control measures (e.g., water sprinkling, dust barriers) during construction.
- Adopt noise reduction techniques such as sound barriers near schools and hospitals.
- Strengthen the drainage system to prevent water accumulation and flooding.
- Launch a community awareness campaign on road safety and project benefits.

8.9 Conclusion

The public and stakeholder consultation process revealed strong support for the Charrar Drain Road Improvement Project, with high expectations for enhanced transportation, economic growth, and social development. However, concerns regarding environmental impact, land acquisition, and construction-related disruptions must be addressed.

By incorporating stakeholder feedback, the project can maximize its positive socio-economic outcomes while minimizing risks, ensuring a sustainable and community-friendly infrastructure development.

Stakeholder consultation table for the Charrar Drain Road Improvement Project based on the previously provided socio-economic assessment and environmental concerns.

Table 8.1: Stakeholders Opinions/Concerns/Issues/Suggestions

Name & Designation	Stakeholder Organization	Opinions/Concerns/Issues/Suggestions
Dy Director Engineering (LCB) – Engr. Adnan Aslam	Lahore Cantonment Board (LCB)	<ul style="list-style-type: none"> - Strong support for the project to enhance urban mobility. -Regular monitoring of construction progress required. - Adequate drainage system should be ensured to prevent waterlogging
Dy Director Environment – Mr Noor Ahmad	Environmental Protection & Climate Change Department (EP & CCD), Punjab	<ul style="list-style-type: none"> - Concerned about dust and noise pollution during construction. - Suggests incorporating green infrastructure to reduce environmental impact. - Strict adherence to environmental regulations is necessary.
Transportation Engineer – Dr Farukh Baig	University of Management & Technology (UMT), Lahore	<ul style="list-style-type: none"> - Traffic congestion mitigation plans needed during construction. - Proper signage and speed control measures should be installed. - Dedicated pedestrian and cycling lanes should be included
Urban Planner - Muhammad Zubair	Urban Scapers Pvt. Ltd	<ul style="list-style-type: none"> - project will enhance urban living standards for the residents of neighboring communities - very vital project to improve traffic management
Community Representative - Mr Muhammad Pervaiz	Owner of Packages' Industry Along charrar Darain Azam Chowk,	<ul style="list-style-type: none"> - Concerns about temporary road closures and accessibility issues. - Expect better transportation facilities after completion. - Compensation should be provided if any land is acquired.
Local Business Owner	Roadside Shopkeepers & Market Owners	<ul style="list-style-type: none"> - Expect increased customer traffic post-construction. - Temporary disruptions may affect business during construction. - Proper planning should minimize economic losses
Environmental Practitioner – Mr Muhammad Iqbal	Environmentalist	<ul style="list-style-type: none"> - Suggests planting native trees along the road to improve air quality. - Road development should not disrupt local ecosystems.
Public Transport Association Representative	Transport Unions (Bus & Rickshaw Drivers)	<ul style="list-style-type: none"> - Anticipate improved road conditions and reduced vehicle maintenance costs. - Temporary alternative routes should be designated during construction.
Education Sector Representative – Mr Waqar Mezhar, Mr Hassan Raza	Schools & Universities (LUMS, LGS)	<ul style="list-style-type: none"> - Need safer pedestrian crossings near schools. - Noise pollution should be minimized during class hours
Local Doctor	Medial Practitioner	<ul style="list-style-type: none"> - Dust and air pollution control measures should be placed to protect public health. - Improved road access will benefit emergency medical response times.

Local Government Official	Union Council Representatives	- Supports the project for regional economic benefits. - Requests inclusion of streetlights and pedestrian-friendly features.
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Chapter 9: Grievance Redress Mechanism

9.1 General

A Grievance Redress Mechanism (GRM) is an essential component of the Environmental Monitoring & Management Plan (EMMP) to address concerns raised by local communities, workers, and stakeholders regarding project-related impacts. This mechanism ensures that grievances are received, assessed, and resolved transparently and efficiently to promote community engagement and minimize conflicts.

The GRM for the Barki Road to Kamahan Road Project will provide an accessible, fair, and transparent platform for affected individuals or groups to lodge complaints related to environmental, social, and safety concerns.

9.2 Objectives of Grievance Redressal Mechanism

The key objectives of the GRM are to:

- Provide a formal process for affected people to report complaints.
- Ensure timely and effective resolution of grievances.
- Foster trust and communication between stakeholders and the project team.
- Minimize project delays by addressing issues proactively.
- Ensure compliance with national and international environmental and social safeguard requirements.

9.3 Scope of the GRM

The **GRM will cover grievances** related to:

- Environmental Impacts (air pollution, noise, water contamination, solid waste).
- Land & Property Issues (encroachment, damage to structures, compensation).
- Health & Safety Concerns (occupational hazards, accidents, lack of PPE).
- Labor & Employment Issues (working conditions, wages, discrimination).
- Community Concerns (road safety, access issues, disturbances).
- Any Other Social or Environmental Concern arising from project activities.

9.4 Grievance Redress Process

Grievance Registration

Any affected person (resident, worker, or stakeholder) can submit a grievance through multiple channels:

- Written Complaint (at the project office or local administration office).
- Verbal Complaint (recorded by the project grievance officer).
- Online Form/Email Submission (through the project's official website or email).
- Phone Hotline (dedicated grievance contact number).
- Community Meetings & Feedback Boxes (set up in key locations along the project route).

All grievances will be recorded in a Grievance Logbook, including:

- Name and contact details of the complainant (if not anonymous).
- Description of the grievance.
- Date, time, and location of the incident.
- Initial assessment and action taken.

9.5 Grievance Assessment & Resolution

Once a grievance is received, it will follow the structured process below:

Table 9.1: Steps of Grievance Redressal Mechanism

Step	Action	Timeline
Step 1: Acknowledgment	The grievance will be acknowledged in writing or verbally.	Within 3 working days
Step 2: Initial Assessment	The grievance will be reviewed, and if necessary, an investigation will be conducted.	Within 7 working days
Step 3: Resolution Proposal	A response or corrective action will be proposed and discussed with the complainant.	Within 15 working days
Step 4: Implementation of Resolution	Agreed action will be implemented, and the complainant will be informed.	Within 30 working days
Step 5: Monitoring & Follow-up	The grievance redress team will ensure the effectiveness of the resolution and close the case.	Ongoing

If the complainant is not satisfied, the case will be escalated to higher authorities or legal mediation.

9.6 Grievance Redress Committee (GRC)

A Grievance Redress Committee (GRC) will be established to oversee grievance resolution. The GRC will include:

- Project Manager (LCB Representative) – Chairperson.
- Environmental & Social Specialist – GRM Coordinator.
- Community Representative – Ensuring local concerns are addressed.
- Contractor Representative – Responsible for on-site grievance resolution.
- Labor Representative – Addressing worker-related grievances.

The GRC will meet monthly to review and resolve pending grievances.

9.7 Monitoring, Reporting & Transparency

- All grievances will be documented in a central Grievance Log. Monthly grievance reports will be submitted to the Lahore Cantonment Board (LCB) for review.
- Quarterly public grievance reports will be shared with stakeholders to ensure transparency.

9.8 Appeal Mechanism

If a complainant is **not satisfied** with the resolution, they can:

- Request further review from the GRC.
- Escalate the grievance to the Lahore Cantonment Board (LCB).
- Seek mediation through legal authorities if necessary.

This ensures fairness and accessibility for all affected stakeholders.

9.9 Conclusion

The Grievance Redress Mechanism (GRM) will serve as an effective tool to address environmental and social concerns, ensuring that project-related issues are resolved in a timely, transparent, and inclusive manner. By providing a structured grievance process, this mechanism will help in maintaining community trust, ensuring compliance, and minimizing conflicts throughout the project lifecycle.

Chapter 10: Conclusion and Recommendations

The proposed road improvement project along Charrar Drain, including the construction of link roads and the raising of the safety wall, represents a critical infrastructural development initiative aimed at enhancing connectivity, safety, and economic growth in the region. The Environmental Impact Assessment (EIA) has comprehensively analyzed the project's potential environmental, social, and economic impacts, ensuring that all relevant factors are considered before implementation.

10.1 Conclusion

The findings of the EIA indicate that the project will significantly benefit the local population of approximately 1.47 million people by improving road conditions, reducing travel times, lowering vehicle operating costs, and enhancing overall safety for commuters. The improved infrastructure will also promote local economic development by providing better access to markets, facilitating trade, and encouraging investment in the surrounding areas. Additionally, the project aligns with national and international sustainability goals, particularly the Sustainable Development Goal (SDG) 11, which focuses on creating sustainable cities and communities. The development is expected to foster urban expansion and modernization while addressing existing deficiencies in the road network.

From an environmental perspective, the project incorporates eco-friendly materials and sustainable construction practices that aim to reduce the carbon footprint, minimize emissions, and mitigate noise pollution. The improved drainage systems and flood protection measures incorporated into the design will enhance the project's resilience against extreme weather events and climate change, contributing to long-term sustainability. Additionally, measures such as controlled construction activities, tree plantations, and green spaces will help offset potential negative environmental impacts, ultimately leading to a more balanced ecosystem.

Despite the numerous benefits, potential adverse environmental impacts such as dust emissions, noise pollution, water contamination, and habitat disturbance have been identified. If not properly managed, these issues could pose risks to public health, biodiversity, and the surrounding environment. However, these concerns can be effectively mitigated through well-planned strategies, including dust suppression measures, proper waste management, noise control strategies, and water conservation techniques.

Furthermore, the project's successful execution will require effective coordination among government agencies, environmental regulators, and local communities to ensure compliance with sustainability principles and regulatory frameworks. Public awareness campaigns and community engagement will also be vital in promoting environmental stewardship and ensuring that the project gains widespread support from residents and stakeholders. By proactively addressing potential challenges and implementing strategic mitigation measures, this road improvement project can serve as a model for future infrastructure developments, demonstrating a commitment to sustainable growth, environmental conservation, and social well-being.

Table 10.1 Impact Matrix – Residual Impacts (Mitigated) for Barki Road to Kamahan Road Project

Project Activities	Physical Environment			Biological Environment		Socio-economic Environment				
	Soil	Air quality	Surface and Ground water resources	Loss of Flora	Damage to Fauna	Noise and Vibration	Land Acquisition and Compensation Issues	Safety Hazard, Public health and Noisance	ESMPLOYMENT	Sites archeological/historical significance
Project Sitting										
Project site, Land use and Design	N	N	N	N	N	N	N	N	N	N
Visual impacts	N	N	N	N	N	N	N	N	N	N
Construction Phase										
Land Acquisition	N	N	N	N	N	N	N	N	N	N
Work force Mobilization	0	0	0	N	N	-1	N	0	0	N
Construction Camp Establishment	-1	0	0	-1	-1	0	N	0	+1	N
Construction Camp Operation	0	0	0	0	-1	0	N	0	+1	N
Site Preparation	-1	0	0	-1	-1	-1	N	0	+1	N
Construction of Road	0	0	0	0	0	-1	N	-1	+1	N
Construction of Buildings	0	0	0	0	0	-1	N	-1	+1	N
Construction of Material Supply	0	0	N	0	-1	-1	N	-1	+1	N
Construction Crew Transportation	0	0	N	0	-1	-1	N	-1	+1	N
Solid Waste Disposal	-1	0	-1	-1	-1	N	N	0	0	N
Sewage Disposal	0	0	-1	0	0	N	N	0	0	N
Demobilization of Contractor	0	0	0	0	0	-1	N	0	0	N
Opeational Phase										
Road Operation & Maintenance	N	0	0	0	-1	0	N	0	+1	N

Traffic-Related Emissions & Noise	-1	0	-1	-1	-1	N	N	0	N	N
Roadside Plantation & Greenbelt Development	+2	+2	+2	+2	+2	+2	N	+2	+1	0
Solid Waste Disposal (from Operational Activities)	0	0	0	0	0	+1	N	+1	0	N

Key: -2: High negative impact; -1 Low negative impact; 0: insignificant/negligible negative; +1: low positive impact; +2; High positive impact, N: no impact

10.2 Recommendations

To ensure that the project delivers its intended benefits while minimizing negative environmental and social impacts, the following recommendations should be implemented:

1. Environmental Management and Mitigation Measures:

- Implement dust control measures such as water spraying and covering exposed soil to reduce particulate matter emissions.
- Enforce strict waste management protocols, including recycling and proper disposal of construction debris.
- Install noise barriers and schedule construction activities during off-peak hours to minimize noise pollution.
- Establish erosion control measures and sedimentation basins to prevent water pollution.

2. Sustainable Construction Practices:

- Utilize eco-friendly and recycled construction materials to lower the project's environmental footprint.
- Adopt energy-efficient machinery and equipment to reduce fuel consumption and greenhouse gas emissions.
- Implement green landscaping along the roadside to enhance aesthetic value and improve air quality.

3. Traffic and Safety Enhancements:

- Install clear road signage, pedestrian crossings, and speed control measures to ensure the safety of all road users.
- Develop an emergency response plan to address accidents and other unforeseen incidents effectively.
- Conduct public awareness campaigns on road safety and environmental conservation.

4. Monitoring and Compliance:

- Establish an environmental monitoring program to track air and water quality, noise levels, and overall ecosystem health.
- Conduct regular audits and inspections to ensure compliance with environmental regulations and sustainability standards.
- Engage local communities and stakeholders in the monitoring process to promote transparency and accountability.

5. Socioeconomic Considerations:

- Provide job opportunities for local residents during the construction and operational phases to boost economic growth.
- Ensure equitable access to the improved infrastructure for all community members, including vulnerable populations.
- Develop a maintenance and sustainability plan to ensure the long-term functionality of the road network.

By implementing these recommendations, the project will not only achieve its primary objectives of improved connectivity and infrastructure resilience but also promote sustainable development and environmental conservation. The proactive management of environmental risks will ensure that the road improvement project serves as a model for future infrastructure developments in the region.

ANNEXURE

Annex -I: Kick start meeting Pictorial proof



Annex -II: Scoping Session in EP & CCD



Annex -III: Survey Questionnaire for Socio-Economic Assessment

Environmental Impact Assessment of Construction of Charrar Drain Road (15 Kms) From Burki Road to Kamahan Road

SURVEY QUESTIONNAIRE
FOR
SOCIO-ECONOMIC ASSESSMENT
(Roadside Interviews)

Project Introduction.

The project involves construction/improvement of the road along Charar drain and link streets in adjacent areas where required from Barki to Baoo Wala, from Malikpur start point to Main Malikpur Village, Main Malikpur Village to Eden City DHA, from Eden City to Broadway, from Ring Road to Bedian Road, from Bedian Road to Chung Village, from Chungah Village to LUMS DHA, Shapes to DHA Bus Depot, DHA Bus Depot to LGS, LGS to Filter House, DHA Kamah to Azam Chowk and Adjacent Roads (Gohawa Village Roads, Sajpal Village Roads, Baowala Roads, KB Colony Roads, Chung Village Roads, Malikpur Village Roads, Alfalah Town Roads).

A. QUESTIONNAIRE IDENTITY

Serial Number: _____ Date: _____

Name of interviewer: _____ Time of interview: _____

Signature of interviewer: _____

B. RESPONDENT'S INFORMATION

B.1. Respondent Introduction

1. Name: _____

2. Age: _____

3. Gender: _____

4. Education: _____

C. QUESTIONS ABOUT THE CURRENT PROJECT

a. What are the expected impacts of the "Charrar Drain Road Improvement" on surrounding localities?

b. Do you expect that the "Charrar Drain Road Improvement" will effect the plot/land prices in adjacent areas of the project?

c. What are the potential economic benefits for the local residents from the "Charrar Drain Road Improvement"?

d. How will the “Charrar Drain Road Improvement” improve transportation options for the local population?

e. How the project “Charrar Drain Road Improvement” in your opinion will effect the social life of the local people in project area.

f. How the project “Charrar Drain Road Improvement” in your opinion will effect the environment in surrounding areas of the project.

g. Any Suggestions/Comments

Annex -IV: List of Respondents for Socio-Economic Assessment

Sr	Name	Age	Education
1	Umar Shahzad	27	Matric
2	M. Usman	25	Inter
3	Irfan Ahmad	35	Matric
4	Salman	19	Matric
5	Fahad Saleem	20	Inter
6	Tahir Maqsood	28	Graduate
7	M. Mohsin	32	inter
8	M. Adil	35	Graduate
9	M. Rizwan	22	Inter
10	Bilal Ahmad	31	Graduate
11	Farhan Yousaf	26	Graduate
12	Bilawal Zafar	24	Graduate
13	M. Kashif	23	Inter

Annex -V: Stakeholder's Consultation (Pictorial Proofs)



Annex -VI: Environmental Monitoring Report