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NATIONAL HIGHWAY AUTHORITY

MINISTRY OF COMMUNICATIONS
GOVERNMENT OF PAKISTAN

Feasibility Study and Detailed Design for Construction of Interchange on Lahore – Karachi Motorway (M–3) at Bucheki – Nankana Road in the Name of Rai Mansab Ali Khan Kharal

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

Associated Consultancy Centre (Pvt.) Ltd. Islamabad

In JV with

Finite Engineering (Pvt.) Limited, Islamabad &
Technical Associates Peshawar (Sub Consultant)

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LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACC	Associated Consultancy Centre
ACE	Associated Consulting Engineers
ACGR	Annual Compound Growth Rate
ACI	American Concrete Institute
AIDS	Acquired Immune Deficiency Syndrome
ASTM	American Society for Testing and Material
BOD	Biochemical Oxygen Demand
BOQ	Bill of Quantities
COD	Chemical Oxygen Demand
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMMP	Environment Mitigation and Monitoring Plan
EMP	Environment Management Plan
EPC	Environmental Protection Council
GoP	Government of Pakistan
HIV	Human Immunodeficiency Virus
HSE	Health Safety Equipment
IEE	Initial Environmental Examination
IEM	Independent Environmental Monitor
M&E	Monitoring and Evaluation
NCS	National Conservation Strategy
NGOs	Non–Government Organizations
NHA	National Highway Authority
NOC	No Objection Certificate
O&M	Operation and Maintenance
OP	Operational Policy
Pak–EPA	Pakistan Environment Protection Agency
PAP	Project Affected Person
PD	Project Director
PEPA	Pakistan Environmental Protection Agency

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PEPA	Punjab Environmental Protection Agency
PEPC	Pakistan Environment Protection Council
PEQS	Punjab Environment Quality Standards
PHED	Public Health Engineering Department
PKR	Pak Rupees
PM	Project Manager
PMC	Project Management
PPC	Pakistan Penal Code
PPE	Personal Protective Equipment
PSDP	Public Sector Development Project
PSDP	Public sector Development Programme
PSQCA	Pakistan Standards Quality Control Authority
PTCL	Pakistan Telecommunication Limited
RE	Resident Engineer
ROW	Right of Way
SPM	Suspended Particulate Matter
SRO	Statutory Regulation Order
UBC	Uniform Building Code
VOC	Vehicle Operating Cost
WHO	World Health Organization

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EXECUTIVE SUMMARY

This Environment Impact Assessment (EIA) has been prepared for National Highway Authority (NHA) by Associated Consultancy Centre (Pvt.) Ltd. Islamabad, in a joint venture with Finite Engineering (Pvt.) Limited, Islamabad & Technical Associates Peshawar (Sub Consultant) to address the environmental impacts of the proposed project. This study covers the impacts of the Construction of the Interchange on the Lahore – Karachi Motorway (M-3) at Bucheki – Nankana Road. in the Name of Rai Mansab Ali Khan Kharal.This report has been prepared to meet compliance with environmental regulations and requirements under Punjab Environmental Protection Act(amendment) 2012.

Name of the Proponent

National Highway Authority (NHA)

Name of Organizations preparing the Report

M/s. Associated Consultancy Centre ACC (Pvt.) Limited in JV with M/s Finite Engineering (Pvt.) Limited, Islamabad and M/s Technical Associates Peshawar (Sub Consultant)

Need of Project

Lahore Abdul Hakeem Motorway (M-3) is a 230 Km long section of the Karachi–Lahore Motorway (KLM). The M-3 is a north-south motorway in Pakistan connecting the end of the M-4 near Abdul Hakeem. The M-3 motorway is the parallel motorway of the M-4 motorway and took an eastern route from Lahore to Abdul Hakeem city, while the M-4 motorway connects M-2 to the same Abdul Hakeem city. M-3 Motorway is a 6-lane controlled access highway with 3 rest areas along the route. The route of the M-3 Motorway runs almost parallel to River Ravi although the river might not be seen easily anywhere along this motorway. M-3 Motorway has 3 Railway Line Bridges. Currently, there are two existing interchanges in the vicinity of Nankana Sahib and surrounding towns namely Nankana Sahib Interchange and Jaranwala Interchange, both interchanges are located approximately 35 Km apart.

NHA has planned to construct a new Interchange on M-3 to provide access for locals of towns and surroundings areas located between Nankana Sahib and Jaranwala

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Interchanges. The project will be financed by the Government of Pakistan through PSDP 2022-23 through separate head/allocation.

Objectives of the Project

The project objective is the construction of an interchange on the Abdul Hakeem – Lahore Motorway (M-3) at Bucheki – Nankana Sahab Road to connect Bucheki, Nankana Sahab, and surrounding areas with the Motorway (M-3). The design of the interchange shall not only reflect the functionality and comprehensive operational benefits of the project but also consider the relationship between the project, local economy, and traffic of the regions along the Bucheki – Nankana Sahab Road as a whole; which will make it beneficial for the traffic movement and socioeconomic development.

It will bring more population into the stream of benefits, which in turn will change the social complexion of people around the area. This route will bring further socio economic benefits to road transport and time saving journey for passengers. It will also contribute to ensure smooth and efficient movement of trade, goods and traffic in relatively shorter time.

Project Description

The proposed Diamond Interchange with opposite Quadrants can be constructed to provide access to the local population through the existing Bucheki – Nankana Sahab Road. At an intersection point of Bucheki – Nankana Sahab Road with Motorway (M-3); the existing Road shall be connected through interchange entry and exit ramps on the North and South of the Motorway (M-3).

Project Alternatives

For this EIA, the following alternatives were considered:

No Project Option;

Not taking up the project would mean withholding the development of the entire area along the extended area of the project in the whole of Nnakan sahib. This would also mean restricting the trade opportunities between areas connected by road. The existing road, due to neglect does not meet international standards, and keeping it as such means declining to open the door of opportunity for better social uplift through education and poverty alleviation. Further, the recurring cost of the construction of the

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road will be increased along with enhanced operational costs. The project would provide greater job prospects to people during construction as well as the operational phase. Not taking up the project would mean depriving the local people of a blessing of a whole lot of new opportunities.

Alternative Alignment Design

Three alternative alignment designs of interchange are provided to identify proposed solutions that may influence the design methodology and criteria, the project acceptance, the possible conflicts with other existing or planned infrastructures, the technical construction techniques, and the achievement of the expected project results in term of efficiency, operation and maintenance and others relevant aspects. The following four alternatives are proposed:

Alternative-1: Diamond Interchange (Opposite Quadrants)

- The design speed of interchange loops and legs will be 60 km/hr.
- The minimum curve radius is 125 meters.
- The existing service road on the north side of m-3 is relocated in a 1.35 km length
- Estimated construction cost including land acquisition is Rs. 1,332 million

Alternative-2: Diamond Interchange (Diagonal Quadrants)

- The design speed of interchange loops and legs will be 50-60 km/hr
- The minimum curve radius is 115 meters.
- The existing service road on the north side of m-3 is relocated in a 1.35 km length
- Estimated construction cost including land acquisition is Rs. 1,484 million

Alternative-3: Trumpet Interchange

- The design speed of interchange loops and legs will be 50 km/hr
- The minimum curve radius is 100 meters.
- The existing service road on the north side of m-3 is relocated in a 0.28 km length
- The estimated construction cost along with land acquisition is Rs. 1,647million

Alternative-4: Diamond Interchange (Opposite Quadrants)

- The design speed of interchange loops and legs will be 50 km/hr.
- The minimum curve radius is 90 meters.
- The existing Service Road on the North side of M-3 is relocated in 572m length.
- The estimated construction cost including Land Acquisition is Rs. 1,171 million.

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Recommended Alternative:

Based on the silent features of all three alternatives and cost comparison, being economical and easy to negotiate by the traffic, the alternative-4 i.e., Diamond Interchange (Opposite Quadrants) is recommended for implementation

A simple Diamond Interchange with opposite Quadrants can be constructed to provide access to the local population through the existing Bucheki – Nankana Sahab Road. At an intersection point of Bucheki – Nankana Sahab Road with Motorway (M-3); the existing Road shall be connected through interchange entry and exit ramps on the North and South of the Motorway (M-3).

Environmental Baseline

The existing environmental conditions around the proposed project have been considered in physical, biological, and socio-economic aspects. The methodology used for the EIA preparation included the collection and review of relevant documents and firsthand data including policy and previous study documents, use of satellite imagery and Google Earth, onsite environmental, ecological, and social investigation, consultation with public and stakeholders, and undertaking the social impact assessment and analysis. Mitigation measures were then put in place to address negative impacts and compensatory plans are designed and recommended.

The Consultant has employed a participatory bottom-up transparent and consultative approach in the preparation of the Environmental Impact Assessment (EIA) report. Various qualitative and quantitative data collection tools were used to develop an environmental baseline for the proposed area.

Physical Environment:

The study area (Nankana Sahib District) is in Punjab province, Pakistan, The district has three subdivisions: Shangla Hill, Shah Kot, and Nankana Sahib Tehsil. Geographically, it is situated about 91 km from the west of Lahore and about 75 km from the east of Faisalabad city. The total population of Nankana Sahib is approximately 1,356,774 inhabitants (2017 census report by Pakistan bureau of statistics). Climatically, it lies within the semi-arid climatic zone. In the summer, the temperature reaches 40–45 °C. The temperature in May and June is quite high, while a minimum temperature of 22–25 °C is recorded for December and January. The monsoon season begins in June and lasts for around two months. The average rainfall

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of Nankana Sahib is 635 mm The soil of Nankana Sahib is fertile. There are three major crops cultivated in the area: wheat, rice, and sugarcane In the District, most inhabitants use groundwater for domestic use; the tube-well density in the entire District is (19,161 in total). In most areas, the depth of the water table is about 7.5 to 9.14 m, which has no difficulty pumping out

Biological Environment

Wild boar, jackals, hares, and wolves are the only wildlife found in the district. Birds include crows, mynas, sparrows, black and grey partridges, falcons, eagles, quails, starlings, jungle pigeons, house pigeons, Russian sparrows, doves, various varieties of ducks, egrets, kingfishers, snipes, parrots.

The most common flora of the district is the Karir, Jhand, Vann, Shisham, Kikar, Peepal, Bohar, Eucalyptus, Poplar, Shirin, Lana, Lani, Babul, Semal or Silk cotton tree. Some important vegetables are Phool Gobhi /Cauliflower, Band Gobhi Turnip, Raddish, Carrot, Bhindi, and Tomato. Crops usually seeded in the area include Rice, Barley, Jawar, Maize, and Sugarcane along with other fodder.

Socio-Economic Environment:

Nankana Sahib has three Tehsils/Towns i.e, Nankana Shib, Shakot and Sangla Hill. The population growth rate of 2.35 % as per the 1998 Population Census, which is quite similar to the provincial average. The population of the Town was 48,899 individuals in 1998 and is currently estimated at 69,282 individuals. Given the population growth rate and using 1998 as the base year for arithmetic growth method estimation, the population of the town is likely to increase to 110,249 individuals in 20 years from now (the year 2033). The district belongs to the Northern Irrigated Plains Agro-Ecological Zone of Pakistan. Agriculture and its allied livestock breeding is the main occupation of the rural areas of the area with nearly 35.9% of the rural population engaged in this occupation.

The district is linked with Sheikhupura, Lahore, and Faisalabad districts through black topped roads. Lahore-Islamabad Motorway touches Nankana Sahib at Khanqah Dogran where an interchange has been constructed. The district is linked with Lahore and Faisalabad districts through the Pakistan Railway network. Nankana Sahib Town, Chak Jumra, Mandi Warburton, and Sangla Hill are the major rail links.

Environmental Impact Analysis And Mitigation Measures

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During the field surveys, significant efforts were made to identify the main social, cultural, and environmental issues related to the construction/up gradation of the existing highway. Data from Various government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents and stakeholders. Following is the list of main issues and concerns:

- The physical scarring caused by clearing and levelling during project site construction activities could lead to alteration of soil quality by removal of topsoil, loses of plant cover and limited soil erosion induced by disturbance to native soil.
- Air pollution due to emissions from asphalt plant, vehicles, and construction machinery as well as dust and particulate matter during the construction phase and movement of vehicles during the operational phase
- Drainage issues during the construction phase and operation phase
- Contamination of surrounding soil and water resources from oil spills and release of contaminated water both during construction and operational phases
- Noise and vibration, construction works, and machinery movements during the construction phase;
- Waste from construction activities as well as labor camps at different locations during the construction phase
- One of the major project related impact will be the land acquisition for the proposed project that will result in causing disturbance to the affected residents along the project area.
- Disturbance of traffic flow and pattern during the construction phase of the project
- Mobility and safety of Livestock during construction and operational phases;
- Health and safety issues of laborers at the site during construction and at the labor camp

Mitigation Measures

Landscape:

To minimize the impact of the project on the geophysical environment, several measures have been included in the design of the project facilities and will ensure during the construction phase. To reduce physical scaring of the landscape, unnecessary widening and clearing of vegetation will be avoided. Greenbelt

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plantations will be maintained, and parking of construction vehicles will not be allowed on the median. Borrow areas will be selected in consultation and approval of the Project Director and would not be much deeper to avoid alteration of drainage and soil erosion. The borrow area will be leveled and topsoil restored.

Air Pollution:

To reduce the impact on air quality, cleaner fuels (less 1% sulphur content) will be preferred to procure. Monitoring of Ambient air parameters and emissions should be carried out on to ensure compliance with the PEQS.Dust emissions from vehicular traffic will be restricted by imposing speed limits. Water will be sprinkled on roads and construction sites during the construction phase. The open-body trucks and trollies will be covered during the transportation of road materials. Good housekeeping will also be followed to reduce dust emissions from construction sites. All equipment including generators and construction machinery will be kept properly tuned to reduce exhaust emissions. The asphalt plant will have proper dust control systems. The outdated and mechanically unfit construction machinery will not be allowed to avoid air pollution

Water and Drainage:

The contractor may be advised to avoid the contamination of surface water during construction. The contractor will not be allowed to disturb the quality and quantity of groundwater in any case. The contractor will also prepare guidelines for workers to reduce water wastage. To maintain natural drainage patterns, culverts, and bridges will be constructed. To avoid hygienic and environmental issues, proper road drainage is necessary at critical locations along the proposed project.

Soil and Water Contamination:

To avoid contamination of soil and water, all fuels, oils, and bitumen will be stored with concrete padding as well as bunding and secondary containment for curtailing leakages. No contaminated effluent will be released during the storage and handling of such materials. The labor camp will be allowed at a reasonable distance from the surface and drinking water sources to avoid contamination. In addition, a proper wastewater collection and disposal system will be arranged at campsites. A proper septic tank will be maintained at campsites to avoid the contamination of land, surface water, and groundwater.

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Noise Pollution:

Noise has the potential to cause an impact to nearby communities and working personnel. To avoid the impact of noise, it will be ensured that generators, vehicles and other potentially noisy equipment used are in good condition. All on-site personnel will use required personal protective equipment (PPE) in high noise areas that will be clearly marked.

Waste from construction activities

National Highway Authority will implement a thorough waste management plan to ensure that any impact resulting from waste generation and management shall be minimal. The recyclable waste will be sold to waste contractors, as per waste management plan. No hazardous chemical will be uncontrollably discharged into the environment. A waste management plan will be developed and implemented by considering the best technological and environmental options and will apply the "Reduce, Re-use, Recycle" hierarchy thereby minimizing the overall fuel consumption.

Records of all waste generated during the project activity period will be maintained. Quantities of waste disposed, recycled, or reused will be logged on a waste tracking register. Audits of the waste disposal contractors and waste disposal facilities will be undertaken on a regular basis to ensure the implementation of waste handing and disposal procedures.

Land Acquisition

Careful alignment and route selection by the designer to minimize the impacts by avoiding the residences/houses of these families. Proper access should be provided to the farmers to cultivate the divided land at a minimum travel distance. For the land coming in the proposed project, the affected people will be provided with suitable compensations as per rules and regulations of Government of Punjab.

Disturbance of Traffic Flow

A traffic management plan will be developed before the start of construction. Over Hanger Exit Signs and Gantry Signs as per drawing including RCC foundations complete with all respect and as directed by the engineer will be installed at the site of construction. The delineator, attached to the metal barriers, can show the outer

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contour of the highway when being illuminated by the car lamps, thus ensuring driving safety

Mobility of Locals and Livestock:

The contractor will provide appropriate crossing points for locals and livestock without compromising safety.

Health and Safety:

The contractor will comply with ILO Convention No 62 and workers will be trained in construction safety procedures. PPE use would be made mandatory. The contractor will also ensure adequate first aid kits and ambulances at the camp and site. The basic medical facility will be provided at the campsites by the contractors.

To mitigate the project's impacts on the already stressed biological resources of the area, following measures will be incorporated into its design;

- Clearing of vegetation will be kept to an absolute minimum.
- Local wood for fuel will not be used during project activities.
- A 'no-hunting, no-trapping, no-harassing' policy will be strictly enforced.
- All the wastes will be properly handled, stored and disposed through implementation of an effective waste management plan.
- Reforestation activities will be followed

Environmental Management Plan (EMP)

For effective implementation and management of mitigation measures, an Environmental Management Plan has been prepared. The EMP provides a delivery mechanism to address potential impacts of project activities, to enhance project benefits and to introduce standards of good practice in all project activities. The EMP has been prepared with the objective of:

- Defining mitigation/ monitoring plan required for avoiding or minimizing potential impacts assessed by the EIA;
- Defining roles and responsibilities of the project proponent and the contractor;
- Defining requirements for environmental monitoring and reporting;

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- Defining the mechanism with which training will be provided to the project personnel. Environmental sensitivities and impacts, as well as the associated mitigation plan have been addressed in the EMP.

NHA will ensure that the project staff will be adequately trained in HSE sensitivities and operational management procedures, so that all levels of staff effectively contribute to impact prevention and mitigation at all times.

An Environmental Management Plan (EMP) has been prepared and provided in Chapter 09 of the report, providing:

- A systematic approach to ensure that mitigation strategies prepared in this EIA are implemented during project activities.
- An appropriate monitoring plan is device to ensuring strict adherence to the environmental mitigation and control measures.
- A training program is device to providing awareness training on all potential environmental issues of the project to all personnel at site.
- A waste management plan, identifying the most suitable waste disposal and pollution control options throughout the project lifecycle.

Institutional Arrangements

The overall responsibility of EMP implementation rests with NHA. Project Director (PD), Deputy Project Director (DPD), Quality Control Specialist (QCS), and other required official and supporting staff will be deputed by the NHA. The PD/Site Engineers will be responsible for general administration, handing over of sites, coordination with other authorities to ensure timely relocation of various utility services, oversight of environmental safeguards, management of social safeguards, and performance monitoring of civil works implementation.

The contractor will also be responsible for the implementation of EMP at the site. The contractor will hire qualified engineers/technical experts and fix their responsibilities for the proper implementation of EMP. All mitigation measures for adverse impacts proposed in the EMP will be duly and timely implemented in true letter and spirit. For this purpose, daily, monthly and annual checklists will be formulated and maintained by the contractor.

Consultation Outcomes

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Overall, people expressed their wish for the construction of the road and their support for the proposed project. The construction of the interchange project was welcomed by the people as it will reduce traffic congestion and minimize other road hazards along the selected road section. Local communities demanded that they should be part of a continuous consultation process, together with other stakeholders, during different stages of the project including design, construction, and operation

Conclusion

After assessing the significance of potential impacts, it has been concluded that if the project activities are carried out as described in this report, and the suggested mitigation measures are implemented, the proposed project will not have a significant impact on the area's natural and socioeconomic environments. Hence, this EIA concludes that the upon implementation of the mitigation, the residual impacts of the proposed operation will be low and careful implementation of the provided EMP will ensure that environmental impacts are managed and minimised and all statutory requirements are met by the project proponent.

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1 INTRODUCTION

1.1 PROJECT INTRODUCTION

Road Projects are generally intended to improve the economic and social welfare of people. For all the positive aspects of road projects, they may also have significant negative impacts on nearby communities and the natural environment. New roads may induce development in previously undeveloped areas, sometimes significantly affecting sensitive environments and the lifestyle of indigenous people.

Roads are agents of change and can be responsible for both benefits and damages to the existing balance between people and their environment, especially large highway and motorway projects.

A national highway or motorway project;

i) Should maximize economic return;

ii) Should be technically feasible; and

iii) Should be socially acceptable and environmentally sustainable.

The last 50 years have highlighted the performance as well as the social and environmental impacts of large highway projects. There is an increasing public and official awareness that a project which develops natural resources may involve costs in many unforeseen ways while returning benefits in other ways not expected by its planners. Worldwide experience with hundreds of projects has shown that these secondary or environmental benefits and costs are real, definable, and often predictable although not always amenable to economic evaluation

Without, and sometimes with environmental assessment process unexpected effects on natural resources or human living standards may occur. Mere identification and assessment of potential environmental effects serve no purpose unless the findings are translated into mitigation actions. Since environmental management is a predictive and corrective process, its effectiveness depends on close interaction between environmentalists, sociologists, economists, and engineers.

The overall transportation sector contributes around 10% of the total GDP of Pakistan, consuming 35% of the total energy and engages over 6% of total employment. The highway system has a total road length of 263,942 km. This total

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includes 185,063 km of paved highways (70%) and 708 km (0.3%) of motorway/expressway. The highway network of Pakistan includes 12,131 km of motorways and national highways, with another 93,000 km of provincial highways with the remainder classified as either district or urban roads. A review of the national highway network concluded that only 56% was in either good or fair condition.

Lahore Abdul Hakeem Motorway (M-3) is a 230 Km long section of the Karachi–Lahore Motorway(KLM). The M-3 is a north-south motorway in Pakistan connecting the end of the M-4 near Abdul Hakeem. The M-3 motorway is the parallel motorway of the M-4 motorway and took an eastern route from Lahore to Abdul Hakeem city, while the M-4 motorway connects M-2 to the same Abdul Hakeem city.

M-3 Motorway is a 6-lane controlled access highway with 3 rest areas along the route. The route of the M-3 Motorway runs almost parallel to River Ravi although the river might not be seen easily anywhere along this motorway. M-3 Motorway (Lahore to Abdul Hakeem Motorway) has 3 Railway Line Bridges.

Currently, there are two existing interchanges in the vicinity of Nankana Sahib and surrounding towns namely Nankana Sahib Interchange and Jaranwala Interchange, both interchanges are located approximately 35 Km apart. NHA has planned to construct a new Interchange on M-3 to provide access for locals of towns and surroundings areas located between Nankana Sahib and Jaranwala Interchanges. The design speed of the M-3 Lahore Abdul Hakeem Motorway is 120 Km/hr. and posted speed limit is also 120 Km/hr.

The project will be financed by the Government of Pakistan through PSDP 2022-23 through separate head/allocation. No mitigation plan can be made without assessing the environmental impacts of the project.

According to the Punjab Environmental Protection (Amendment) Act 2012 and its interpretation as per the Review of IEE & EIA Regulations, 2022 for filing, review, and approval of environmental assessments, the present project is categorized under Schedule II. Regulation 4 states that "A proponent of the project falling in any category specified in schedule II shall file an EIA".

M/s. Associated Consultancy Centre ACC (Pvt.) Limited in a joint venture with M/s Finite Engineering (Pvt.) Limited, & Technical Associates Peshawar (Sub Consultant) has been awarded the "Feasibility Study and Detailed Design for Construction of

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Interchange on Lahore - Karachi Motorway (M-3) at Bucheki - Nankana Road in the Name of Rai Mansab Ali Khan Kharal"

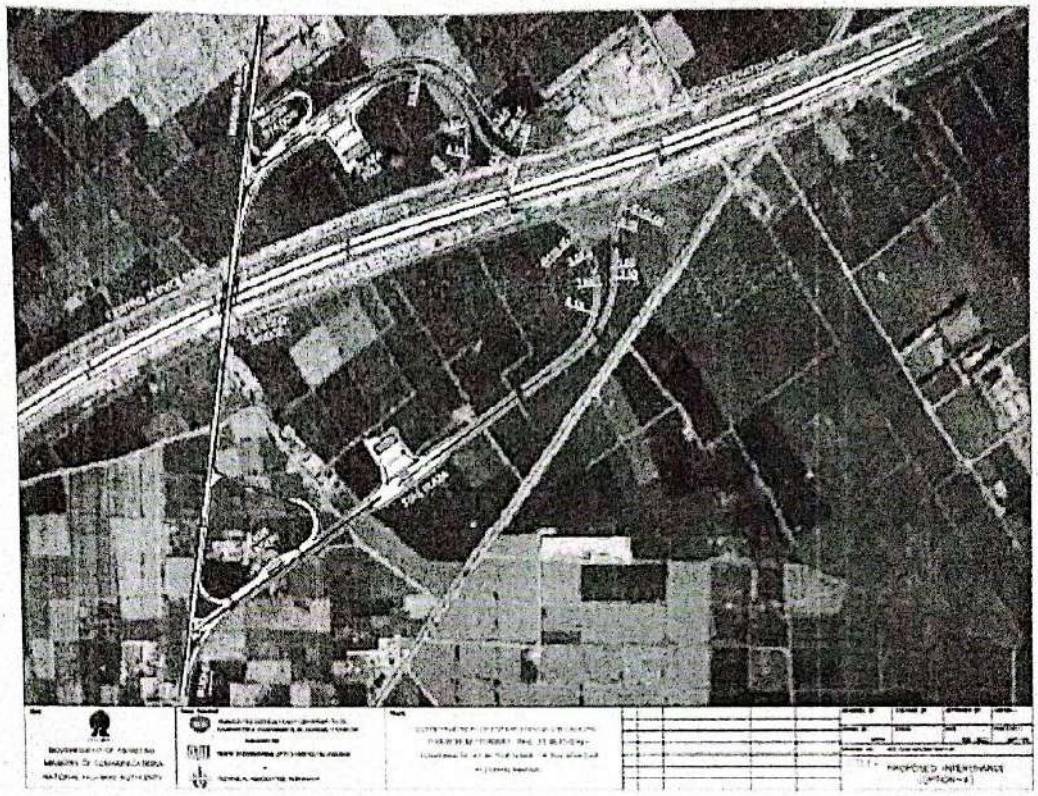


Figure 1-1: Location Map of Proposed Interchange

1.2 PURPOSE OF THE REPORT

EIA is mandatory according to the Punjab Environmental Protection Act (Amended), 2012. Section 12 (1) of the Punjab PEPA (Amended), 2012 states that: "No proponent of a project shall commence construction or operation unless he has filed with the Provincial Agency an initial environmental examination or, where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Provincial Agency approval in respect thereof".

The specific objectives of this environmental assessment can be identified as follows:

- Collect the baseline data on the physical, biological, and socio-economic conditions of the project area using both primary and secondary sources.
- Carry out an environmental assessment, including the supporting administrative and legal framework of the proposed interchange infrastructure.

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- Identify mitigation measures for the potential environmental impacts.
- Propose institutional responsibilities and methods of monitoring the mitigation measures and monitoring procedures.
- Prepare the Environmental Management and Monitoring Plan

1.3 IDENTIFICATION OF PROJECT AND PROPONENT

The proponent of the project is "National Highway Authority (NHA)"; while Associated Consultancy Centre ACC (Pvt.) Limited JV with Finite Engineering (Pvt.) Limited, & Technical Associates Peshawar (Sub Consultant) has been assigned to prepare a complete feasibility of the project; including the preparation of the EIA of the said project to be submitted by them to NHA.

NHA has planned to construct a new Interchange on M-3 to provide access for locals of towns and surroundings areas located between Nankana Sahib and Jaranwala Interchanges. The construction of the interchange is also intended to provide access for locals of the surroundings to the Lahore Karachi Motorway and more efficient passage to various cities of Punjab.

1.4 PROJECT DETAILS

The project will be financed by the Government of Pakistan through PSDP 2022-23 through separate head/allocation. The design speed of the M-3 Lahore Abdul Hakeem Motorway is 120 Km/hr. and posted speed limit is also 120 Km/hr. The following table shows the existing interchange locations on M-3 Lahore Abdul Hakeem Motorway.

Table 1-1: Existing Interchange Locations on M-3 Lahore Abdul Hakeem Motorway

Interchange	Junction	Location
M-2	1	Sagian
Sharaqpur Sharif	2	Nazir Labana
Nankana Sahab	3	Mangtanwala Rd
Jaranwala	4	Syedwala
Samundri	5	Tandlianwala Rd
Rajana	6	Rajana - Chichawatni Road
Pir Mahal	7	Shorkot Road
Abdul Hakeem	8	M-4

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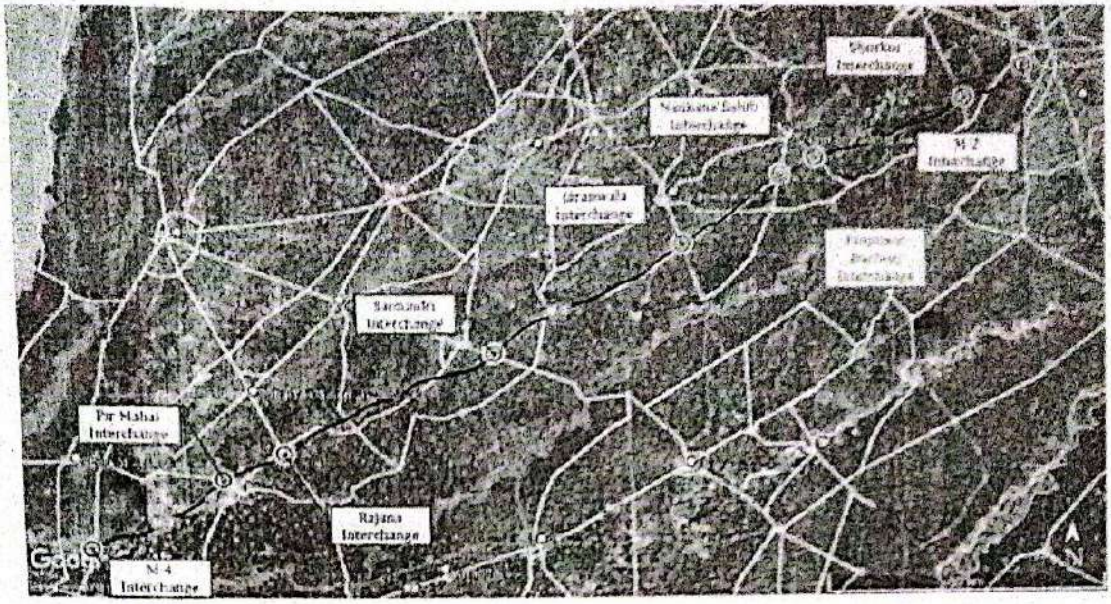


Figure 1-2: Location of Proposed Interchange on M-3 Lahore Abdul Hakeem Motorway

1.5 PROJECT SCOPE OF WORK

The project "Feasibility Study and Detail Design for Construction of Interchange on Lahore Karachi Motorway (M-3) at the intersection of the point of Bucheki – Nankana Road in the name of Rai Mansab Ali Khan Kharal".

The scope of work of the assignment has been defined in the TOR as per the following details:

Table 1-2: Project Scope of Work as per TOR

Design & Posted Speed of Motorway (M-3)	120 km/hr
Design Speed	40-60 km/hr
No of Lane	2 Lanes
Carriageway Width	7.3 m (Legs)

1.6 EXTENT OF THE EIA STUDY AND SCOPE OF THE STUDY

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The present EIA report has been prepared in conformity with the rules and regulations of the Punjab Environment Protection Agency, Government of Punjab, and those guidelines required for the preparation of environmental assessment reports.

The main scope of the EIA study includes :

- Identifying the baseline condition of the project area.
- Evaluating the ability of the site because of social acceptance and environmental soundness.
- Providing maximum information to the proponent and other stakeholders about the existing environmental conditions and the implications of the proposed project.
- Identification of the potential environmental and social impacts related to the project implementation.
- Proposing mitigation measures to eliminate or reduce the negative impacts to an acceptable level.
- Developing well-resourced environmental management and monitoring plans to identify mitigation strategies targeted towards avoidance, minimization, and rehabilitation of the impacts.
- Preparing Environmental Management and Monitoring Plan to make the part of tender document.

The EIA aims to identify the likely potential impacts, both positive and negative, of the proposed project-related interventions to quantify and, where possible value these so that they can be used in a multi-criteria analysis for rational decision-making by the project authority and policymakers. The overall aim is to ensure that the recommended intervention is carried out in an environmentally sound and sustainable manner and that the EMP recommendations are followed by the project proponent / implementing agency during the project cycle.

1.7 PERSONS PERFORMING THE EIA STUDY (TEAM MEMBERS)

The EIA study of the proposed project has been conducted according to Environmental Assessment Procedures-1997, Review of IEE, and EIA Regulation-2022 as prescribed by the Federal Environmental Protection Agency (Pak-EPA), Government of Pakistan. The study team which completed the EIA Report consists of the following Experts :

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Table 1-3 Lists of Experts Performing EIA

Name	Qualification	Status In Project
Mr. Ahtasham Raza	M.Phil, Ph.D. Scholar, (Environmental Sciences)	Team In-charge
Mr. Adnan Sharif	Postgraduate (Environmental Law)	Project Manager
Mr. Mehmood Amjad	B.S (Environmental Sciences)	Monitoring In-charge
Ms. Iram Naz	M.Sc. Water Resource Management	Team Member
Dr. Gulnaz Malik	Ph.D. (Environmental Science)	Team Member

1.8 EIA METHODOLOGY

The EIA project passes through series of stages prior to report preparation. The EIA process and the approach followed for the proposed project is defined below:

Scoping

Scoping is an early stage of the process and is designed to ensure that the environmental studies provide all the relevant information on:

- the impacts of the project, in particular focusing on the most important impacts;
- the alternatives to the project;
- Other environmental sensitivities to be addressed at early stage.

The EIA process started with the scoping. The purpose of scoping was to identify:

- the important issues to be considered in an EIA;
- the appropriate time and space boundaries of the EIA study;
- the information necessary for decision-making;
- the significant effects and factors to be studied in detail.

The scoping was followed by data collection describes in subsequent section.

1.8.1 Data Collection

Following literature review and data collection was carried out for EIA:

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- A generic description of the proposed project and its related activities was collected from Consultancy Centre ACC (Pvt.) Limited, Finite Engineering (Pvt.) Limited, & Technical Associates Peshawar.
- Baseline of the area's environmental and socio-economic settings was collected through literature search and field surveys.

1.8.2 Baseline

The environmental impact is measured through a change in the environment, resulting from a designated action or activity. In order to identify such a change, it is essential to have as complete as practicable understanding of the nature of the existing environment, prior to its interaction with the proposed activity. This translates into the need to characterize the existing baseline environmental conditions, including establishing prevailing conditions for a range of environmental media, particularly air, water, soil and groundwater, flora and fauna and the human environment. This was achieved through a detailed review of all secondary resources (i.e. existing documentation and literature); and the undertaking of project specific baseline studies and surveys to collect supplementary data in the following areas:

- Geology;
- Flora and fauna;
- Water quality characteristics;
- Soil quality;
- Traffic;
- Ambient air quality;
- Noise conditions;
- Socio-economic conditions;
- Archaeology.

Both the existing secondary sources and literature studies were conducted and integrated into one coherent description of baseline characteristics.

1.8.3 Stakeholder Consultation

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Communities within the project area were consulted during the fieldwork to record their concerns and suggestions.

1.8.4 Evaluation of Alternatives

To establish an environmentally sound preferred option for achieving the objectives of the proposed project, different alternatives including site selection, raw material and technology alternatives were studied in collaboration with the project proponent. Technology selection was made taking in to consideration environmentally, economically and socially suitable as well as technically feasible options.

1.8.5 Impact Assessment and Mitigation

The information collected in the previous phases was used to assess the potential environmental impacts of the proposed project activities.. Detailed methodology is included in Chapter 8 of the report. Mitigation measures were evaluated to reduce the impacts of project activities on environment. The issues studied during impact assessment include potential impacts on:

- Physical environment of the area
- Biological environment of the area
- Socio-economic environment of the area

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2 SCREENING OF PROJECT

2.1 SCREENING

According to the Punjab Environmental Protection (Amendment) Act 2012 and its interpretation as per the Review of IEE & EIA Regulations, 2022 for filing, review, and approval of environmental assessments, the present project is categorized under Schedule II. Regulation 4 states that "A proponent of the project falling in any category specified in schedule II shall file an EIA". The following projects relating to the transport sector fall in Schedule II:

The "Feasibility Study and Detailed Design for Construction of Interchange on Lahore - Karachi Motorway (M-3) at Bucheki - Nankana Road in the Name of Rai Mansab Ali Khan Kharal Additional" has been carried out by M/s. Associated Consultancy Centre ACC (Pvt.) Limited in a joint venture with M/s Finite Engineering (Pvt.) Limited, & Technical Associates Peshawar (Sub Consultant) The total investment amount of the project is Rs. 1,171 million.

According to the Punjab Environmental Protection Review of IEE & EIA Regulations, 2022, an EIA study is mandatory to be submitted to EPA Punjab and get its approval under section 12 of the Punjab Environmental protection Act (Amendment) 2012. as prescribed by the Federal Environmental Protection Agency (Pak-EPA), Government of Pakistan

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3 SCOPING OF PROJECT

The scoping identifies the key issues and impacts that should be further investigated. The Scoping defines the spatial and temporal boundaries, important issues and concerns raised during consultation and significant impact factors to be determined.

3.1 SPATIAL AND TEMPORAL BOUNDARIES OF ENVIRONMENTAL ASSESSMENT

Lahore Abdul Hakeem Motorway (M-3) is 230 Km long, starts from M-3 & M-4 Junction on Abdul Hakeem and traverses through Pir Mahal, Rajana, Samundri Jaranwala Nankana Sahib, Sharqpur, and terminates at Lahore M-2 & M-3 Junction.

The proposed interchange is located near Nankana Sahib Interchange on M-3 at the intersection point of Bucheki and Nankana Sahib Road. The proposed interchange is located at a distance of 10 Km approx. from the Nankana Sahib Interchange and 25 Km approx. from the Jaranwala Interchange. The spatial temporal boundaries are given in the below map

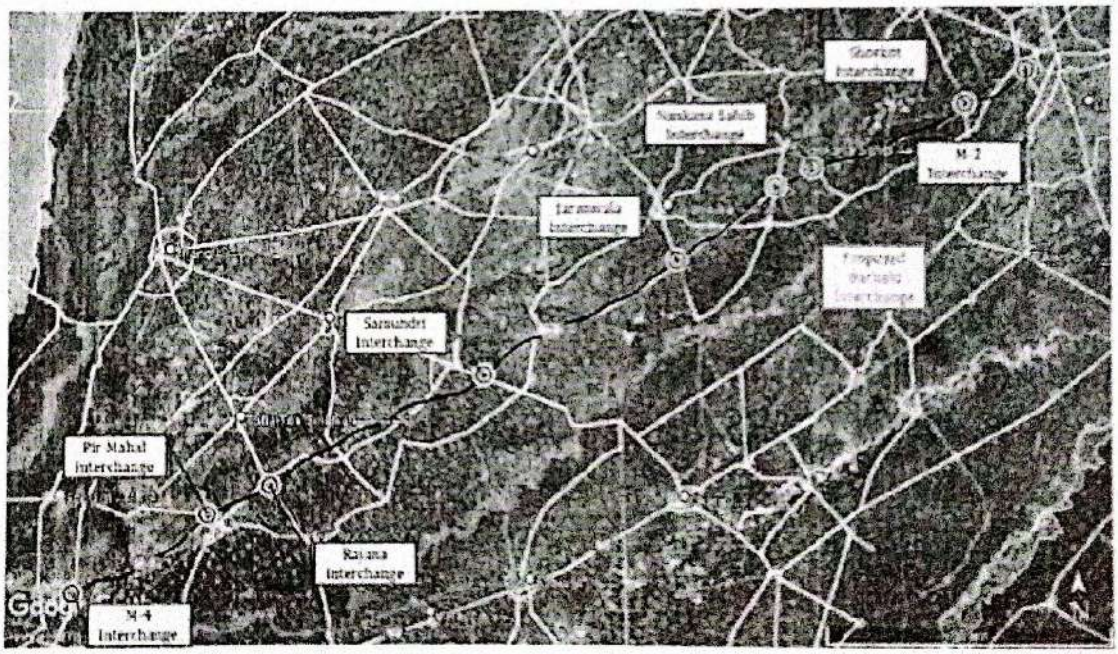


Figure 3-1: Spatial and Temporal Boundaries of the Project

3.2 IMPORTANT ISSUES AND CONCERNS RAISED DURING CONSULTATION

The consultation and scoping meeting were carried out in the project area to disseminate information about the project and its expected impact on the primary and secondary stakeholders. Several relevant stakeholders were consulted regarding the

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proposed project activities during different interviews and discussions. Detailed informtaon about the stakeholder concerns raised during the consulation are provided in chapter 10.

3.3 SIGNIFICANT IMPACTS AND FACTORS TO BE DETERMINED

Considered during EIA Study, it was unanimously agreed by almost all the consultation participants that the Construction of an Interchange on the Lahore – Karachi Motorway (M-3) at Bucheki – Nankana Road in the Name of Rai Mansab Ali Khan Kharal is necessary for smooth and safe traffic flow. However, the participants are concerned that the Environmental Impacts and their mitigations should be addressed during the EIA study.

3.4 APPROACH TO WORK

The study is based on both primary and secondary data and information. The primary data includes data collected from field observations and secondary data includes a review of relevant information from Government Departments. Discussions were held with stakeholders including government officials, community representatives, and a wide range of road users and roadside dwellers. The main purpose of this approach was to obtain a fair impression of the people's perceptions of the project and its environmental impacts.

3.5 METHODOLOGY

3.5.1 Project Orientation Meetings

Meetings and discussions were held between the consulting team of Consultants (Associated Consultancy Centre (Pvt.) Ltd. Finite Engineering (Pvt.) Limited and Technical Associates Peshawar (Sub Consultant)& and the proponent to decide on an Agenda for the execution of the EIA study. This activity mainly aimed at achieving a common ground of understanding regarding the EIA of the proposed project.

3.5.2 Strategy Planning for Data Collection

After getting a clear overview of the project, a comprehensive data acquisition plan was formulated to develop the EIA report. The plan identifies the various data requirements of the projects and delineates the sources from where they will be obtained.

3.5.3 Field Data Collection

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A team of experts visited the project locations to collect the area-specific primary data. Where required, the secondary data was also collected by the experts through the perusal of previously published literature and web research related to the project area. The following activities were carried out for data collection:

- Site Reconnaissance Surveys
- Analysis of Maps and Plans
- Literature Review and Desk Research
- Public Consultations and Focused group discussions
- Field Observation and Site studies
- Monitoring and Laboratory Analysis

3.5.4 Review of Secondary Data

Previous environmental and social soundness assessment for the South Punjab region and other published and unpublished information was collected to gain a complete understanding of existing environmental conditions of the area including:

Physical Environment: topography, geology, soils, surface and groundwater resources, and climate;

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

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

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

3.5.5 Two Stage Consultations

For this EIA study, two-stage consultation was carried out through one on one meetings. First stage consultation was limited to local government functionaries, affected persons, and local communities were consulted. The objective of the consultation was to assess the long-term as well as short-term impacts of the new development of the proposed project at an early stage. In the second stage consultations will be carried out through public participation if required.

3.5.6 Identification & Assessment of Impacts and Recommendations for Mitigation

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Potential impacts arising from the construction as well as operational activities of the proposed project were identified. These include the effects of the activities on the physical, biological, socio-economic, archaeological, and cultural environments of the area. Impacts were identified and assessed based on field data, secondary data, and expert opinion. Mitigation measures were identified to help, prevent or minimize all potential adverse environmental impacts from the proposed project activities. The proposed mitigation measures are based on the sensitivity and behavior of environmental receptors within the project area.

3.5.7 Development of an Environmental Management Plan (EMP)

An EMP for the proposed project activities was prepared. The EMP provides a framework for implementing and managing the mitigation and monitoring measures recommended in the EIA. The EMP includes the following:

- Mitigation and monitoring plan.
- Definition of roles and responsibilities of the proponent, contractors, and monitoring teams.
- Requirements for communication, documentation, and training during the project.
- Restrictions on design, timing, and conduct of the project.
- Change Management Plan to cover unforeseen events/environmental conditions during the project.

3.6 EIA REPORT STRUCTURE

This document is part of the complete environmental Impact assessment as described by Environmental Protection Department (EPD) Punjab and EPA Pakistan.

3.7 INCORPORATION OF SAFEGUARDS DOCUMENTS IN CONTRACT DOCUMENTS

The proposed EMP forms part of the Request for Proposals package/ Bid Documents and its compliance is mandatory. The contractor will be required to prepare site-specific plans as stipulated in Environmental Mitigation and Monitoring Plan. These site-specific plans will then be embedded into the civil works contracts and therefore will be legally binding on the contractor. The site-specific plans must be submitted to the Project Director/Project Engineer for review and clearance within 30 days of the signing of the contract or before mobilization on-site, whichever date is earlier.

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4 ALTERNATIVES ANALYSIS

4.1.1 No Project Option / Worst Scenario OptionStrengths and Opportunities

If the project is not taken up at all then all the funds, efforts, and inconvenience will be saved and these will become available for diversion to other projects. No land will be required and no disturbance will be caused to people through the resettlement or land acquisition process. No disturbance will be caused to any physical, biological, or social part of the environment. The people benefiting from a status quo will continue benefiting.

4.1.2 Weaknesses and Threats

Not taking up the project would mean withholding the development of the entire area along the extended area of the project in the whole of Nnakan sahib. This would also mean restricting the trade opportunities between areas connected by road. The existing road, due to neglect does not meet national standards, and keeping it as such means declining to open the door of opportunity for better social uplift through education and poverty alleviation. Further, the recurring cost of the construction of the road will be increased along with enhanced operational costs. The project would provide greater job prospects to people during construction as well as the operational phase. Not taking up the project would mean depriving the local people of a blessing of a whole lot of new opportunities.

4.1.3 Conclusion

The "No project option" reveals the withholding of development activities in the entire area, trade limitations, and degradation of economic activities, therefore not recommended.

4.2 INTERCHANGE DESIGN ALTERNATIVES

Three alternative alignment designs of interchange are provided to identify proposed solutions that may influence the design methodology and criteria, the project acceptance, the possible conflicts with other existing or planned infrastructures, the technical construction techniques, and the achievement of the expected project results in term of efficiency, operation and maintenance and others relevant aspects. The following three alternatives are proposed:

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1. Alternative-1: Diamond Interchange (Opposite Quadrants)
2. Alternative-2: Diamond Interchange (Diagonal Quadrants)
3. Alternative-3: Trumpet Interchange
4. Alternative-4: Diamond Interchange (Opposite Quadrants)

4.2.1 Alternative-1: Diamond Interchange (Opposite Quadrants)

A simple Diamond Interchange with opposite quadrants can be constructed to provide accessibility to the local population through the existing Bucheki – Nankana Sahab Road. At an intersection point of Bucheki – Nankana Sahab Road with Motorway (M-3); the existing Road shall be connected through interchange entry and exit ramps on the North and South of the Motorway (M-3). A flyover bridge is already available and Motorway (M-3) overpasses the existing Bucheki – Nankana Sahab Road. The following figures show the proposed plan for Diamond Interchange (Opposite Quadrants):

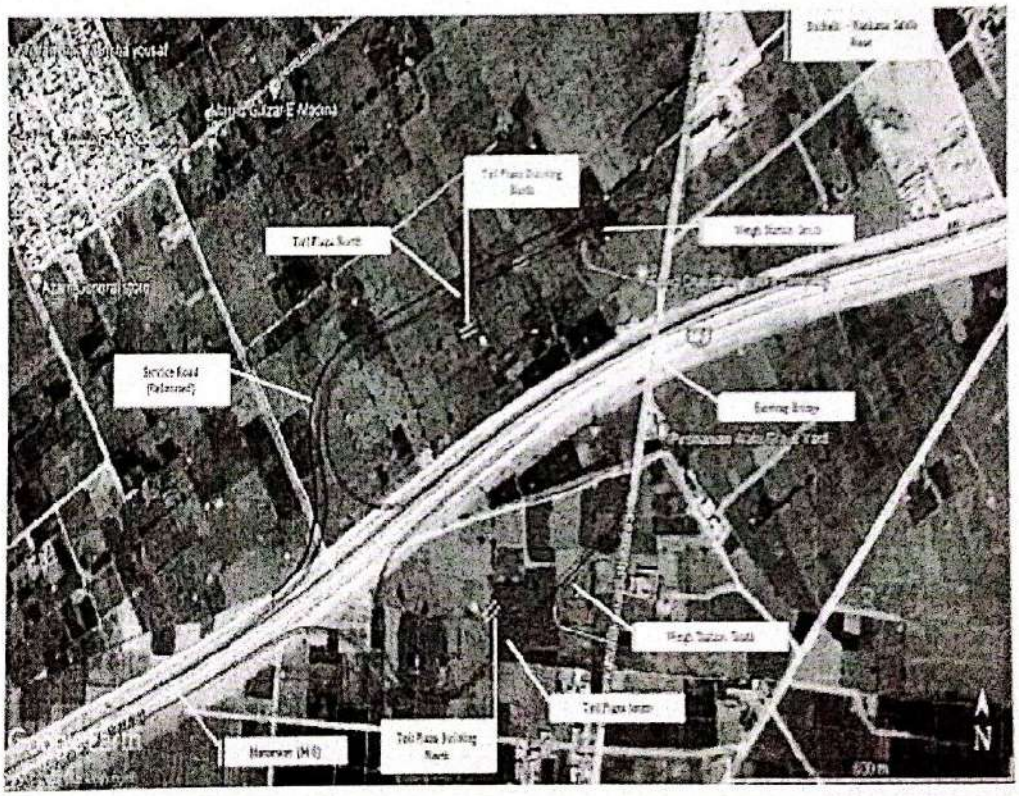


Figure 4-1: Aerial View of Proposed Diamond Interchange (Opposite Quadrants)

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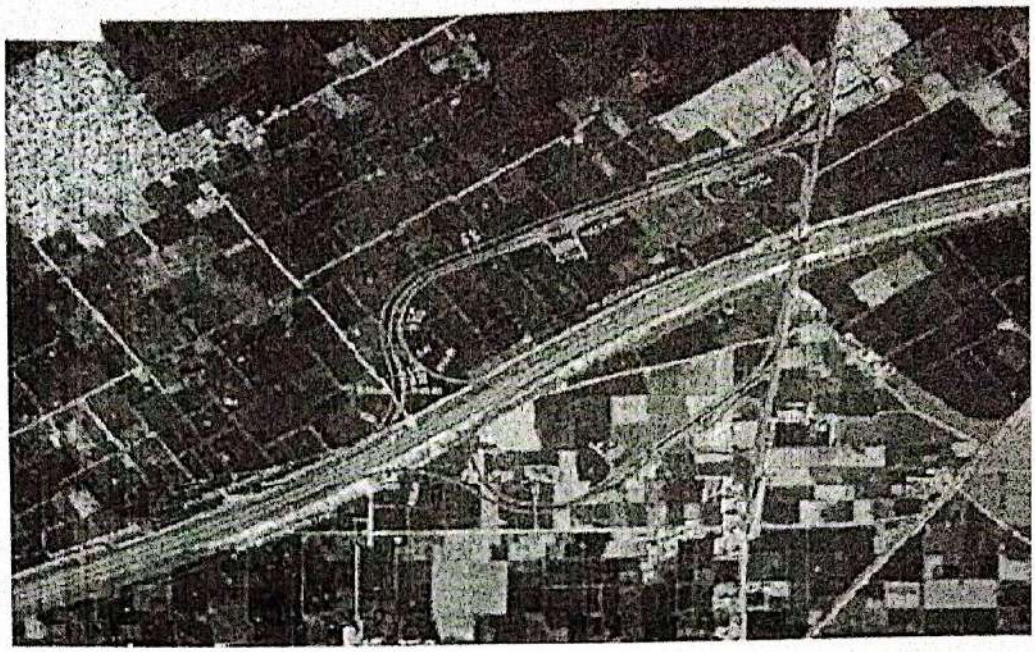


Figure 4-2: Layout Plan Of Proposed Diamond Interchange (Opposite Quadrants)

4.2.2 Alternative-2: Diamond Interchange (Diagonal Quadrants)

A simple Diamond Interchange with Diagonal Quadrants can be constructed to provide accessibility to the local population through the existing Bucheki – Nankana Sahab Road. At an intersection point of Bucheki – Nankana Sahab Road with Motorway (M-3); the existing Road shall be connected through interchange entry and exit ramps on the North and South of the Motorway (M-3). A flyover bridge is already available and Motorway (M-3) overpasses the existing Bucheki – Nankana Sahab RoadTwo numbers of Toll Plazas along with the buildings are to be constructed. The following figures show the proposed plan for Diamond Interchange (Diagonal Quadrants).

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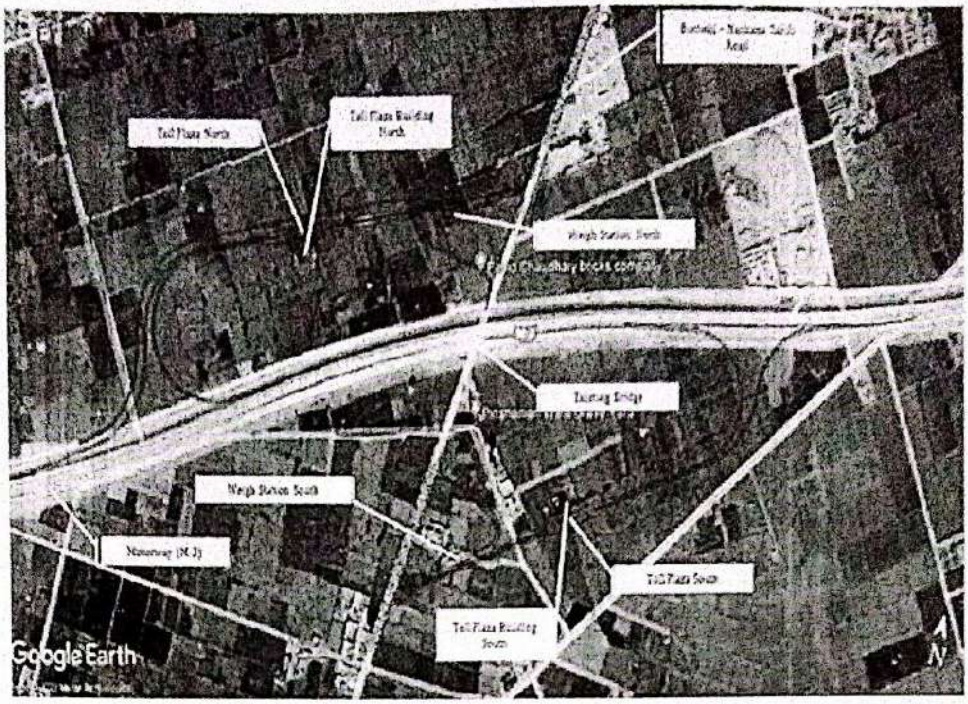


Figure 4-3: Aerial View of Proposed Diamond Interchange (Diagonal Quadrants)

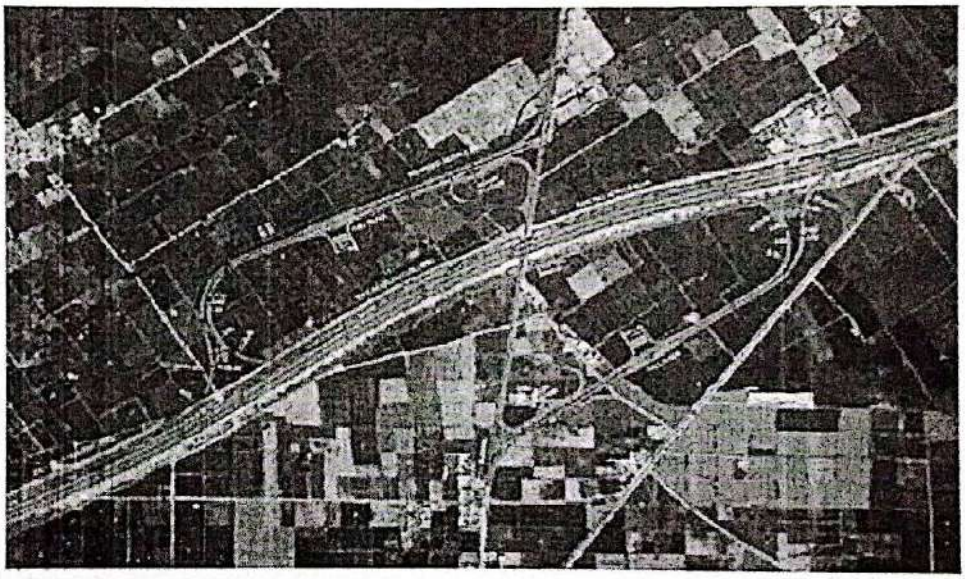


Figure 4-4: Layout Plan of Proposed Diamond Interchange (Diagonal Quadrants)

4.2.3 Alternative-3: Trumpet Interchange

A Trumpet Interchange can also be considered to provide accessibility to the local population through the existing Bucheki – Nankana Sahab Road. At an intersection point of Bucheki – Nankana Sahab Road with Motorway (M-3); the existing Bucheki – Nankana Sahab Road shall be connected through interchange entry and exit ramps on the South of the Motorway (M-3). A new flyover bridge shall be required to

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connect the interchange loop with the existing Bucheki – Nankana Sahab Road. The following figures show the proposed plan for Trumpet Interchange:

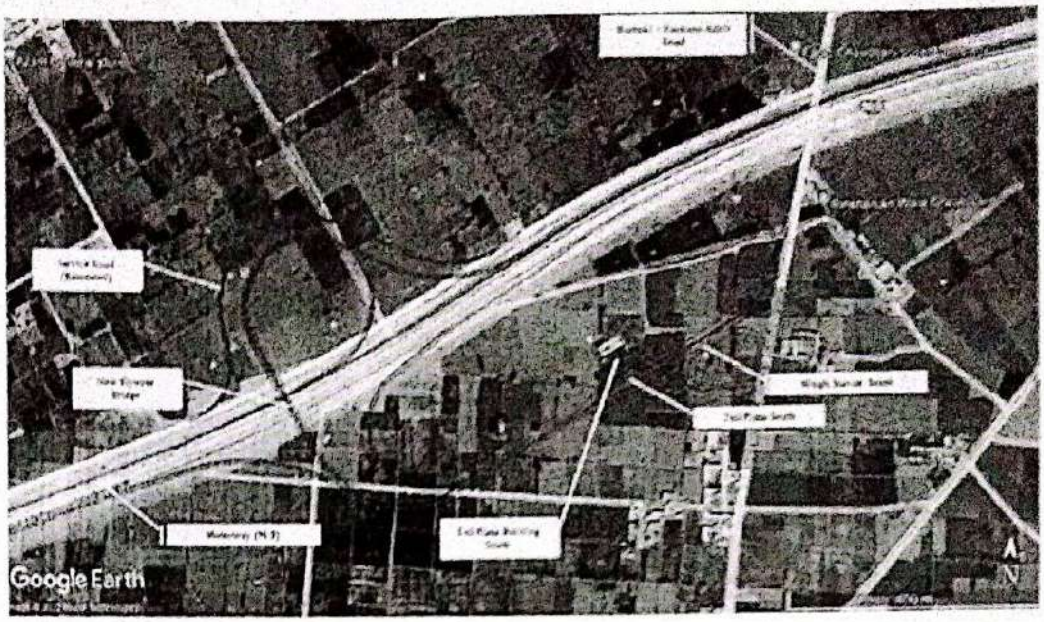


Figure 4-5: Aerial View Of Proposed Trumpet Interchange



Figure 4-6: Layout Plan of Proposed Trumpet Interchange

4.2.4 Alternative-4: Diamond Interchange (Opposite Quadrants)

A simple Diamond Interchange with opposite Quadrants can be constructed to provide access to the local population through the existing Bucheki – Nankana Sahab Road. At an intersection point of Bucheki – Nankana Sahab Road with Motorway (M-3); the existing Road shall be connected through interchange entry and exit ramps on the North and South of the Motorway (M-3).

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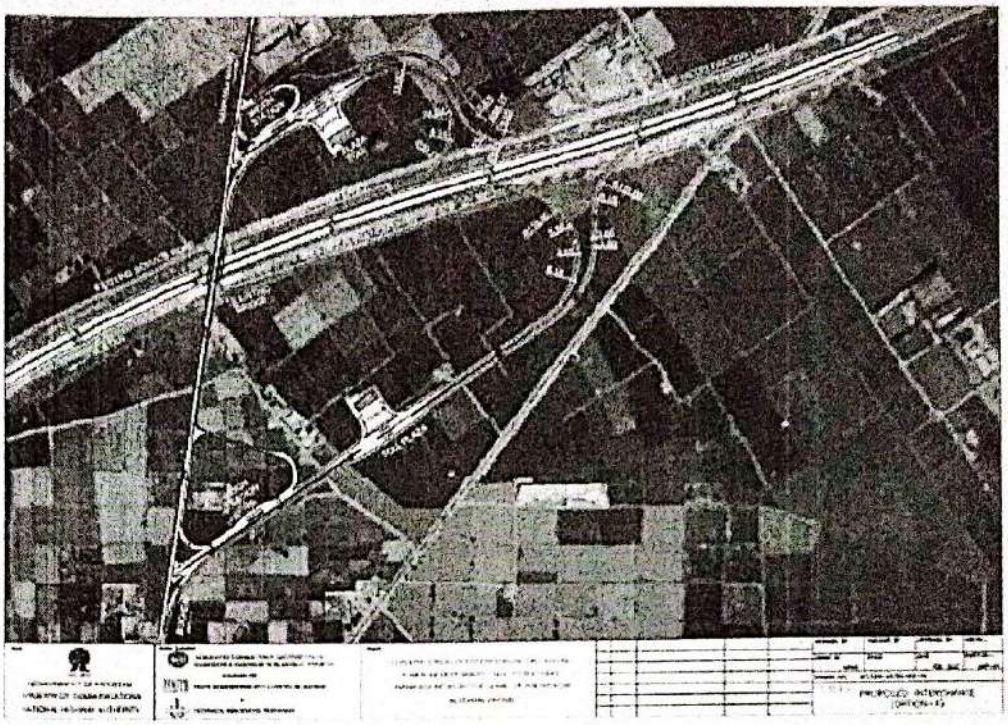


Figure 4-7: Layout Plan of Proposed Diamond Interchange

Comparative analysis of silent features of three proposed alternatives are summarized in Table 4.1

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Table 4-1: Comparative Analysis of Silent Features of Four Alternatives

Alternative-1: Diamond Interchange (opposite quadrants)	Alternative-2: Diamond Interchange (diagonal quadrants)	Alternative-3 Trumpet Interchange	Alternative-4: Diamond Interchange (opposite quadrants)
A diamond interchange having entry and exit ramps on either side of the motorway (M-3).	A diamond interchange having entry and exit ramps on either side of the motorway (M-3).	A trumpet interchange has entry and exit ramps on one side of the motorway (M-3).	A Diamond Interchange has entry and exit ramps on either side of the Motorway (M-3).
Loops and legs are provided in opposite quadrants	Loops and legs are provided in diagonal quadrants.		Loops and Legs are provided in opposite quadrants.
The design speed of interchange loops and legs will be 60 km/hr.	The design speed of interchange loops and legs will be 50-60 km/hr.	The design speed of interchange loops and legs will be 50 km/hr.	The design speed of interchange loops and legs will be 50 km/hr.
The minimum curve radius is 125 meters.	The minimum curve radius is 115 meters.	The minimum curve radius is 100 meters	The minimum curve radius is 90 meters.
Lengths of acceleration and deceleration lanes are provided as per AASHTO standards.	Lengths of acceleration and deceleration lanes are provided as per AASHTO standards.	Lengths of acceleration and deceleration lanes are provided as per AASHTO standards.	Lengths of acceleration and deceleration lanes are provided as per AASHTO standards.
The existing service road on the	The existing service road on the	The existing service road on the	The existing Service Road on the

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north side of M-3 is relocated to a 1.35 km length	north side of M-3 is relocated to a 1.35 km length	north side of M-3 is relocated to a 0.82 km length	North side of M-3 is relocated in 572m length.
Existing motorway bridge over Bucheki – Nankana sahib road is utilized for the proposed new interchange without extension.	Existing motorway bridge over Bucheki – Nankana sahib road is utilized for the proposed new interchange without extension.	A new flyover bridge over M-3 is provided for the proposed new interchange.	The existing Motorway Bridge over Bucheki – Nankana Sahib Road is utilized for the proposed new interchange without extension
Two numbers of toll plazas along with the buildings to be constructed	Two numbers of toll plazas along with the buildings to be constructed	One number of toll plazas along with the building to be constructed.	Two numbers of Toll Plazas along with the buildings are to be constructed.
Two numbers of weigh stations are to be provided	Two numbers of weigh stations are to be provided.	One number of weigh stations to be provided	Two numbers of Weigh Stations are to be provided.
Estimated construction cost including land acquisition is Rs. 1,332 million	Estimated construction cost including land acquisition is Rs. 1,484 million	The estimated construction cost along with land acquisition is Rs. 1,647million	The estimated construction cost including Land Acquisition is Rs. 1,171 million
NHA CSR 2022 rates of District Nankana Sahab are applied for the tentative cost estimation.			

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4.3 RECOMMENDED ALTERNATIVE

Based on the silent features of all four alternatives and cost comparison, being economical and easy to negotiate by the traffic, the alternative-4 i.e., Diamond Interchange (Opposite Quadrants) is recommended for the consideration of the competent authority of NHA.

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5 DESCRIPTION OF THE PROJECT

5.1 TYPE AND CATEGORY OF THE PROJECT

The proposed interchange is located near Nankana Sahib Interchange on M-3 at the intersection point of Bucheki and Nankana Sahib Road. The proposed interchange is located at a distance of 10 Km approx. from the Nankana Sahib Interchange and 26 Km approx. from the Jaranwala Interchange.

According to the Punjab Environmental Protection (Amendment) Act 2012 and its interpretation as per the Review of IEE & EIA Regulations, 2022 for filing, review, and approval of environmental assessments, the present project is categorized under Schedule II. Regulation 4 states that "A proponent of the project falling in any category specified in schedule II shall file an EIA". The following projects relating to the transport sector fall in Schedule II

This Environment Impact Assessment (EIA) has been prepared for National Highway Authority (NHA) by Associated Consultancy Centre (Pvt.) Ltd. Islamabad, in a joint venture with Finite Engineering (Pvt.) Limited, Islamabad & Technical Associates Peshawar (Sub Consultant) to address the environmental impacts of the proposed project. This study covers the impacts of the Construction of the Interchange on the Lahore – Karachi Motorway (M–3) at Bucheki – Nankana Road. in the Name of Rai Mansab Ali Khan Kharal.This report has been prepared to meet compliance with environmental regulations and requirements under Punjab Environmental Protection Act(amendment) 2012.

5.2 PROJECT OBJECTIVES

The objectives of the project are:

- The construction of the interchange is intended to provide access for locals to the surroundings of the Lahore Karachi Motorway and more efficient passage to various cities of Punjab.
- After the construction of the interchange, smooth traffic flow will be possible to a great extent.
- Vehicle operating costs will be reduced for existing traffic using the bypass road;
- Traveling time will be saved.
- Job opportunities will be created for local people in surrounding areas.

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- To meet national highway safety standards, Road furniture, markings, and traffic signs are further elements to improve the overall standard of this highway section.

5.3 PROJECT DETAILS

The project will be financed by the Government of Pakistan through PSDP 2022-23 through separate head/allocation. The design speed of the M-3 Lahore Abdul Hakeem Motorway is 120 Km/hr. and posted speed limit is also 120 Km/hr. The following table shows the existing interchange locations on M-3 Lahore Abdul Hakeem Motorway.

Table 5-1: Existing Interchange Locations on M-3 Lahore Abdul Hakeem Motorway

Interchange	Junction	Location
M-2	1	Sagian
Sharaqpur Sharif	2	Nazir Labana
Nankana Sahab	3	Mangtanwala Rd
Jaranwala	4	Syedwala
Samundri	5	Tandlianwala Rd
Rajana	6	Rajana - Chichawatni Road
Pir Mahal	7	Shorkot Road
Abdul Hakeem	8	M-4

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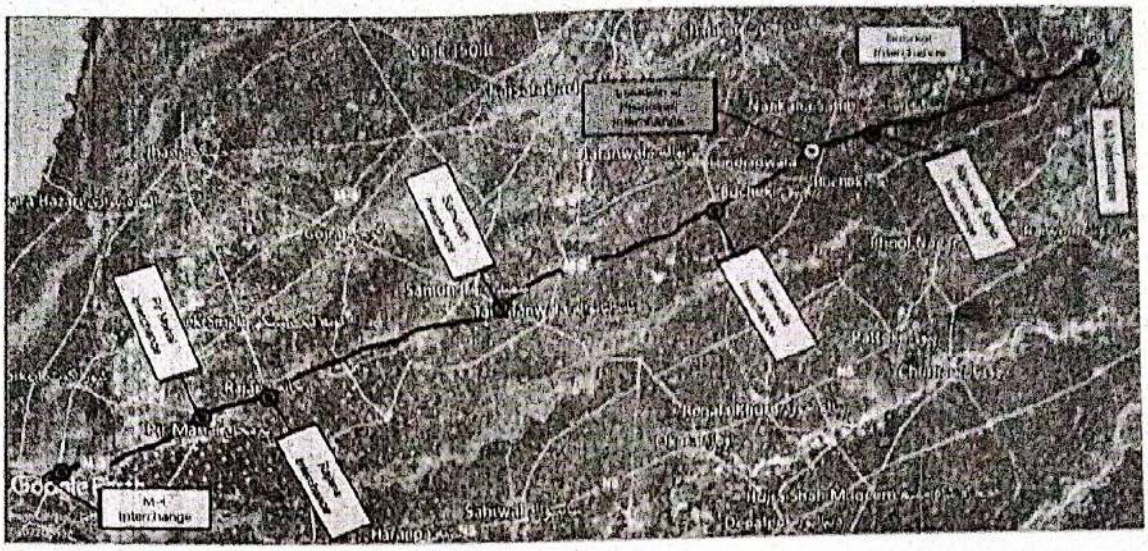


Figure 5-1: Location of Proposed Interchange on M-3 Lahore Abdul Hakeem Motorway

5.4 PROJECT SCOPE OF WORK

The project "Feasibility Study and Detail Design for Construction of Interchange on Lahore Karachi Motorway (M-3) at the intersection of the point of Bucheki – Nankana Road in the name of Rai Mansab Ali Khan Kharal''.

The scope of work of the assignment has been defined in the TOR as per the following details:

Table 5-2: Project Scope of Work as per TOR

Project Name	Construction of Interchange on Lahore – Karachi Motorway (M-3) at Bucheki – Nankana Road in the Name of Rai Mansab Ali Khan Kharal
Design & Posted Speed of Motorway (M-3)	120 km/hr.
Design Speed	40-60 km/hr.
No of Lane	2 Lanes
Carriageway Width	7.3 m (Legs)

5.5 ACQUISITION OF LAND

The existing Motorway Bridge over Bucheki – Nankana Sahib Road is utilized for the proposed new interchange without extension and the existing Service Road on the North side of M-3 is relocated in 572m length.The land acquired for the construction of an

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interchange at Bucheki – Nankana Sahab Road to connect Bucheki, Nankana Sahab, and surrounding areas with the Motorway (M-3).and other structures of the project as per design standards/site requirements. The cost of the land acquired for the interchange is 83,698,668 PKR.

5.6 LAND USE ON THE SITE

The route of the M-3 Motorway runs almost parallel to River Ravi although the river might not be seen easily anywhere along this motorway. Attention has been paid to the arrangement and type selection of interchange and reasonable spacing will be kept, to improve the operation level and investment benefit. The project once completed will provide a good link to the towns and villages along the alignment as well as prove to be advantageous for the freight traffic moving goods, products and material from the factories.

5.6.1 Proposed Interchange Location

M-3 Motorway is a 6-lane controlled access highway with 3 rest areas along the route. The route of the M-3 Motorway runs almost parallel to River Ravi although the river might not be seen easily anywhere along this motorway. M-3 Motorway (Lahore to Abdul Hakeem Motorway) has 3 Railway Line Bridges.

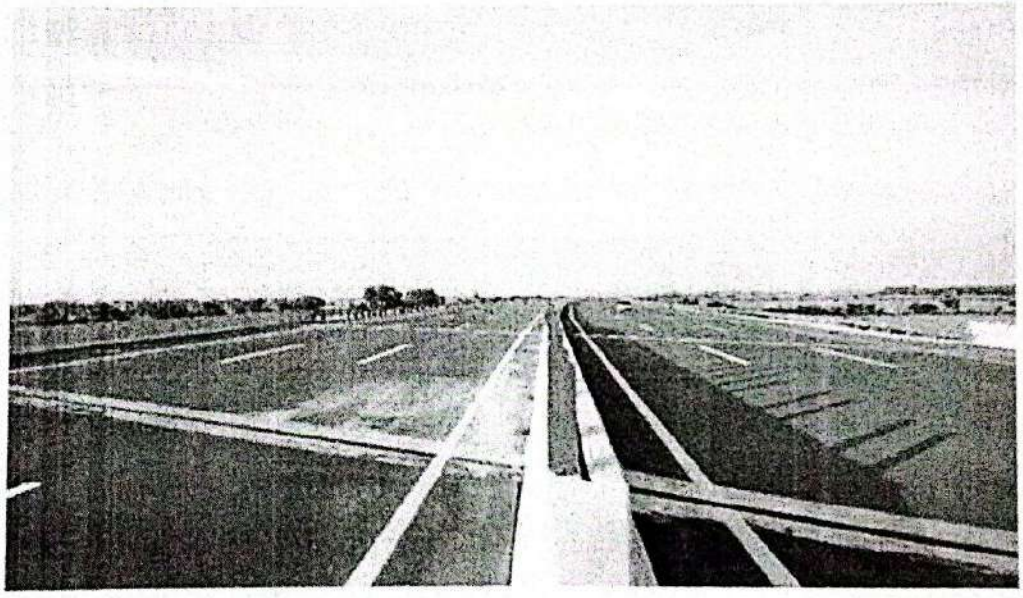


Figure 5-2: Lahore Karachi Motorway (M-3)

Currently, there are two existing interchanges in the vicinity of Nankana Sahib

and surrounding towns namely Nankana Sahib Interchange and Jaranwala Interchange, both interchanges are located approximately 35 Km apart. NHA has planned to construct

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a new Interchange on M-3 to provide access for locals of towns and surroundings areas located between Nankana Sahib and Jaranwala Interchanges

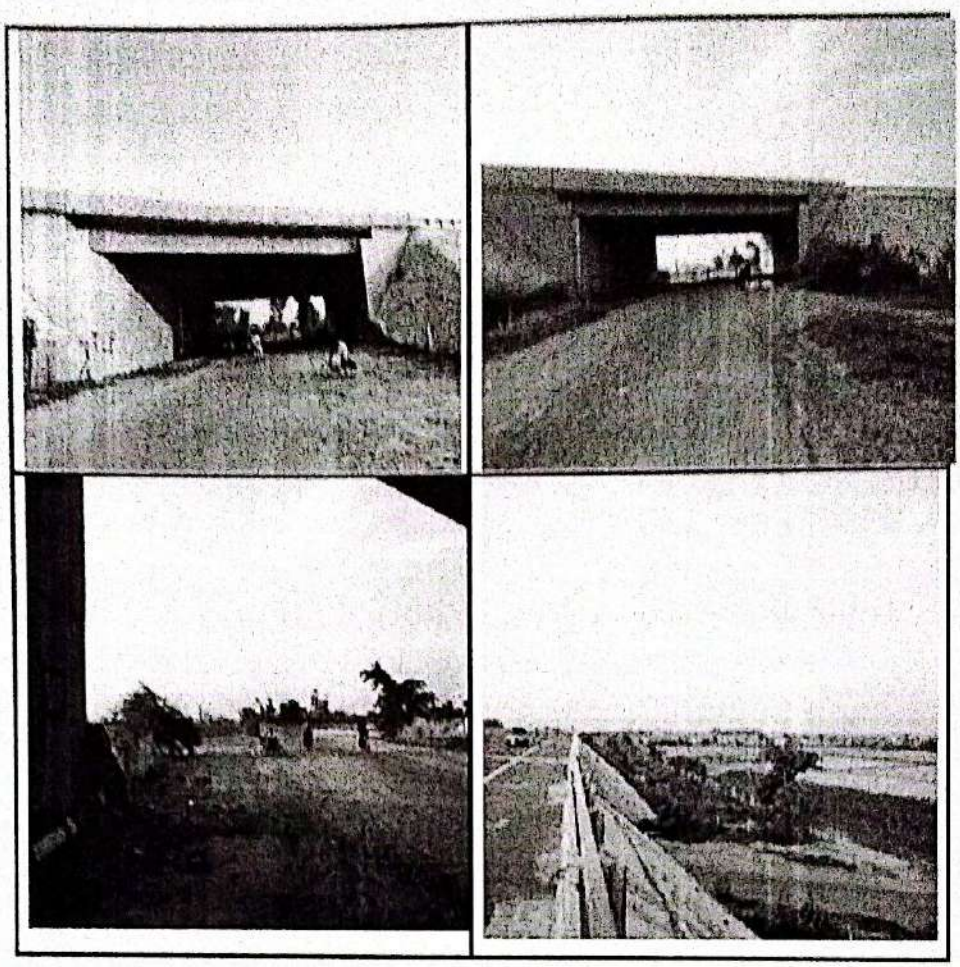


Figure 5-3: Proposed Location For Interchange on M-3 at Bucheki Nankana Road

5.7 ROAD ACCESS

The proposed project comprises of construction of an interchange on the Abdul Hakeem – Lahore Motorway (M-3) at Bucheki – Nankana Sahab Road to connect Bucheki, Nankana Sahab, and surrounding areas with the Motorway (M-3). The existing Motorway Bridge over Bucheki – Nankana Sahib Road will be utilized for the proposed new interchange without extension. Due to the construction of the interchange as per NHA standards, the capacity of the highway will be enhanced.

5.8 VEGETATION FEATURES OF THE SITE

The existing Motorway Bridge over Bucheki – Nankana Sahib Road will be utilized for the proposed new interchange without extension. Some scarce grasses, shrubs, and trees of non ecological importance are exist along the road. If a tree of rare species is growing within the ROW and is required to be removed. It will not be filled but uprooted and

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transplanted in close consultation with the forest department.

5.9 COST OF PROJECT

The cost has been estimated based on the NHA Composite Schedule of Rates 2022(Dist Pakpattan). Detailed Cost Estimates are provided below

Table 5-3: : Estimated Breakup Cost of Proposed Project

Bill No.	Description	Total Amount (Rs)
1.	Earth Work	125,655,362
2.	Sub-Base and Base Course	191,217,610
3.	Surfacing and Pavement	87,767,925
4.	Structures & Drainage Works	332,436,681
5.	Ancillary Works	132,012,411
6.	Miscellaneous Items	42,440,000
7.	Facilities	115,000,000
8.	Road Lighting	60,959,085
	Total Amount (Rs)	**1,087,489,574**
	Land aquisition	83,698,668
	Total cost	**1,171,188,242**

Financial Cost includes all the costs of the project while economic costs include all costs excluding the land acquisition cost.

Table 5-4: Cost of Construction (Rs Million)

ROAD	FINANCIAL	ECONOMIC
Bucheke Interchange	1171	995

5.10 PROJECT IMPLEMENTATION SCHEDULE

The construction of the proposed project is expected to be completed within a time period of one year. The construction of the proposed project will be executed after receiving of all relevant NOCs

5.11 FEATURES OF THE PROJECT

5.11.1 Project Alignment

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The project comprises of construction of an interchange on the Abdul Hakeem – Lahore Motorway (M-3) at Bucheki – Nankana Sahab Road to connect Bucheki, Nankana Sahab, and surrounding areas with the Motorway (M-3). The design speed of the M-3 Lahore Abdul Hakeem Motorway is 120 Km/hr. and posted speed limit is also 120 Km/hr.

The interchange will connect Bucheki, Nankana Sahab, and surrounding areas with the Motorway (M-3) in the project-influencing area and consistently drive the development of adjacent cities and towns.

In the plan design, the factors such as geological conditions, roads, and requirements for environmental protection will be taken into comprehensive consideration. The elements of alignment i.e., straight lines and circular curves will be used in an appropriate proportion. The values of technical indexes of plan and profile alignments will be balanced and reasonably coordinated. Visually, the alignment would naturally guide the driver's sight and keep visual continuity and generally, the alignment will smooth. The horizontal alignment will be designed at the center however vertical profile (FGL) will be designed at the edges of the New Jersey Barrier on both sides.

The project is to be financed by the Government of Pakistan through the Public sector Development Programme (PSDP) 2022-23 through separate head/allocation. Typical cross sections for the proposed project are shown in the figures below(5.4, 5.5 & 5.6).

5.11.2 Super-Elevation Arrangement

Main route: The design elevation is the elevation of the median strip edge (edge of Jersey barrier); no superelevation is set on the main route within the scope of interchange and the radius of horizontal curvature has been kept greater than 4770 meters at a design speed of 120 km/hr. however, super-elevation has been designed for the curve radius less than 4770 meters outside the scope of interchange as per AASHTO requirements.

Ramps: The design elevation is the elevation of the centerline. The design elevation of the section is placed at the median strip edge, and the superelevation rotates around the median strip edge. Super-elevation has been designed for the curve radius of less than 738 & 1440 meters respectively at the design speed of 40-60 km/hr. The transition of the ramp super elevation is designed in linear gradient mode.

Intersected road: The design elevation is the elevation of the setting-out centerline. The calculation formula for the cross slope at any point within the super-elevated transition section is:

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$i = i0 + \Delta i \times l / L$

Where:

i = Cross slope at any point within the transition section

i0 = Cross slope at the start point of the transition section

Δi = Algebraic difference of cross slopes at the end and start point of the transition section

l = Distance from any point within the transition section to the start point of the transition section

L = Total length of the transition section

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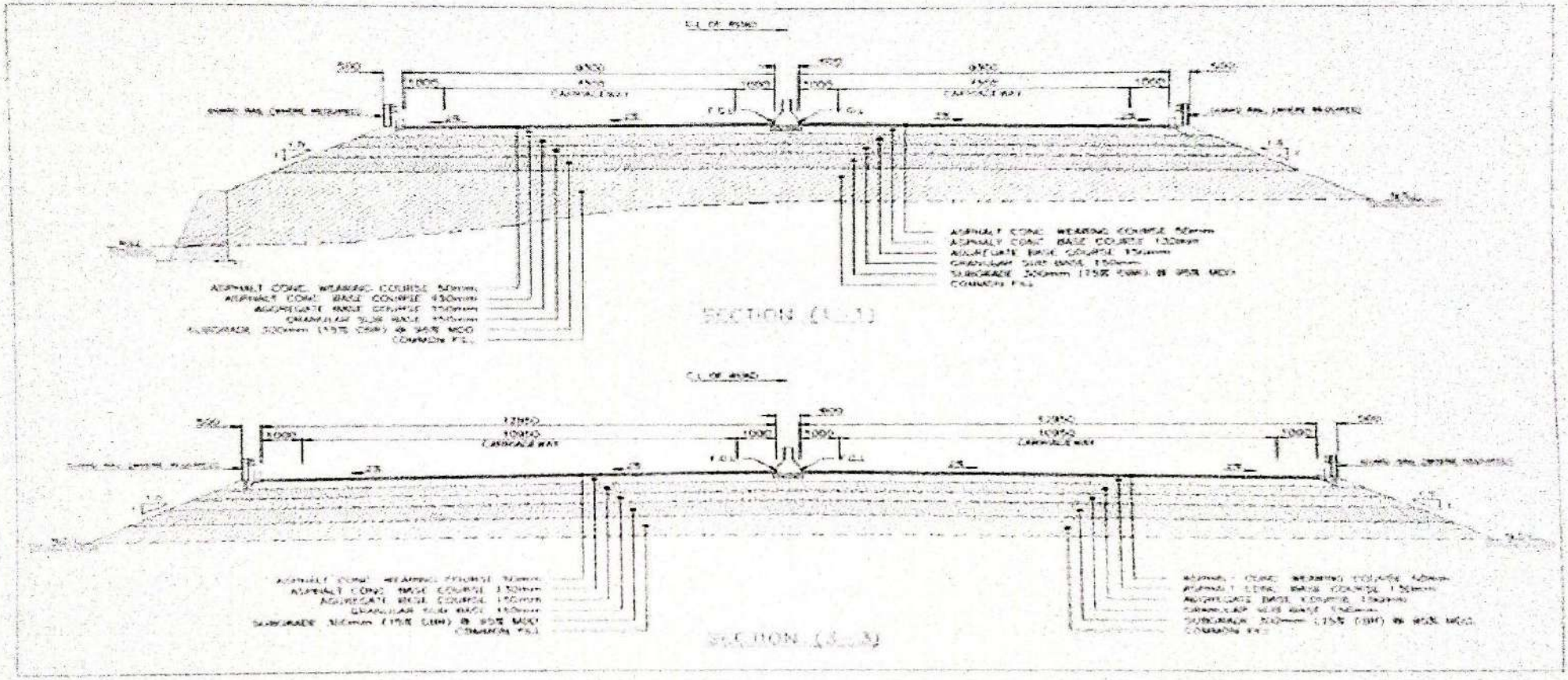


Figure 5-4: Typical cross section (section 1-1) and (section 3-3)

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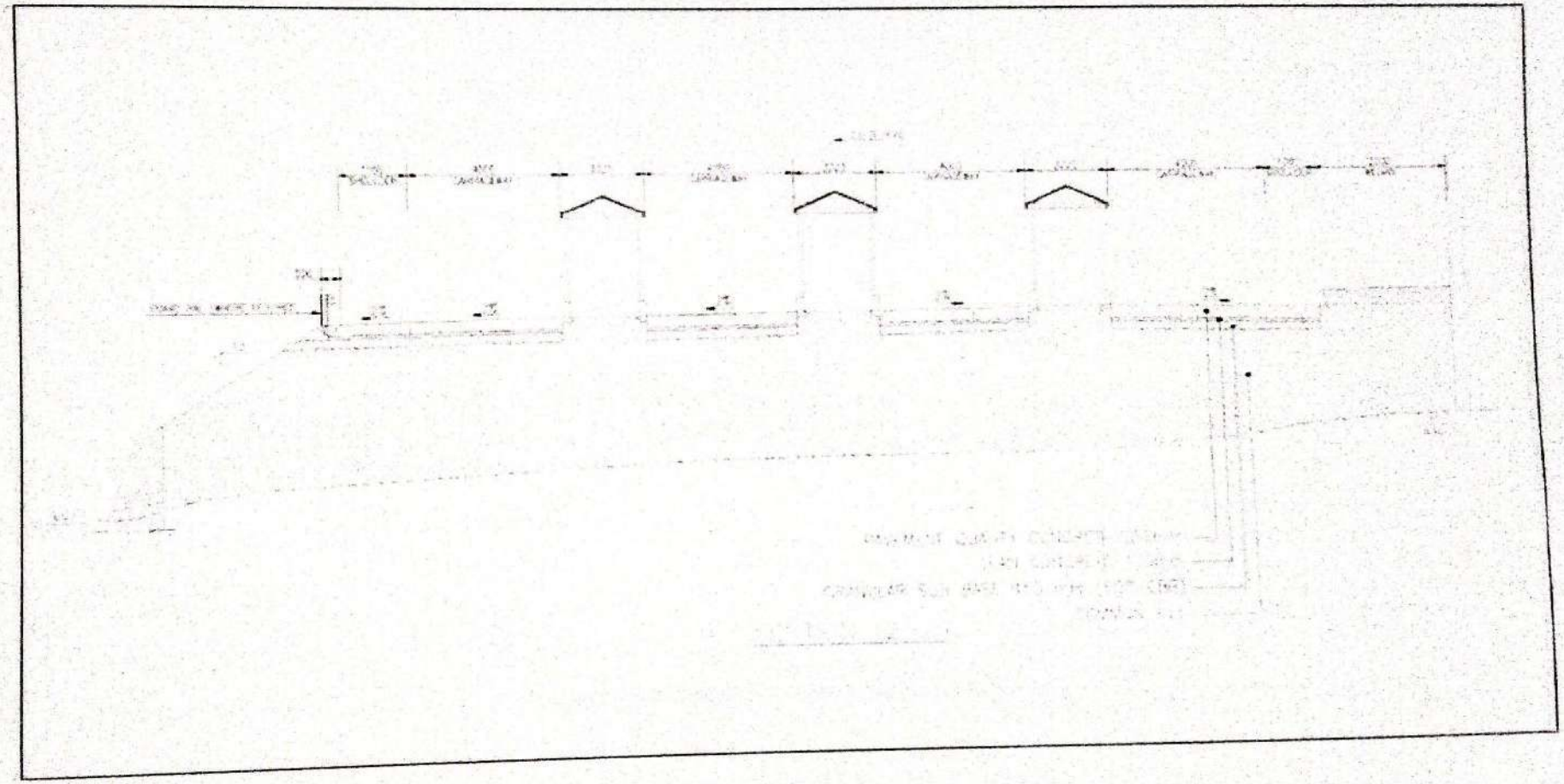


Figure 5-5: Typical cross section (section 2-2)

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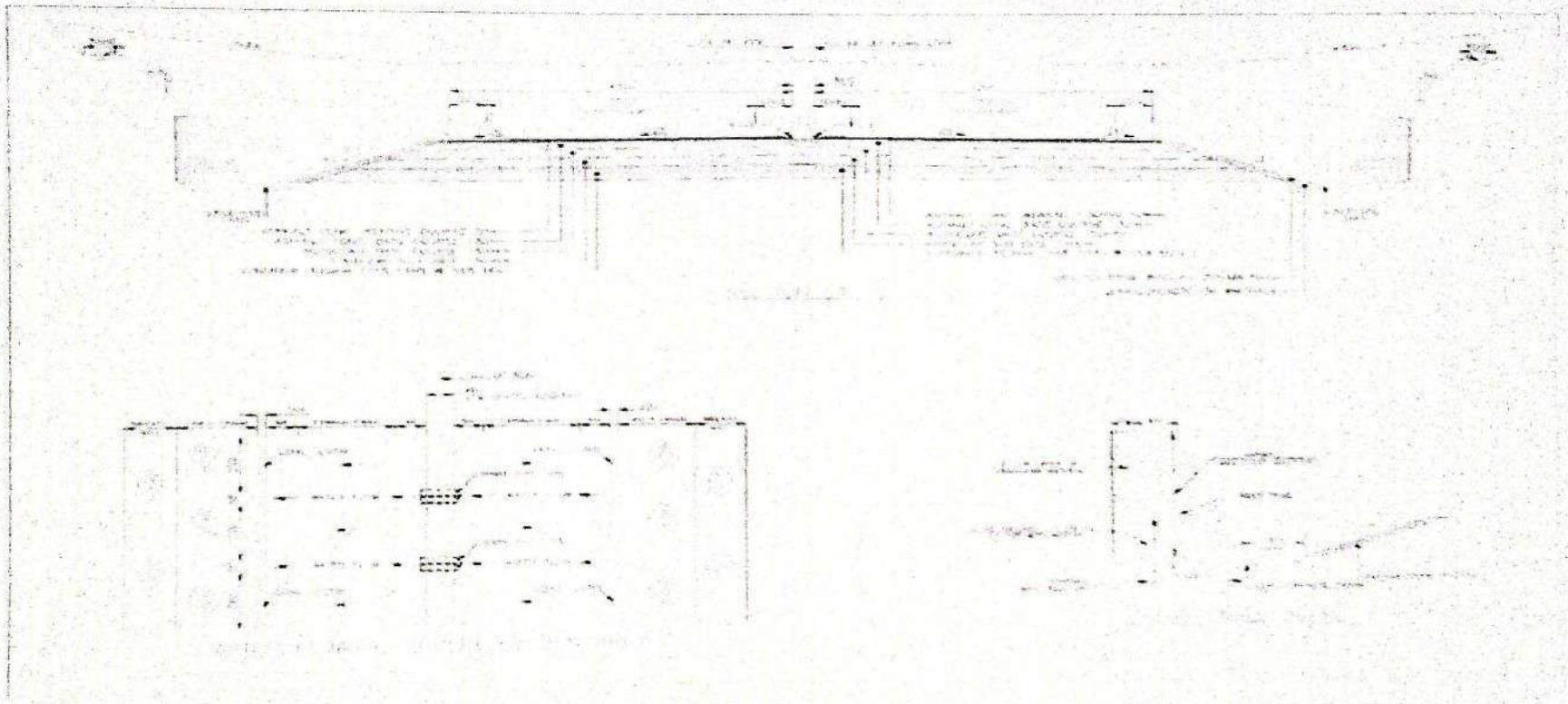


Figure 5-6: Typical cross section (section 2-2)

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5.11.3 Structure Design Standards

The design criteria adopted are in accordance with the recommendations of the National Highway Authority and the following design standards and policies have been adopted.

Table 5-5: Design Standards

Sr. #	Description	Design Code/Standard
1	Geometric Design	American Association of State Highway and Transportation Officials (AASHTO): A policy on Geometric Design of Highways and Streets (Latest Edition)
2	Analysis and Design of Structures	AASHTO - LRFD current edition, ASTM, ACI Code, Pakistan Highway Code of Practice for Bridges 1967 WPHC-67, UBC/IBC 2003 and Seismic Zone Mapping of Pakistan
3	Pavement Design	ASSHTO Guide for Design of Pavement Structures (1193) and TRL Overseas Road Note 31 (1993) for the design of pavements.
4	Drainage Design	Highway Drainage Guidelines By AASHTO (Latest version)
5	Roadside Design	AASHTO Road Side Design (Latest version)
6	Lighting	Roadway lighting design guide by AASHTO (latest version)
7	Design of Traffic Control Devices, Work Zone Safety, and preparation of Maintenance & Protection of Traffic (MPT) Plan	As per the latest published version of "Manual of Uniform Traffic Control Devices (MUTD)" by FHWAUSA
8	Testing and Specifications of	ASTM, AASHTO, NHA General Specifications,

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	Material	etc
9	Capacity Analysis and Level of Service Analysis	Highway Capacity Manual by the United States Transportation Research Board (2000) or the latest
10	Engineer's Estimate	As per the Prevailing CSR of NHA
11	Bidding Documents	As per requirement of Pakistan Engineering Council & NHA

5.11.4 Geometric Design Of Interchange

The geometric design of the interchange will be carried out in accordance with the AASHTO Policy on Geometric Design of Highways and Streets (latest version). The following details will be adopted during the geometric design:

- Plans and profiles at scales 1/1000 (H) and 1/200 (V) will be prepared for the interchange and side roads showing reference lines, edge lines, setting out data, curve radius, and data, gradients, ground, and finished levels, cross falls, superelevation application, and locations of crossing facilities such as bridges, underpasses, tunnels, culverts, and other structures.
- A Traverse plan (at an appropriate scale) showing the location, setting out, and levels of all traverse points and control stations will be prepared.
- Computer-generated horizontal and vertical geometric data sufficient for setting out and for all geometric calculations will be prepared.
- Typical cross sections, interchange ramps, and side roads, including earthwork slopes and pavement details will be prepared.
- Details layout of junction areas, intersections, and any other areas of complex three-dimensional geometry with sufficient information for setting out will be prepared.
- Typical details of intersections, recovery lanes, areas of lanes widening, merging lanes, superelevation application, and any other information necessary for setting out will be generated
- Expropriation plans (scale 1:2000) showing the limits of road work, and ROW will be prepared and marked on the drawings.

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4. Guardrail and fencing plans (1:1000 scale) showing the location, type, and terminal details of all proposed guardrails, New Jersey barriers, fencing, and right-of-way monuments will be prepared.

The Design Codes to be referred to for detailed design are as follows:

Geometric Design:

AASHTO: American Association of State Highway and Transportation Officials – A Policy on Geometric Design of Highways and Streets 2011 Version

Traffic Markings and Road Signs, etc.

NTRC:National Transport Research Centre / Highway Code / AASHTO

A Summary of Geometric Design Standards is tabulated as under:

Table 5-6Summary of AASHTO Geometric Design Standards

Sr. No.	Design Elements	Units	Interchanges
1	Design Speed	Km/h	40-60
2	Minimum Stopping Sight Distance	meter	50-85
3	The maximum rate of super-elevation	%	6
4	Horizontal Curvature		
	(i) Absolute Minimum Radius	meter	43-123
	(ii) Radius above which no super-elevation is required	meter	738-1440
5	Road Formation Width	meter	8.15
6	Carriageway Width	meter	3.65
7	Shoulder Width	meter	Inner = 1.0 Outer = 3.5 Earthen = 0.5

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8	Cross Fall Slope	%	Carriageway = 2.0 Outer Shoulder = 2.0
9	Maximum Grade	%	6
10	Minimum Grade	%	In Fill 0.3% & In Cut 0.5%
11	Rate of Vertical Curvature K Value		
	(i) K Value for Crest Vertical Curve	L/A	>4-11
	(ii) K Value for Sag Vertical Curve	L/A	>9-18
12	Fill Slope		
	(i) 0.0 m – 3.0 m Fill Height	H: V	2:1
	(ii) >3.0 m Fill Height	H: V	1.5:1
13	Minimum Vertical Clearance	meter	5.5
14	Right of Way (ROW)	meter	50

5.11.5 Evaluation Criteria

- Cost-effectiveness, user efficiency, geometric standards, environmental aspects
- Accessibility to the influenced area
- Level of connectivity with existing principal arterial road network

5.11.6 Evaluation Criteria for Selecting Optimal Alignment

- Connectivity in light of arterial road network between two cities
- Minimization of severance among existing neighboring villages and public complaint
- Cost-effectiveness, constructability, and maintenance of the road section that traverses through the Caucasus mountain range
- Minimization of environmental impact and benefits of local public
- Minimization of interference with existing structures and utilities
- Harmonization with high-rank development plans
- Type and location of junctions and intersections

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- Effective connection to the existing or future road network

5.11.7 Installation of Right of Way Markers

The consultant will install the ROW markers if instructed by NHA. The ROW markers will be installed at an interval of 100m on straight portions of alignment and 50 m on a curve.

5.11.8 Design Standards & Criteria for Highway Structures

- American Association of State Highway and Transportation Officials (AASHTO): A Policy on Geometric Design of Highways and Streets (1995) for Geometric Design;
- Highway Capacity Manual, by the United States Transportation Research Board for the analysis of roadway capacity;
- AASHTO: Guide for Design of Pavement Structures (1993) and TRL Overseas Road Note 31 (1993) for the design of pavements; and
- The design criteria adopted are in accordance with the recommendations of the National Highway Authority and the following design standards and policies have been adopted :
- Pakistan Highway Code of Practice for Bridges & ASTM for the analysis and design of structures.

5.12 TRAFFIC SURVEY ANALYSIS

Traffic Data Collection and projections thereof of traffic volumes are basic requirements for planning road development and management schemes. Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow periods, determine the influence of large vehicles on vehicular traffic flow, and vehicle hourly patterns, and document traffic volume trends and annual traffic estimates. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded.

The subject Traffic Study Report is intended to provide necessary input data for the determination of the magnitude and pattern of the traffic load for the project road. This involves the collection, verification, and analysis of the traffic data. From the collected data, the projected traffic for the design life is calculated and converted into Equivalent Standard Axle Loads (ESAL) for the structural design of pavement. M/s ACC has

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conducted a detailed traffic survey for 7 days on Lahore - Karachi Motorway M - 3 (at planned locations during December 2022.

5.12.1 Purpose Of Traffic Analysis

The primary objective of this traffic survey is to determine the current traffic plying towards Bucheki and Nankana, to evaluate the existing traffic pattern, and to estimate future traffic statistics on the proposed Interchange including calculation of traffic ESALs and capacity analysis.

5.12.2 Traffic and Axle Load Survey

The traffic survey will collect information on traffic by hour, vehicle type, and direction, using subcontractors. A traffic survey has been carried out by classifying non-motorized & motorized traffic in accordance with NTRC standards. The determination of Equivalent Single Axle Loads (ESAL) is one of the governing factors of pavement design. Therefore, it is imperative to derive a reasonably accurate measure of the magnitude frequency, and distribution of axle loads applied by heavy traffic faring on a road for a feasible design. The collected data for the Damaging factors based upon NTRC Axle Load Study Report 2020 for M-2 is as follows;

Table 5-7:Traffic and Axle Load Survey

Sr #	Axle Configuration	Code	Damage Factor	
			Road Note 40	AASHTO 1993
1	2 Axle Single	1.2	2.83	2.33
2	3 Axle Tandem	1.22	8.80	3.69
3	4 Axle Single Tandem	1.2-22	6.38	4.43
4	5 Axle Single Tridem	1.2-222	11.81	6.10

5.12.3 Classified Traffic Counts

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Traffic Counts have been carried out manually using traffic enumerators. Chief enumerator was stationed to overall review the quality of the traffic surveys. A detailed traffic survey has been carried out at the following locations during December – 2022.

Table 5-8:Traffic Counts

Sr.#	Location	Period
1	Nankana Sahib M-3 Toll Plaza South (L - 1)	7 days (24 Hrs) Traffic Count i/c 7 days OD Survey
2	Nankana Sahib M-3 Toll Plaza North (L - 2)	7 days (24 Hrs) Traffic Count i/c 7 days OD Survey
3	Bucheki Nankana Sahib Road (L - 3)	7 days (24 Hrs) Traffic Count i/c 7 days OD Survey

The traffic survey was stratified by vehicle type. The table lists the vehicle types counted during the traffic study:

Table 5-9: Traffic Survey Vehicle Types

Fast Moving Vehicles			
Sr.#	Vehicle Type	Sr.#	Vehicle Type
1	Motor Cycle/Rickshaw	7	Truck 2. Axle
2	Car/Taxi/jeep	8	Truck 3. Axle
3	Mini Bus	9	Truck 4. Axle
4	Large Bus	10	Truck 5
5	Pickup / Van	11	Truck 6 Axle
6	Mini Truck	12	Tractor Trolley

The location map of traffic count stations is provided in the Figure below:

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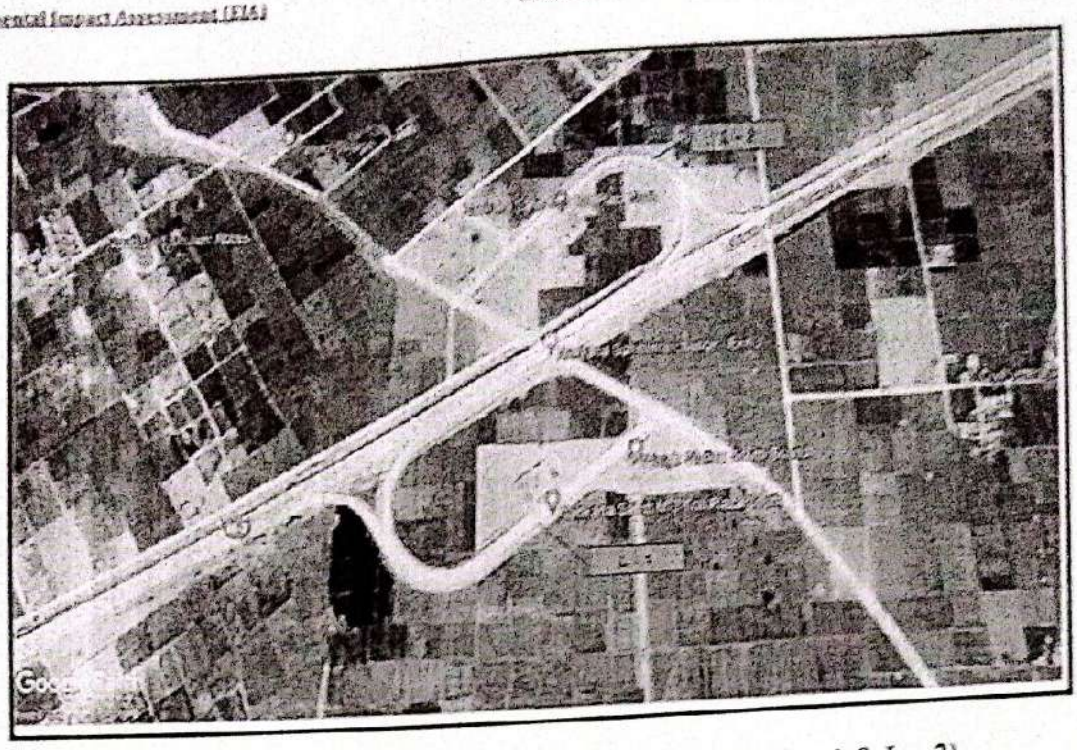


Figure 5-7: Location Map of Traffic Count Stations (L – 1 & L – 2)

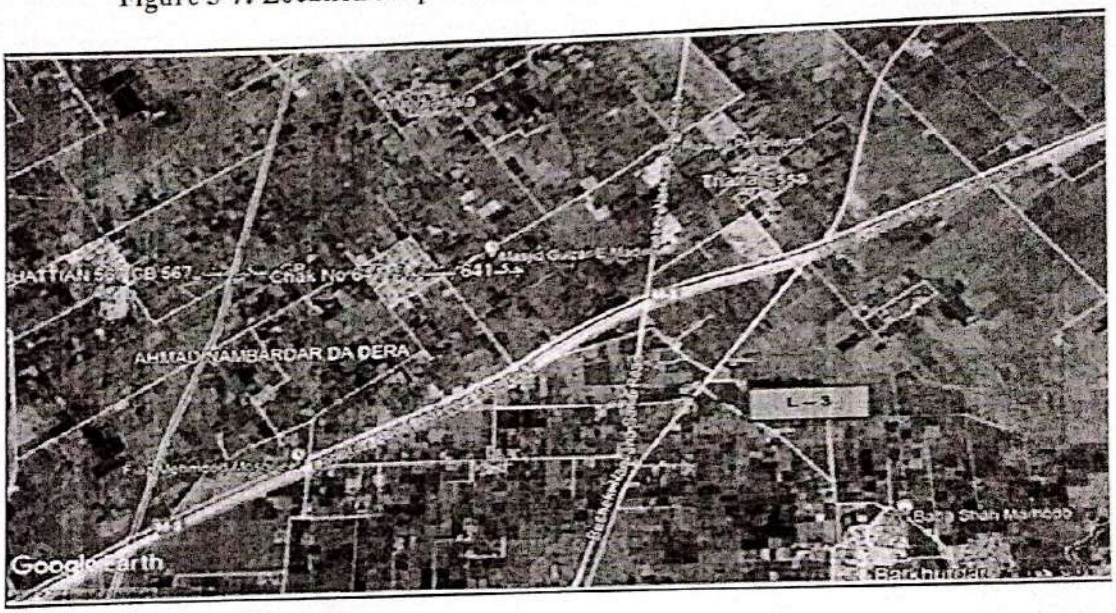


Figure 5-8: Location Map of Traffic Count Station (L – 3) – Bucheki – Nankana Road

5.12.4 Average Annual Daily Traffic (AADT) L – 1 (M-3 South)

The traffic counts were carried out in December – 2022 for seven days (7x24 hrs) to check the volume of traffic for the Construction of the Bucheki Interchange on M – 3. Types of Vehicles surveyed included cars, jeeps, passenger buses, and multi-axle trucks. The traffic counts were conducted for both directions at L - 1. The value of AADT in this section is 1,412 vpd.

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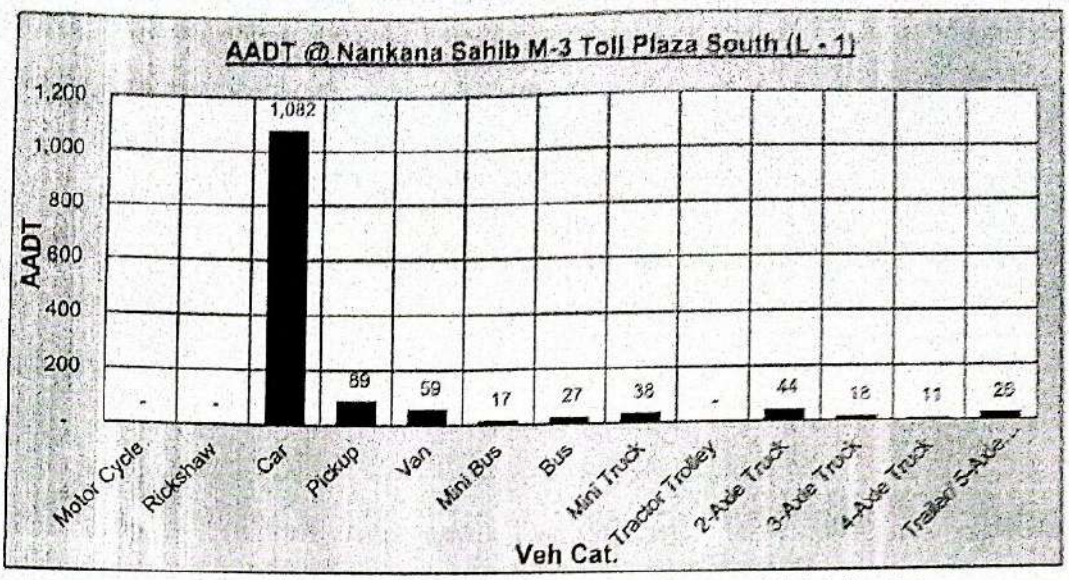


Figure 5-9: Average Annual Daily Traffic L – 1 (M-3 South)

5.12.5 Average Annual Daily Traffic (AADT) L – 2 (M-3 North)

The traffic counts were carried out in December – 2022 for seven days (7x24 hrs) to check the volume of traffic for the Construction of the Bucheki Interchange on M – 3. Types of Vehicles surveyed included cars, jeeps, passenger buses, and multi-axle trucks. The traffic counts were conducted for both directions at L - 2. The value of AADT in this section is 1,486 vpd.

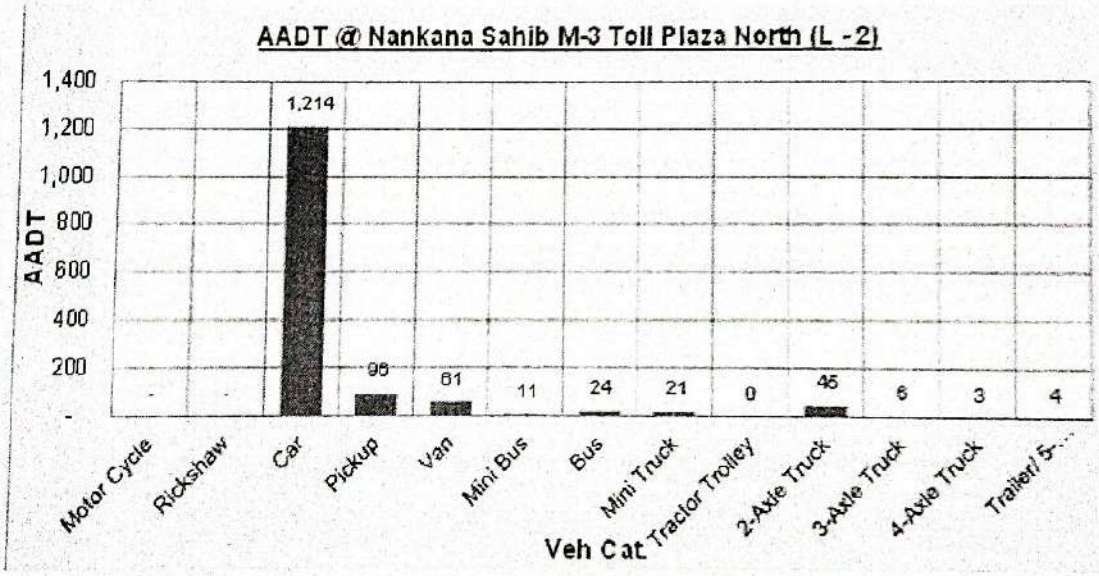


Figure 5-10: Average Annual Daily Traffic L – 2 (M-3 North)

5.12.6 Average Annual Daily Traffic (AADT)L – 3 (Nankana – Bucheki Road)

The traffic counts were carried out in December – 2022 for seven days (7x24 hrs) to check the volume of traffic for the Construction of the Bucheki Interchange on M – 3. Types of Vehicles surveyed included cars, jeeps, passenger buses, and multi-axle trucks.

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The traffic counts were conducted for both directions at L - 3. The value of AADT in this section is 5,123 vpd.

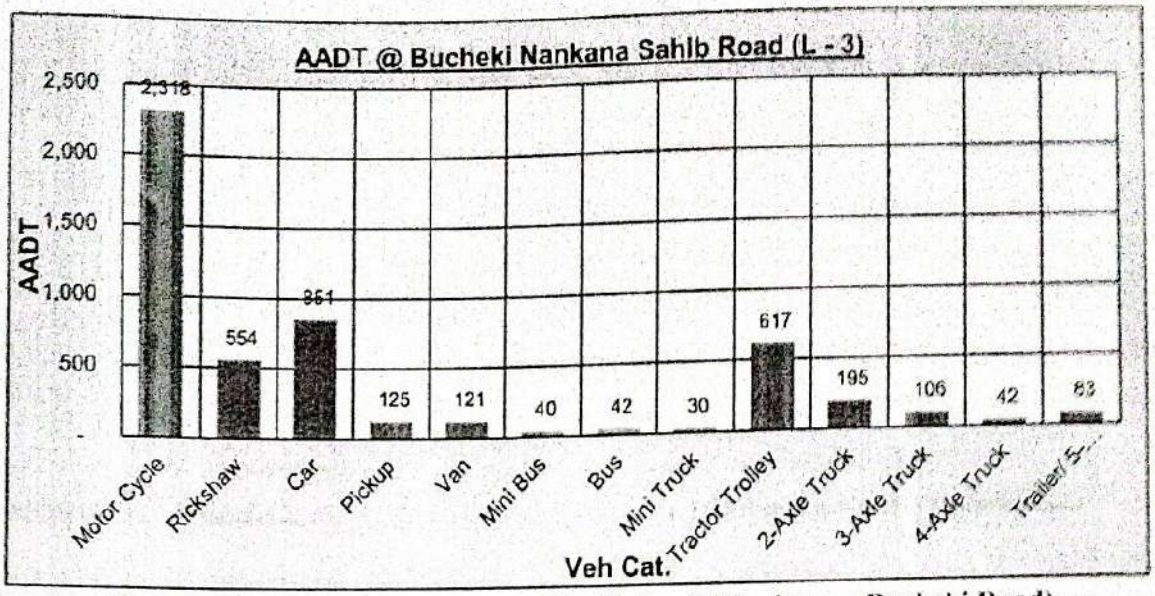


Figure 5-11: Average Annual Daily Traffic L – 3 (Nankana – Bucheki Road)

The above figures show that the maximum of the traffic constitutes of cars and other light vehicles followed by vans, pickups, minibusses, and trucks.

5.13 CONSTRUCTION MATERIAL.

The interchange/road will be constructed as a flexible pavement highway. The construction process involves base course preparation (using stone, slag/gravel, cement, asphalt coarse & fine aggregates, soil, water & other material) & compaction/grading, and the making of the final layer of hot asphalt mix (150-177 C) with further compacting, employing rolling at a speed of 5km/hr. Construction of the bridge on the Interchange will require iron and steel to make the structural support along with already described materials.

5.13.1 Availability of Construction Material

Steel will be obtained from local steel factories and bitumen from Attock oil refinery. However, cement can be obtained from local distributors or alternately transported directly from nearby cement factories, whichever proves more viable. Water will be used from nearby tube wells as well as groundwater in the project area is found acceptable for making and curing concrete

5.13.2 Soil Availability

A detailed Soil Survey was conducted on the construction site of the interchange on Bhucheki Nankana Road in M-3. Some of the fundamental physical properties of the soil

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encountered throughout the alignment of the proposed road have been analyzed. Overall the soils encountered along the project road are generally fair and may be utilized for embankment preparation of the project road.

5.14 WORKFORCE AND MACHINERY REQUIREMENT

Employment generation is a natural process of social development. Human beings bring with them into the world an array of needs that present employment opportunities for others to meet. The Employment hiring is purely based on merit and competency as well as sound technical and management skills to perform the project within the allocated time and budget. The director (environment) will be the overall incharge for handling NHA's obligations with respect to the EMP. The director (environment) will depute one deputy director (environment) for the project, who will be responsible for ensuring that the provisions of the EMP are implemented. Supervision consultant along with his team will supervise the project contractors to ensure quality of work and fulfilment of contractual obligations. The supervision consultant (SC) will provide one environmental specialist/ monitoring consultant (MC)

Table 5-10 Environment Health, And Safety Staff

Designation	No of Posts	Duration (Months)
Director Environment	1	14
Deputy Director	1	12
Environmental Specialist	1	12
HSE Engineer	1	12
HSE Officers	2	12

Table 5-11: Contractor Staff

Sr. #	Designation	No of Posts	Duration (Months)
	Contractor's Staff		
1	Project Manager	1	14

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2	Deputy Project Manager	2	12
3	Structure Engineer	2	12
4	Highway Engineer	1	12
5	Quantity Surveyor	1	12
6	Chief Surveyor	1	12
7	Surveyor	2	12
8	Surveyor Helpers	4	12
9	Material Engineer	1	12
10	Lab Technician	2	12
11	Site Foreman	2	12
12	Store Keeper	2	12
13	Accountant	1	12
14	Skilled Labour	30	12
15	Unskilled Labour	60	14
16	Office Boy	2	14
17	Drivers	3	12
18	Chowkidars/ Guards	3	12

Table 5-12:Consultant Staff

Sr. #	Designation	No of Posts	Duration (Months)
	Consultant / Supervisory Staff		
1	Chief Resident Engineer	1	14
2	Resident Engineer	1	12
3	Assistant Resident Engineer (Highways)	1	12

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4	Assistant Resident Engineer (Structures)	1	12
5	Material Engineer	1	12
6	Senior Quantity Surveyor	1	12
7	Contract Specialist	1	12
8	Material Inspector	1	12
9	Site Inspector (Highways)	1	12
10	Site Inspector (Structures)	1	12
11	Surveyor	1	12
12	Surveyor Helpers	2	12
13	CAD Operator	2	12
14	Office Assistant	3	12
15	Computer Operator	3	14
16	Office Boy	6	14
17	Drivers	2	12
18	Chowkidars/ Guards	3	12

Table 5-13: Client Staff

Sr. #	Designation	BPS	No of Posts	Duration (Months)
	Employer's Staff			
1	Project Director / Director (Engineer)	19	1	14
2	Deputy Director (Engineer)	18	1	12
3	Assistant Director (Engineer)	17	1	12

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4	Assistant Director (A/C)	17	1	12
5	Surveyor	16	1	12
6	Accountant/Superintendent	16	1	12
7	Computer Operator	16	1	12
8	Office Assistant	16	1	12
9	Auto CAD Operator	11	1	12
10	Qanoongo	11	1	12
11	Patwari	5	1	12
12	UDC	3	1	12
13	LDC	1	1	12
14	Photo Copy Machine Operator	5	1	12
15	Driver	4	2	12
16	Naib Qasid	1	2	12
17	Chowkidar	1	2	12
18	Sweeper	1	2	12

Most of the road construction equipment is heavy machines and dozers whose engines run on diesel and thus require a temporary workshop close to the construction site for longer projects, for their regular maintenance and repair in case of any technical or mechanical glitch

5.15 CAPACITY ANALYSIS

- Capacity Analysis is done using Highway Capacity Manual (HCM) 2010. It is an AASHTO Publication that contains concepts, guidelines, and computational procedures for computing the capacity and quality of service of various highway

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facilities, including freeways, highways, arterial roads, etc. The output is given in terms of the Level of Services (LOS).

- LOS is a qualitative measure used to relate the quality of traffic service. LOS is used to analyze highways by categorizing traffic flow and assigning quality levels of traffic based on performance measures like speed, density, etc.
- There are (7) levels of service starting from A to F. Top being A and the worst being F.
- LOS 'A' is free flow. Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes. The average spacing between vehicles is about 550 ft. (167 m) or 27 car lengths. Motorists have a high level of physical and psychological comfort. The effects of incidents or point breakdowns are easily absorbed. LOS A generally occurs late at night in urban areas and frequently in rural areas.
- LOS 'F' represents forced or breakdown flow. Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity.

5.16 CONSTRUCTION LOGISTICS

Labor Camps

Campsites will be selected keeping in view the availability of adequate areas for establishing campsites, asphalt, and batching plant site, including parking areas for machinery, stores, and workshops, access to local markets, and an appropriate distance from sensitive areas in the vicinity. The area requirement for construction camps will depend upon the deployed manpower and the type and quantity of machinery mobilized. Because of the area required, the contractors will have to acquire land on lease from private landowners, unless the appropriate area would not be possible to locate campsites within the ROW. Keeping in view the following criteria guidelines, the Contractor has to identify the construction camp sites before the start of the construction activities

- There should be no resettlement issue for the location of the camps;
- The campsite should be away from residential areas and sensitive receptors;
- Selection of sites for construction camps shall be near the project area having proper access to the nearby main link road;

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- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Campsite must be adequate in size to prevent overcrowding of necessary structures;
- The campsite should consider avoiding any damage to property, vegetation, irrigation, and drinking water supply systems;
- The campsite must not be subject to periodic flooding; and
- There should not be any ecologically sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near the construction camp.

Figure 5-12 Map Showing Proposed Locations of Camp sites



Figure 5-13 Map Showing Proposed Locations of Asphalt, and Batching Plant

Note: Final locations will be selected by the contractor after approval from NHABorrow sources for embankment preparations were identified along the alignment at different chainages. Overall the soils encountered along the project road are generally fair and may be utilized for embankment preparation of project road. Work Base

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Since all works are located along the alignment, the best option would be to set up the work bases near the respective project sites, probably through private rental deeds.

5.16.1 Labor Supply

The contractor will be contractually bound to employ a maximum number of local people except for jobs where local expertise is not available. By and large, the daily wage rates fixed by the local authorities will be used.

5.16.2 Machinery Maintenance and Equipment Yards

Machinery and equipment yards will be sited near work camps. The yard will have enough storage and haulage space with ample moving and working space. The yard will be walled and will have a gate provided with ample security staff at the work base and a machinery and equipment yard will be provided. The yard will have enough storage and haulage space with ample moving and working space. The yard will be walled and will have a gate provided with ample security staff.

5.16.3 Material Depots

Near-work bases material depots will be required for storing construction materials. They will include temporary sheds for storing cement, steel, and asphalt and open space for storing stones, shingles, and bricks. The material depots will be walled and the gate will be provided with ample security. A storekeeper will keep account of incoming and outgoing material.

5.16.4 Machinery Repair Workshops

With a large number of vehicles and other similar machinery, a repair workshop is essential. The contractor may establish his workshop.

5.17 APPROACH TO WORK BASES

Since work bases will be established close to the road sections under can provide easy access to them. Public or private land (with the consent of the owner and/or locals) can be used for providing supplementary access roads and paths to work bases.

5.17.1 Camp Offices

Adjacent to labor camps and to work bases, the contractor will be allowed to set up a camp office to run his day-to-day field affairs. For that, the public or private land can be used by the contractor.

5.17.2 Security Arrangements

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Given the prevailing field condition, security staff is necessary. Enough security will be required at the Work Base, Labor Camp, Material Store, Equipment Yards, and location of the work in progress on the work site. Coordination will be necessary with nearby law enforcement agencies.

5.18 HEALTHCARE

With a large number of laborers and employees working on the project of road construction, minor accidents are expected to take place on all construction sites. A dispensary will be set up by the contractor. For major cases, the patients will be shifted to the District Hospital under a pre-coordinated arrangement.

5.18.1 Labor Reporting Office

Along the road and in work bases special areas will be marked where the labor can gather at the time of pick and drop, emergency, or briefing. Those places will be marked and kept open and clean and as per requirement equipped with a public address system.

5.18.2 Labor Transport

Almost all unskilled labor will be employed from local sources. The contractor will provide vehicle(s), to pick up and drop off local labor every day. This will also keep the camps less pressurized and manageable.

5.19 ADMINISTRATIVE JURISDICTION OF THE PROJECT

The proposed project is the construction of an interchange on the Abdul Hakeem Lahore Motorway (M-3) at Bucheki-Nankana Sahab Road to connect Bucheki, Nankana Sahab, and surrounding areas with the Motorway (M-3). The project will be operational under the administrative jurisdiction of the National Highway Authority.

Table 5-14: Authorities Responsible for Project Activities

SR. NO.	RESPONSIBILITIES	AUTHORITIES
1.	Sponsoring	Ministry of Communications
2.	Execution	National Highway Authority
3.	Operation and Maintenance	National Highway Authority
4.	Concerned Federal Ministry	Ministry of Communications, Government of Pakistan

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5.20 OCCUPATIONAL HEALTH, SAFETY, AND PERSONAL PROTECTIVE EQUIPMENTS

The project's EHS hazards will likely include physical and chemical hazards such as noise and vibration, air quality, flammable materials, site traffic, etc. It will be ensured that the laborers engaged in breaking stones, handling bricks, mixing concrete, or mixing and laying asphalt use personal protective equipment such as helmets, body suits made of appropriate materials, safety glasses, safety boots, gloves, etc.

5.20.1 Signage

During construction, suitable signboards and traffic signs will be displayed on the entire road length in general, and on the construction site, in particular. This will help in forestalling any possible accidents.

5.20.2 Lighting and Illumination

In addition to natural light in workplaces, artificial illumination arrangements will be made by the contractor's overall work base, work sites, campsite, machinery yard, and material depots. This can help the contractor with extended working hours as well as security. If WAPDA electric supply is not available, electricity generators will have to be arranged in all spots where lighting is required.

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6 DESCRIPTION OF THE ENVIRONMENT

6.1 INTRODUCTION

This chapter describes the baseline conditions, which cover the existing physical, ecological, and socio-economic environment of the Study Area. Information on these aspects has been derived from the desk study of available data, field visits to the project area as well as information obtained through visits to the Government departments and other agencies namely the Health Department, Irrigation Department, Meteorological Department, Forest offices, and prevailing environmental laws and environmental quality standards, etc.

6.2 DESK STUDIES

Design data was collected from the project office, District Nankana Sahib. This data included the available documents, drawings, reports, etc. related to the proposed project. The experts conducted a detailed desk study of the above available data before the field visit. The salient features of the project were thoroughly reviewed to assess their environmental implications. The documents which were consulted and departments visited are the project head office, project site, Irrigation Department, Meteorological Department, Forest offices, and other related officials.

6.3 SITE VISITS

A team of experts visited the proposed site for the collection of baseline environmental data for ambient air, noise levels, drinking water and wastewater sampling, public consultation, baseline ecological environment data, etc. After the survey of the project area, the environmental data regarding physical, ecological, and socioeconomic aspects were collected for carrying out an environmental assessment. Secondary data were also collected from various sources mainly studies carried out by project proponents and reports of other line Departments. A social survey of the proposed area was carried out in which people living around the proposed site were interviewed to ascertain their views about the storage and utility facilities commissioning and operational activities to perceive the impacts on the natural and socioeconomic environment around the proposed project site. This included information on land, surface water, groundwater, air, vegetation, animals, and human.

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6.4 STUDY AREA

Currently, there are two existing interchanges in the vicinity of Nankana Sahib and surrounding towns namely Nankana Sahib Interchange and Jaranwala Interchange, both interchanges are located approximately 35 Km apart. NHA has planned to construct a new Interchange on M-3 to provide access for locals of towns and surroundings areas located between Nankana Sahib and Jaranwala Interchanges. Nankana Sahib is the city and capital of Nankana Sahib District in the Punjab province of Pakistan. It is named after the first guru of the Sikhs, Guru Nanak. Guru Nanak was born in the city and first began preaching here. Today, Nankana Sahib is a city of high historic and religious value for Sikhs and is a popular pilgrimage site for Sikhs from all over the world. It is located about 80 kilometers southwest of Lahore and about 75 kilometers east of Faisalabad. The culture of this specific area is not much different from the culture of Punjab province.

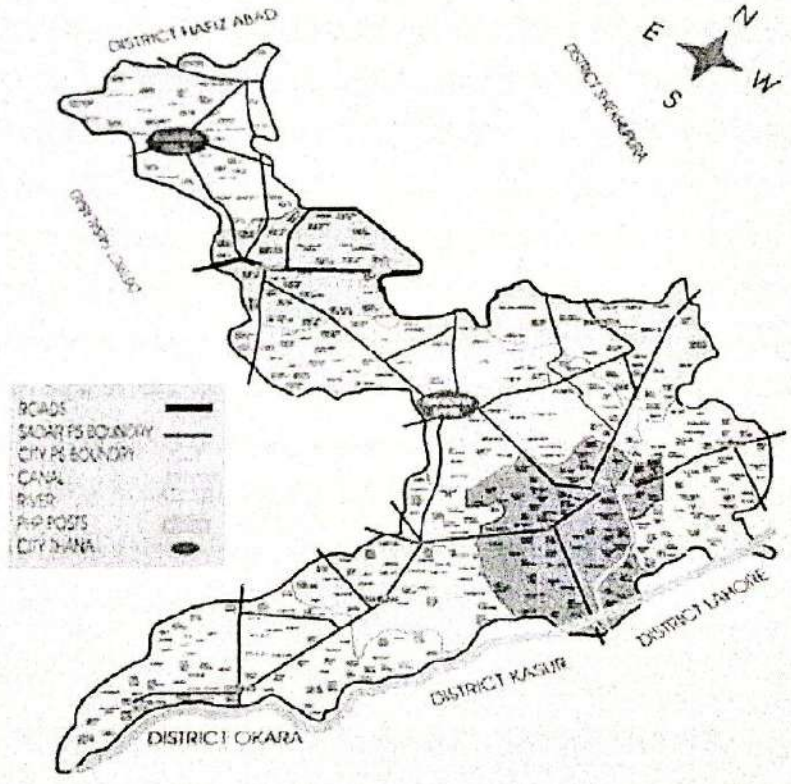


Figure 6-1: Location Map of District Nankana Sahib

6.5 PHYSICAL ENVIRONMENT

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A physical environment is considered an area that is tangible and supports influences and develops life. On Earth, many different types of physical environments, natural and synthetic, have existed throughout its history. The areas covered under physical resources are; climate, water resources, topography, seismology, geology, and soil conditions. The objective of the study was to establish:

- Baseline conditions of surface and groundwater resources
- Assess the surface and groundwater quality
- Soil and geology baseline of the area

6.5.1 Soil

The soil in the district's areas belonging to the Sandal Bar is commonly known as Missie. This type of soil is generally fertile, and is a rapidly water-absorbent soil, making it unfit for rice cultivation. The worst types of this soil are the sand hillocks which are found here and there in all tracts and are known as Tibba. The silt brought in by River Ravi is very fertile. The quality of this soil drops to inferior sandy soil as the land slopes upwards to higher altitudes. Subsurface Lithology is composed of Lean Clay/Silt/Silty/Sand/Poorly Graded Sand with Silt up to a maximum investigated depth of 30 m below NSL. The topmost soil layer mostly comprises Lean Clay in a very soft to a soft state. The thickness of this layer is approximately 3.0 m below NSL. This cover is absent in places. A 7.0 m thick layer of Silt/Silty/Sand/Poorly Graded sand with silt material in a loose state is present underneath the topmost layer. The water table in the area is shallow in general having waterlogging and water pounding in some places. The minimum depth of the groundwater table observed at the site is about 1 meter but it varies from 3.0 to 70.0 meters below NSL. The base soil of project areas may need to be improved with ground improvement techniques for the safe placement of foundations and structures.

6.5.2 Topography

Nankana Sahib district was a tehsil of Sheikhupura district till May 2005, when it was upgraded to a district level. The average elevation of Nankana Sahib is 188 m above mean sea level. The district is located in the Sandal Bar region of Rachna Doab and consists of some recent sediment brought by a spill channel from River Chenab. The topography of the Rechna Doab/ Sandal Bar is relatively flat, with a land surface gradient ranging from about 0.25 m per km in the north and northeast, to less than 0.2

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m per km towards the south and southwest. Most of the district is an alluvial plain, the monotony of which is broken by the Sangla Hills of Sangla Hill Tehsil. This tehsil is located in the Sandal Bar region which is a level prairie, thickly dotted with stunted undergrowth of the bush jungle. But there is a rocky hill known as Sanglanwala Tibba which rises to a height of 65 m (215 ft) above the surrounding plain on its north side. The main feature of the Sangla Hill Tehsil is this hill, the peak of which is visible from miles. The River Ravi separates this district from Sheikhupura. The banks of the river are low and prone to flooding.

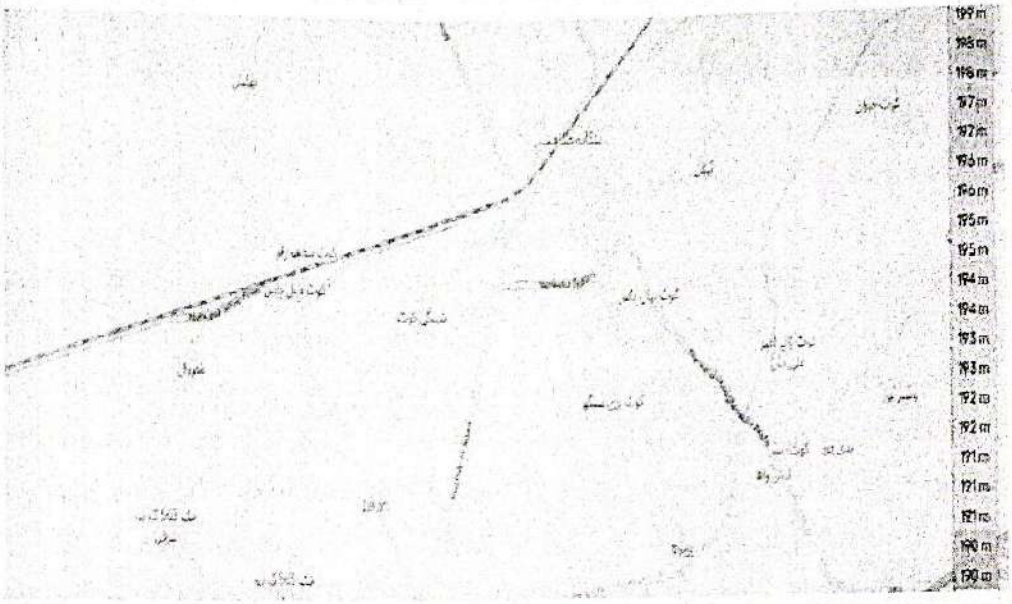


Figure 6-2: Topographic Map of District Nankana Sahib

6.5.3 Rivers, Streams, and Lakes; Nankana Sahib district

River Ravi flows along the southeastern border of the district. The town of Syedwala is situated along its bank. On the west of Syedwala Town is the Degh (or Dek) nullah. In addition, there are several small lakes in the district where fishing is carried out on a large scale; these include the Ranawali Dhand, Nawankot Dhand, Baharipur Dhand, Ganeshpur Dhand, and Dhand Nano Dogar.

6.5.4 Forests; Nankana Sahib district

The following table shows the total forest area under various departments in Nankana Sahib as per Punjab Development Statistics 2018-19:

Table 6-1: Nankana Sahib Forests

Total Forest Area	**2,634 A**	**Reserved**	**700 A**

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		Forests	
District Govt.	- A	Resumed Land	1,937 A
Linear Plantation	- km		

6.5.5 Seismology

The project site falls in the Punjab plain which shows low to moderate levels of seismicity. The epicenters of low to moderate-magnitude earthquakes recorded in the Punjab Plain are associated with the subsurface fractures in the basement rocks which are concealed by the thick alluvial deposits. Figure 6.3 shows that the project area falls in Zone 2A. It is therefore recommended that the project structures should be designed to cater to the requirements of the Minor to Moderate Zone of Building Code of Pakistan (2007).[1]

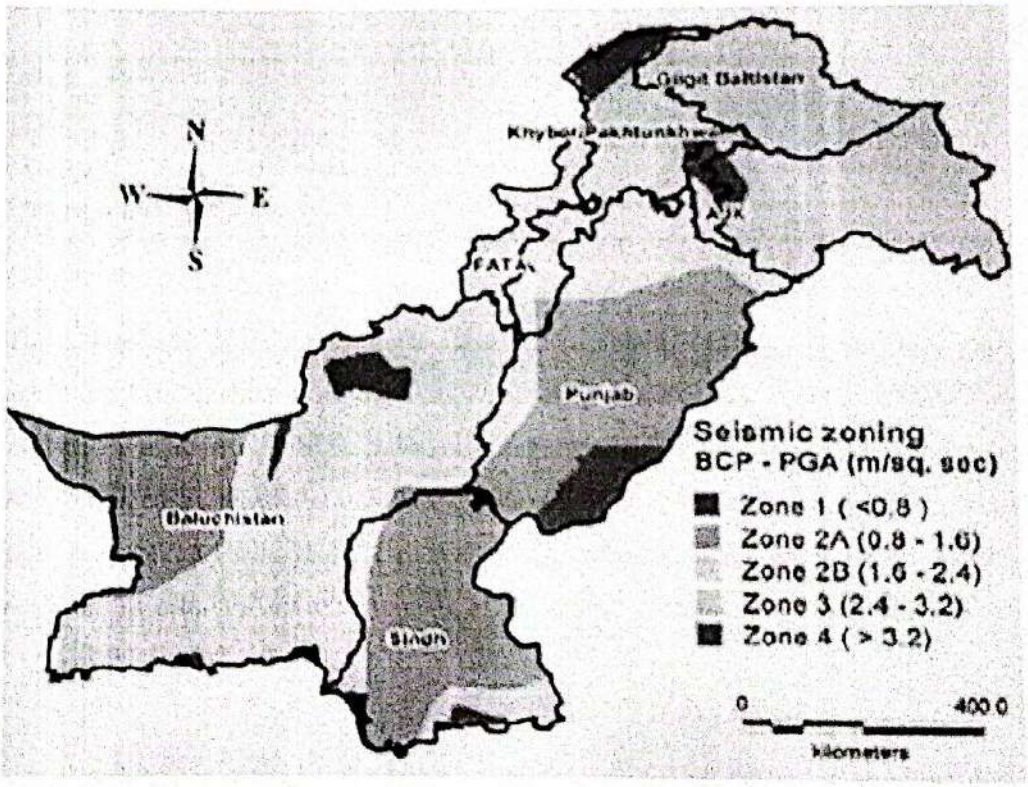


Figure 6-3: Seismic Zoning Map of Project Area

6.5.6 Climate

[1] https://www.researchgate.net/figure/Seismic-zoning-map-of-Pakistan-according-to-Building-Code-of-Pakistan-BCP-2007_fig2_274272010

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Nankana Sahib district belongs to the Rechna Doab area, which is a subtropical, continental lowland designated as a semi-arid area. The climate is characterized by large seasonal fluctuations in temperature and rainfall. Summers are long and hot, usually lasting from April through September with maximum temperatures ranging from 21 °C to 49 °C. The winter season lasts from December through February, with maximum temperature ranging from 21 °C to 27 °C during the day and sometimes falling below zero at night. The average rainfall is about 2000 mm.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)													
Average high °C (°F)													
Daily mean °C (°F)													
Average low °C (°F)													
Record low °C (°F)													
Average precipitation mm (inches)													
Average precipitation days (≥ 1.0 mm)													
Average relative humidity (%)	43.65	46.27	43.91	27.96	18.58	21.9	33.33	40.81	36.98	26.73	28.07	29.78	33.2
Mean monthly sunshine hours													

Figure 6-4: Climate Data of Nankana Sahib

The chart below shows the mean monthly temperature and precipitation of Nankana Sahib in recent years[2].

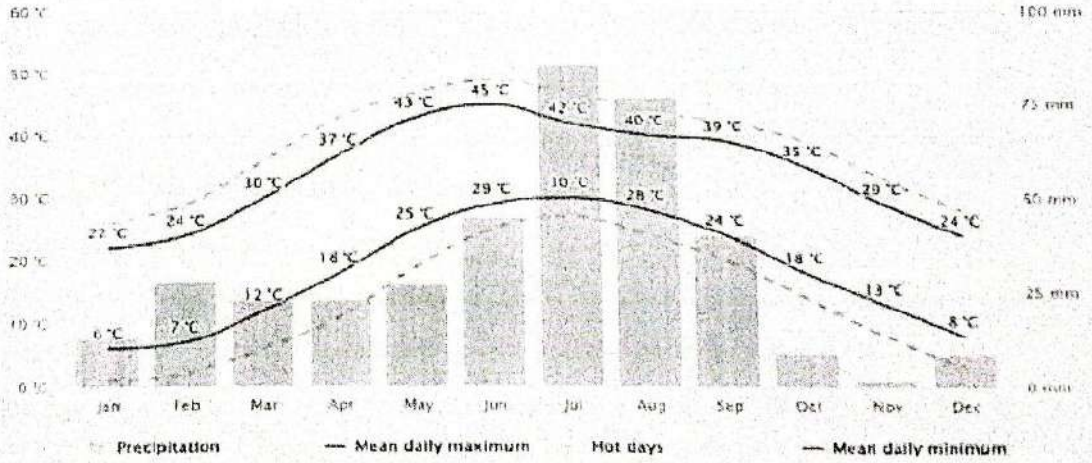


Figure 6-5: Mean Monthly Temperature And Precipitation

6.5.7 Water Resources

[2] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/nankana-sahib_pakistan_1169372

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In the District, most inhabitants use groundwater for domestic use; the tube-well density in the entire District is (19,161 in total). In most areas, the depth of the water table is about 7.5 to 9.14 m, which has no difficulty pumping out Furthermore, the significant sources of aquifer recharge include canals, water channels, and percolation through irrigation and rainfall. The area's water table fluctuates depending on seasonal recharge. During the summer, the average monthly discharge is around 15–20 times that in the winter. Upstream groundwater seepage is a common cause of reduced flow from December to the middle of March. During the spring melt of the Himalayan snow, river levels often rise sharply, reaching their highest point in July or August, when the monsoon rains arrive.

6.5.8 Irrigation Network; Nankana Sahib district

The Upper and Lower Chenab Canals are the major irrigation canals of the district. The Upper Chenab Canal off-takes from the Marala Headworks, whereas the Lower Chenab Canal off-takes from Headworks Khanki. The Rakh Branch Canal has been taken out of the Lower Chenab Canal; it passes through and produces tributaries in, Nankana Sahib, Hafizabad, and Faisalabad districts. Other smaller canals irrigating the district include Nankana Branch, Abbasi Minor, Sharqpur Distributary, and Kanwali Minor

6.6 BIOLOGICAL ENVIRONMENT

Mainly a country's wilderness areas and scenic landscapes with their associated flora and fauna form the natural capital of a country. Both collectively and within each level, the range or variety of the resources is referred to as "Biological Diversity". The contribution of the "Natural capital" is recognized at three distinct levels including genera, species, and community -habitat, and ecosystem.

Pakistan comprises a total of nine major ecological zones and the term has relevance for each of Pakistan's administrative units, districts, provinces, and particular countries. The greater the number of genera, species, habitats, and ecosystems present within these units, the greater the Biodiversity. It is in this background that the biodiversity of the area is discussed below:

6.6.1 Fauna

Wild boar, jackals, hares, and wolves are the only wildlife found in the district. Birds include crows, mynas, sparrows, black and grey partridges, falcons, eagles, quails,

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starlings, jungle pigeons, house pigeons, Russian sparrows, doves, various varieties of ducks, egrets, kingfishers, snipes, parrots. The Balloki Headworks pond area supports fish and a large population of migratory birds, some of which are barbet birds, coppersmith wolvert, bitterns, bulbuls, cuckoos, doves, drongos, eagles, steppe eagles, finches, flycatchers, godwit, harriers, herons, blue jays, kestrels, lapwings, spotted owlet, grey and black partridges, sparrow hawk, purple sunbird, stilts, and blue throat sandpiper[3].

6.6.2 Flora

The most common flora of the district is the karir (Capparis aphylla), jhand (Prosopis spicigera), vann (Salvadora obeoides), shisham (Dalbergio sissoo), kikar (Acacia Arabica), peepal (Ficus religosa), bohar (Ficus indica), eucalyptus (eucalyptus), poplar (Populus), shirin (Albizia lebbek), lana (Suda ruiteesa), lani (Salsola fostida), babul (Acacia nilotica), semal or silk cotton tree (Bombax ceiba), aak (Calotropis procera), and ber (Ziziphus mauritania).

Grasses, and shrubs

Dab (Desmostachya bipinnata), kai (Saccharum spotaneum), kundar (Typha angustata), and nar (Phagmites karka) as well as shrubs like lai (Tamarix dioca), jawanha (Alhaji maurorum), water cabbage (Pistiastratiotes), water hyacinth (Eichhorniacrassipes), reed (Phragmites), lotus (Nelumbonucifera), Sugar cane (saccharum rotundus), coconut (Nucifera), and bulrush (Typhadomigensis)

Vegetables

Different vegetables are grown in the study area. Some important of these are Phool Gobhi/cauliflower (Brassica oleracea Ver. Botrytis), Band Gobhi (Brassica oleracea Ver. capitate) Turnip, Raddish (Raphanus sativus), Carrot (Daucus carota), Bhindi, Tomato (Lycopersicum esculentum), Vegetable Marrow (Cucurbita pepo), Baingan, etc.

Crops and Fodder

Crops usually seeded in the area include Rice, Barley (Hordeum vulgare), Jawar (Andropogan sorghum), Maize, and Sugarcane along with other fodder. The wheat crop was also identified as sown on the project site.

6.6.3 Wildlife Sanctuaries and Game Reservoirs

[3] https://pakistanalmanac.com/punjab-nankana-sahib/#1633497144852-f0a014d6-aded

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The only wildlife-protected area is part of the pond area of the Balloki Headworks which is situated in the Nankana Sahib district. This game reserve provides sanctuary to all the game birds and migratory birds visiting the pond.

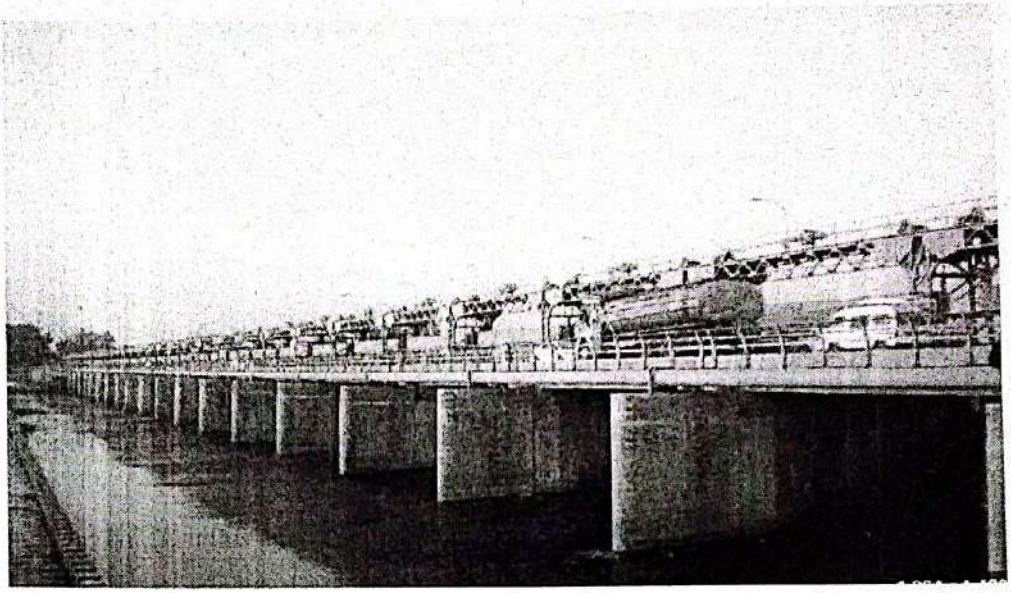


Figure 6-6: Balloki Headworks in Nankana Sahib

6.7 SOCIO-ECONOMIC ENVIRONMENT

This section provides baseline information and a description of the socio-economic and cultural environment of the project area. It presents information on the project area's locations, population distribution, socio-economic conditions, and livelihood activities, state of education and health facilities. The purpose of this socioeconomic survey was to gather information about the generic characteristics of nearby communities, their socioeconomic status, cultural traditions, social issues, and religious affiliations. It also presents the public consultation outcomes during the field survey. The approach used during data collection was interviews, focus group discussions, and rapid rural appraisal techniques for qualitative data collection. Socio-economic and cultural data were collected through a semi-structured questionnaire and focus group interviews with all the major stakeholders.

6.7.1 Administration of Nankana sahib

Nankana Sahib district covers an area of 2,960 km2 (1,140 sq.mi)and was originally subdivided into 3 tehsils[4]

[4] https://nankana.punjab.gov.pk/district_profile

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Nankana Sahib Tehsil	37 Union Councils
Shahkot Tehsil	09 Union Councils
Sangla Hill Tehsil	11 Union Councils

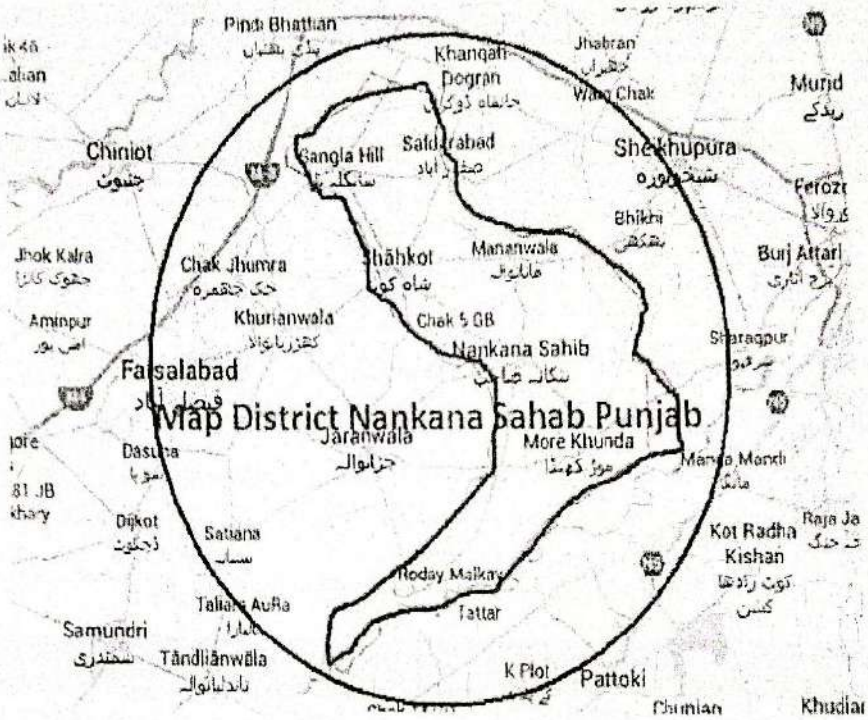


Figure 6-7 Map of District Nankana Sahab with Thesils

6.7.2 Demographics & Population

The demographics of the nankana sahib has undergone significant changes over the year. At the time of the 2017 census, the district's population was **1,3563,74**, of which 691,944 were males and 664,359 females.Table 6.2 gives the population of Nankana Sahib by sex and rural/urban [5]

Table 6-2: Population Of Nankana Sahib By Sex And Rural/Urban

[5] https://www.pbs.gov.pk/census-2017-district-wise/results/055

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Administrative Unit	Households	Population 2017			All Sexes	Population 1998	Sex Ratio	1998-2017 Average Annual Growth Rate
		Male%	Female%	Transgender				
Nankana Sahib Dist.	215,934	691,944	664,359	71	1,3563,74	1,0448,65	104.15	1.38
Rural	176,003	566,963	543,324	34	1,110,321	886,714	104.35	1.19
Urban	39,931	124,981	121,035	37	246,053	158,151	103.26	2.35

6.7.3 Health

The District Health Officer (DHO) is overall in charge of health services provided in the district. This DHO is supported by doctors, paramedics, technicians, and other support staff. The following table 6.3 shows the number of healthcare institutions in the district as per Punjab Development Statistics 2018-19:

Table 6-3: Health Care Institutions In District

Government Hospitals	05/310	Dispensaries	18/-
Rural Health Centers (RHC)	07/144	Basic Health Units (BHU)	48/96
T B Clinics	-/-	Mother Child Health Centers	05/-
Private Hospitals	-/-	Sub-Health Centers	-/-
Private Health Care Providers	73/NA		

6.7.4 Agriculture

The district belongs to the Northern Irrigated Plains Agro-Ecological Zone of Pakistan. Agriculture and its allied livestock breeding is the main occupation of the rural areas of the area with nearly 35.9% of the rural population engaged in this occupation.

Sugarcane, wheat, rice, maize, jawar, bajra, cotton, gram, moong, mash, masoor, rapeseed & mustard, sunflower, groundnut, sesamum, guar seed, linseed, sunn hemp, castor seed, millet, tobacco, and fodder are the crops of the district.

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Administrative Unit	Household	Population 2017			All Areas	Population 1998	Sex Ratio	1998-2017 Average Annual Growth Rate
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Major fruits of the district include guava, citrus, mango, banana, leechee, Jamun, phalsa, ber, mulberry, melon, musk melon, and watermelon. Major vegetables are potatoes, cauliflower, carrots, onions, tomatoes, turnips, peas, chilies, garlic, sugarbeet, coriander, turmeric, bitter gourd, bottle gourd, radish, cucumber, cabbage, pumpkins, sweet potatoes, yams, water chestnut, and brinjals.[6]

6.7.5 Livestock Breeding; Nankana Sahib district

Livestock breeding is an important economic activity of the district. Nearly all farmers keep a few heads of cattle and poultry to help increase the family's income. The following table shows the livestock population as of the 2010 Census of Livestock (quoted in Punjab Development Statistics 2018-19):

Table 6-4: Livestock Population Of District

Goats	243,000 Heads	Camels	395 Heads	Horses	4,655 Heads
Mules	2,265 Heads	Asses	31,400 Heads		

6.7.6 Fishing; Nankana Sahib district

Fishing is carried out in the Ranawali Dhand, Nawankot Dhand, Baharipur Dhand, Ganeshpur Dhand, and River Ravi near Syedwala Town; this fish is consumed locally.

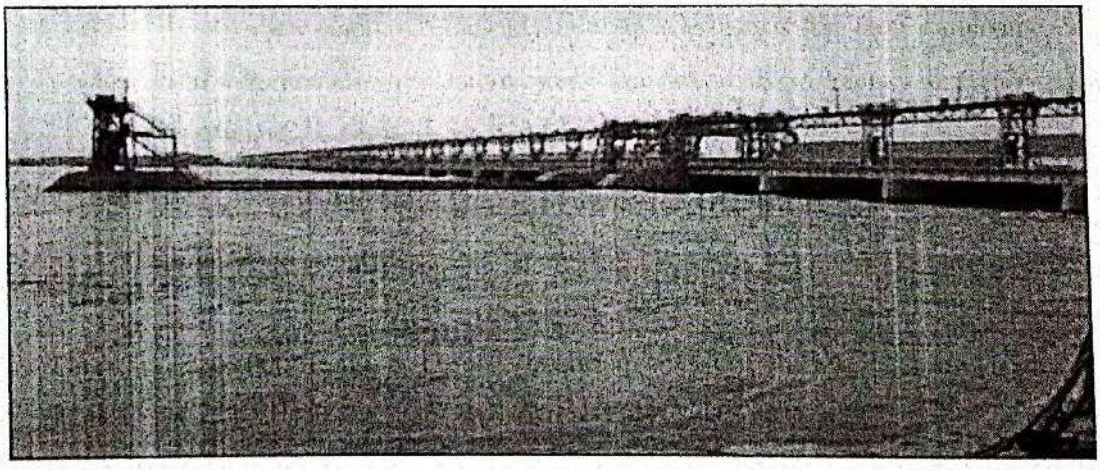


Figure 6-8: Bridge on River Ravi, Syedwala Town

6.7.7 Industries

[6] https://pakistanalmanac.com/punjab-nankana-sahib/#1633497127938-b1d45416-be12

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Even though at present, there is no industrial estate in the district, there are 151 small, medium, and large industrial units operating in the district. The following table shows the type and number of industries in the district.

Table 6-5: Type And Number Of Industries in Nankana Sahib

Chemical	01	Chip/ Straw Board	01
Cold Storage	01	Cotton Ginning & Pressing	01
Flour Mills	04	Food Products	01
Industrial Machinery	01	Power Generation	03
Rice Mills	109	Soaps & Detergents	03
Sugar	02	Textile Processing	01
Textile Spinning	18	Textile Weaving	03
Woolen Textile/ Spinning	02		

6.7.8 Economic Infrastructure

The district is linked with Sheikhupura, Lahore, and Faisalabad districts through black topped roads. Lahore-Islamabad Motorway touches Nankana Sahib at Khanqah Dogran where an interchange has been constructed.

The district is linked with Lahore and Faisalabad districts through the Pakistan Railway network. Nankana Sahib Town, Chak Jumra, Mandi Warburton, and Sangla Hill are the major rail links.

6.7.9 Road Statistics; Nankana Sahib district

The following table shows the road statistics of the district as per Punjab Development Statistics 2018-19;

Table 6-6: Nankana Sahib Road Statistics

National Highways	- km
Provincial highways	1,808.4 km
Motorways	- km

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Sugar Cess Roads	142.6 km

Some of the important roads of the district are:

- Nankana Sahib-Jaranwala Road
- Nankana Sahib–Bucheki Road
- Nankana Sahib-Warburton Road
- Mananwala-Nankana Sahib Road
- Nankana Sahib-Shahkot Road
- Lahore-Sheikhupura-Islamabad Road
- Mananwala-Sargodha Link Road

6.7.10 Rail and airways

The district is linked with Lahore and Faisalabad districts through the Pakistan Railway network. There are 3 railway stations in the district, with 2 in Nankana Sahib tehsil, and 1 in Sangla Hill tehsil.

There is no commercial or military airport/ airbase in the district; the closest commercial airport to Nankana Sahib is the Allama Iqbal International Airport, Lahore

6.7.11 Economy

According to the 1998 Census, the major employers of the district (same as Sheikhupura district) are

- Agriculture with its Allied Livestock Breeding, Fishing, Hunting, etc. (29.6%)
- Construction (37.5%)
- Manufacture (9.5%)
- Wholesale/ Retail, Restaurant/ Hotel (6.7%)
- Community, Social & Personal Services (8%)
- Transport, Communication & Storage (3.2%)
- Others (5.5%)

6.7.12 Education

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Nankana Sahib City is Located in the Punjab Province, it has a unique historical background the name of this city has been found in the name of Sikh Guru Nanak Sahib, there are various educational institutes located and contributing to the increase in the literacy rate in Nankana Sahib region. Colleges/Universities in Nankana Sahib such as Govt. Vocational Training Institute (W), Govt. Technical Training Centre, The international Guru Nanak University is offering diverse courses for students. The students who are located in Nankana Sahib and want to get admission for their career education then they can choose their aspirations.

Among the list of colleges/Universities in Nankana Sahib, the educational institutions are offering leading educational services for the students. Numerous other educational government and private institutions are also certifying their role in education zone to develop the vigorous nation.

Table 6-7: Nankana Sahib Educational Institutions

Facility	Boy/Girl	Facility	Boys/Girls	Facility	Boy/Girls	Facility	Boys/Girls	Facility
Primary Schools	324/241	Middle Schools	58/84	Primary Schools	324/241	Middle Schools	58/84	Primary Schools
Secondary Schools	50/34	Higher Secondary	04/09	Secondary Schools	50/34	Higher Secondary	04/09	Secondary Schools
Degree Colleges	07/08	Other Higher Secondary	02/-	Degree Colleges	07/08	Other Higher Secondary	02/-	Degree Colleges

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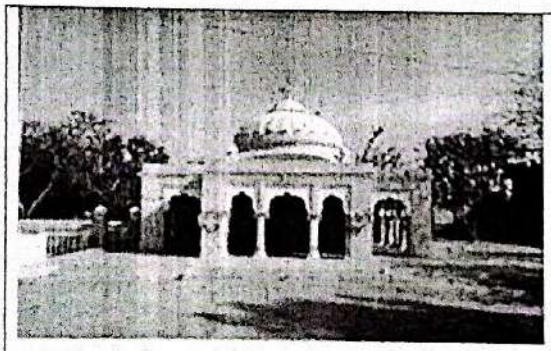


Figure 6-9: Guru Nanak High School

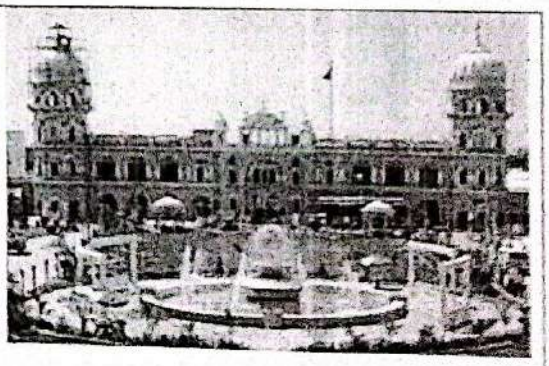
6.7.13 Historical Places

Here is a list of some important and valuable places in the district:

- Quba Masjid (A replica of Quba Masjid of Madina)
- Gurdwara Patti Sahib.
- Gurdwara Bal Leela.
- Gurdwara Mal Ji Sahib.
- Residency of Baba Guru Nanak.



Gurdwara Kiara Sahib



Gurdwara Janam Asthan

There are a few shrines of Muslim Saints in the district as well, including:

- Shrine of Haji Dewan at Khanqah Dogran; Nankana Sahib district where a fair is held every year. Haji Dewan's shrine was built during the reign of Mughal Emperor, Akbar the Great

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- The Shrine of Hazrat Abul Khair Naulak Hazari at Shahkot; Nankana Sahib district also plays host to a large number of devotees every year.

6.7.14 Languages

According to the 1998 census of Pakistan Punjabi is spoken by 98% population of the city. Shahmukhi script is mostly used by natives but Nankana Sahib is one of the few cities in Pakistan where the Gurmukhi dialect is also understood by the locals. The Punjabi dialects spoken in the district are;

- Majhi dialect which is spoken by the majority of the district.
- Malwi dialect is spoken by the migrated people from India Punjab.

Urdu is also used and spoken as the national language in offices and education centers and English is also spoken and understood by educated people.

6.7.15 Religion of Nankana Sahib

Muslims are greater in population size 97% of the population is Muslim

Table 6-8: Nankana Sahib Religions

Muslims	**97%**
Christians	2.6%
Hindus	Negligible %
Ahmadis	0.2%
Scheduled Castes	Negligible %
Others	0.1%

6.8 SUITABILITY OF THE SITE

Currently, there are two existing interchanges in the vicinity of Nankana Sahib and surrounding towns namely Nankana Sahib Interchange and Jaranwala Interchange, both interchanges are located approximately 35 Km apart. NHA has planned to construct a new Interchange on M-3 to provide access for locals of towns and surroundings areas located between Nankana Sahib and Jaranwala Interchanges. The proposed site is suitable for the construction of an interchange because the proposed project will provide access for locals of the surroundings to the Lahore Karachi Motorway and more efficient passage to various cities of Punjab.

6.9 SOCIAL SURVEY RESULTS

The findings of the social survey are described below:

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- Most of the people in the project area were found to be aware of the need for the project
- The majority of the respondents contacted favored the construction of the interchange but at the same time demanded fair and transparent compensation for their lost properties;
- The majority of the respondents contacted were between the age groups of 25 to 45 years, to be mature enough to give some response about the project implementation;
- Most of the respondents interviewed were associated with the profession of shop and transportation sector keeping running their business in the Project area during the day hours.
- The main protective measures suggested by the respondents include the timely completion of the project, a regular sprinkling of water at the construction site to control dust emissions, and proper compensation for the lost assets.

6.10 ENVIRONMENTAL MONITORING DATA

Environmental monitoring is a tool to assess environmental conditions and trends. The main objective of environmental monitoring is to manage and minimize the impact the intended project have on an environment.

6.10.1 Air Quality

Ambient air quality was continuously monitored for 24 hours near the project site. The location for ambient air monitoring demands multiple criteria to meet before selection, mainly monitoring scale, target pollutants, communication protocols, and population density around the project.

The monitored data for ambient air including PM10, PM2.5, CO, NOx, and SO2 indicates that concentration of these pollutants is mostly in compliance with the provincial standards. The Lab reports are attached in the Annexure and the analysis results of air are provided in the Table below.

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Table 6-9: Ambient Particulate Matter Monitoring Report

SR. NO.	PARAMETERS	TIME DURATION	RESULTS UNITS		RESULT (AVERAGE 24 HRS)	
			PM (10) ($\mu g/m^3$)	PM (2.5) $\mu g/m^3$	PM (10) $\mu g/m^3$	PM (2.5) $\mu g/m^3$
1	PARTICULATE MATTER	09:00 AM	96.46	24.38	87.14 ($\mu G/M^3$)	27.21 ($\mu G/M^3$)
2		10:00 AM	98.63	24.95		
3		11:00 AM	95.67	24.95		
4		12:00 PM	99.24	29.95		
5		01:00 PM	100.86	29.05		
6		02:00 PM	101.48	25.08		
7		03:00 PM	101.12	30.25		
8		04:00 PM	103.01	26.45		
9		05:00 PM	100.25	29.15		
10		06:00 PM	96.92	26.75		
11		07:00 PM	100.04	28.35		
12		08:00 PM	101.25	24.95		
13		09:00 PM	98.36	29.35		
14		10:00 PM	90.37	25.45		
15		11:00 PM	67.26	27.55		
16		12:00 AM	86.25	29.35		
17		01:00 AM	58.71	30.15		
18		02:00 AM	46.25	24.95		
19		03:00 AM	39.84	25.95		
20		04:00 AM	59.72	26.45		
21		05:00 AM	80.03	25.05		
22		06:00 AM	81.61	26.85		
23		07:00 AM	99.39	27.75		
24		08:00 AM	88.79	29.95		
PEQS					150 $\mu g/m^3$	35 $\mu g/m^3$

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Table 6-10: Ambient Particulate Matter Monitoring Report

SR. NO.	PARAMETERS	TIME DURATION	RESULTS UNITS		RESULT (AVERAGE 24 HRS)	
			PM (10) ($\mu g/m^3$)	PM (2.5) ($\mu g/m^3$)	PM (10) ($\mu g/m^3$)	PM (2.5) ($\mu g/m^3$)
1	PARTICULATE MATTER	09:00 AM	96.28	24.2	86.96 ($\mu g/m^3$)	27.03 ($\mu g/m^3$)
2		10:00 AM	98.45	24.7		
3		11:00 AM	95.49	24.1		
4		12:00 PM	99.06	29.7		
5		01:00 PM	100.68	28.8		
6		02:00 PM	101.3	24.9		
7		03:00 PM	100.94	30.0		
8		04:00 PM	102.83	26.2		
9		05:00 PM	100.07	28.9		
10		06:00 PM	96.74	26.5		
11		07:00 PM	99.86	28.1		
12		08:00 PM	101.07	24.7		
13		09:00 PM	98.18	29.1		
14		10:00 PM	90.19	25.2		
15		11:00 PM	67.08	27.3		
16		12:00 AM	86.07	29.1		
17		01:00 AM	58.53	29.9		
18		02:00 AM	46.07	24.0		
19		03:00 AM	39.66	25.4		
20		04:00 AM	59.54	26.2		
21		05:00 AM	79.85	24.8		
22		06:00 AM	81.43	26.3		
23		07:00 AM	99.21	27.5		
24		08:00 AM	88.61	29.7		
PEQS					150 ($\mu g/m^3$)	35 ($\mu g/m^3$)

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Table 6-11: Ambient Gaseous Monitoring Report

SR. NO	TIME	PARAMETERS			
		CO	NO	NO_2	SO_2
		UNITS			
	HOURS	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	09:00 AM	0.94	12.14	12.01	14.64
2	10:00 AM	0.89	12.16	12.66	15.01
3	11:00 AM	0.98	12.01	11.77	15.27
4	12:00 PM	0.97	12.1	12.2	15.57
5	01:00 PM	1.05	12.08	12.01	14.81
6	02:00 PM	1.03	12.81	12.88	15.43
7	03:00 PM	1.05	11.92	12.13	15.87
8	04:00 PM	1.03	12.05	11.67	15.99
9	05:00 PM	1.04	11.57	11.34	14.67
10	06:00 PM	1.04	11.78	11.9	14.98
11	07:00 PM	1.06	11.9	11.6	14.93
12	08:00 PM	0.98	12	11.74	14.76
13	09:00 PM	0.95	12.98	11.87	15.8
14	10:00 PM	0.88	12	12.9	15.3
15	11:00 PM	0.86	12.8	12.8	15.8
16	12:00 AM	0.75	12.3	12.4	15.9
17	01:00 AM	0.45	12.1	12.5	15.34
18	02:00 AM	0.34	11.4	13.86	15.1
19	03:00 AM	0.44	10.9	12.45	15.6
20	04:00 AM	0.56	11.5	12.94	11.98
21	05:00 AM	0.78	11.5	12.3	14.9
22	06:00 AM	0.77	11.9	11.4	14.1
23	07:00 AM	0.74	11	11.9	14.9
24	08:00 AM	0.9	12.3	11.98	14.11
AVERAGE CONCENTRATION		**0.85**	**11.9**	**12.21**	**15.031**
PEQSAA		**05 (24HR)**	**40 (24 HR)**	**80 (24 HR)**	**120 (24 HR)**

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Table 6-12: Ambient Gaseous Monitoring Report

SR. NO	TIME	PARAMETERS			
		CO	NO	NO_2	SO_2
		UNITS			
	HOURS	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	09:30 AM	0.66	10.07	9.94	12.23
2	10:30 AM	0.61	10.09	10.39	12.6
3	11:30 AM	0.7	9.94	9.7	12.86
4	12:30 PM	0.69	10.03	10.13	13.16
5	01:30 PM	0.77	10.01	9.94	12.4
6	02:30 PM	0.75	10.74	10.81	13.02
7	03:30 PM	0.77	9.85	10.06	13.46
8	04:30 PM	0.75	9.98	9.6	13.58
9	05:30 PM	0.76	9.5	9.27	12.26
10	06:30 PM	0.76	9.71	9.83	12.57
11	07:30 PM	0.78	9.83	9.53	12.52
12	08:30 PM	0.7	9.93	9.67	12.35
13	09:30 PM	0.67	10.91	9.8	13.39
14	10:30 PM	0.6	9.93	10.83	12.89
15	11:30 PM	0.58	10.73	10.73	13.39
16	12:30 AM	0.47	10.23	10.33	13.49
17	01:30 AM	0.17	10.03	10.43	12.93
18	02:30 AM	0.06	9.33	11.79	12.69
19	03:30 AM	0.16	8.83	10.38	13.19
20	04:30 AM	0.28	9.43	10.87	9.57
21	05:30 AM	0.5	9.43	10.23	12.49
22	06:30 AM	0.49	9.83	9.33	11.69
23	07:30 AM	0.46	8.93	9.83	12.49
24	08:30 AM	0.62	10.23	9.91	11.7
AVERAGE CONCENTRATION		**0.57**	**9.89**	**10.14**	**12.62**
PEQSAA		**05 (24HR)**	**40 (24 HR)**	**80 (24 HR)**	**120 (24 HR)**

6.10.2 Noise

Ambient noise was continuously monitored on the selected locations near the project site. The monitored data for ambient noise indicated the compliance with day and night standards for ambient noise. Punjab Environmental Quality Standards for Noise are shown in table below

Areas	Day Time	Night Time
Residential Area	55	45

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Commercial Area	65	55
Industrial Area	75	65
Silence Zone	50	45

Table 6-13: Noise Level Monitoring Report

SR. NO	TIME HOURS	UNIT	MINIMUM	MAXIMUM	LEQ
1	09:00 AM	dB(A)	80	85	82.75
2	10:00 AM		75	84	79.75
3	11:00 AM		76	84	80.25
4	12:00 PM		79	86	82.75
5	01:00 PM		77	82	79.75
6	02:00 PM		71	84	77.75
7	03:00 PM		70	84	77.25
8	04:00 PM		71	80	75.75
9	05:00 PM		77	85	81.25
10	06:00 PM		75	81	78.25
11	07:00 PM		69	74	71.75
12	08:00 PM		77	80	78.75
13	09:00 PM		74	82	78.25
14	10:00 PM		78	90	84.25
15	11:00 PM		79	83	81.25
16	12:00 AM		76	85	80.75
17	01:00 AM		70	84	77.25
18	02:00 AM		75	79	77.25
19	03:00 AM		74	80	77.25
20	04:00 AM		76	83	79.75
21	05:00 AM		68	76	72.25
22	06:00 AM		73	79	76.25
23	07:00 AM		72	80	76.25
24	08:00 AM		78	84	81.25

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Table 6-14: Noise Level Monitoring Report

Sr. No	Time Hours	Unit	Minimum	Maximum	Leq
1	09:30 AM	dB(A)	79	84	81.5
2	10:30 AM		74	83	78.5
3	11:30 AM		75	83	79
4	12:30 PM		78	85	81.5
5	01:30 PM		76	81	78.5
6	02:30 PM		70	83	76.5
7	03:30 PM		69	83	76
8	04:30 PM		70	79	74.5
9	05:30 PM		76	84	80
10	06:30 PM		74	80	77
11	07:30 PM		68	73	70.5
12	08:30 PM		76	79	77.5
13	09:30 PM		73	81	77
14	10:30 PM		77	89	83
15	11:30 PM		78	82	80
16	12:30 AM		75	84	79.5
17	01:30 AM		69	83	76
18	02:30 AM		74	78	76
19	03:30 AM		73	79	76
20	04:30 AM		75	82	78.5
21	05:30 AM		67	75	71
22	06:30 AM		72	78	75
23	07:30 AM		71	79	75
24	08:30 AM		77	83	80

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7 IMPACT ASSESSMENT

7.1 IMPACT ASSESSMENT METHODOLOGY

The significance of potential impacts on the environment was assessed using the risk assessment methodology that considers the impact magnitude and sensitivity of receptors, described below.

7.2 IMPACT MAGNITUDE

The potential implications of the project have been categorized as major, moderate, minor, or nominal based on consideration of the parameters such as i) duration of the impact and its effect; ii) the spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

The magnitude of each potential impact of the project has been identified according to the categories outlined in Table - 7.1.

Table 7-1: Parameters for Determining Magnitude

Parameters	Major	Moderate	Minor	Minimal
Duration of the potential impact	Long-term (beyond the project period)	Medium Term Lifespan of the project (within the project period)	Limited to the construction period	Temporary with no detectable potential impact
The spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond the next project components, site boundaries, or local area	Within project boundary	A specific location within project components or site boundaries with no detectable potential impact
Reversibility of potential impacts	The potential impact is effectively permanent,	Benchmark needs a year or so with some responses to come back to	Baseline returns naturally or with a limited response within	Baseline remains constant

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	requiring considerable intervention to return to baseline	baseline	a few months	
Legal standards and established professional criteria	Breaches national standards /obligation	Complies with limits given in national standards	Meets minimum national standard limits	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Happens under worst-case (negative consequences) or best-case (positive impact) working conditions (Likely)	Occurs under abnormal, exceptional, or emergency conditions (occasional)	Unlikely to happen

7.3 SENSITIVITY OF RECEPTOR

The sensitivity of a receptor has been determined based on a review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity to the topic. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table - 7.2.

Table 7-2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very Severe	The vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation
Severe	The vulnerable receptor with little or no ability to absorb proposed

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	changes or limited opportunities for mitigation.
Mild	The vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low	The vulnerable receptor with a good ability to absorb proposed changes or/and excellent opportunities for mitigation

7.4 ASSESSING SIGNIFICANCE

Following the assessment of impact magnitude and determining the quality and sensitivity of the receiving environment or potential receptor, the significance of each potential impact was established using the impact significance matrix shown in Table - 7.3.

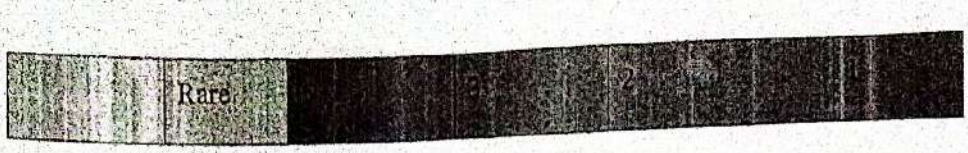
Table 7-3: Criteria for Determining Impact Significance

Magnitude of Impact	**Sensitivity of Receptors**			
	Very Severe	**Severe**	**Mild**	**Low**
Major			Medium	
Moderate			Medium	
Minor	Medium	Medium	Minor	
Minimal				

Risk Score

	Consequence			
		Catastrophic	Major	Moderate	Minor
Likelihood	Certain			10	5
	Likely			6	3
	Unlikely			4	2

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Risk: Significant: 15-25
Medium: 6-10
Low: 1-5

7.5 IMPACT PHASES

These impact assessment and mitigation measures cover the entire cycle of the project activities, from pre-construction to construction and operations of the project. The coverage of each of the project phases is defined as follows:

- Design / Pre-construction Phase
- Construction Phase
- Operation Phase

7.6 IMPACT SCREENING MATRIX

The 'activity-wise' screening of potential impacts during the design/pre-construction construction and operations phases is provided in Tables - 7.4, 7.5, and 7.6 respectively while details are given hereunder.

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Table 7-4: 'Activity Wise' Screening of Impacts during Design/Pre-Construction Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1	Improper road designing	Long term	Unlikely	Moderate	Severe
2	Improper selection of Camp, asphalt, and batching plant sites	Short term	Likely	Moderate	Mild
3	Lack of integration of EIA/EMP requirements into Construction bid documents	Short term	Likely	Moderate	Severe
4	Landscape	Short term	Likely	Moderate	Severe
5	Relocation of utilities	Long term	Unlikely	Minor	Low
6	Waste/construction material dumping site/s	Short term	Likely	Moderate	Mild
7	Natural Hazard Risks (Flooding, Earthquakes, etc.)	Short term	Likely	Moderate	Severe
8	Land Acquisition	Long term	Likely	Major	Severe

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Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	**Likelihood** (Certain/ Likely/ Unlikely/ Rare)	**Magnitude** (Major, Moderate, Minor, Miniinal)	**Sensitivity** (Very Severe/ Severe/ Mild/Low)
9	Cutting of Trees	Temporary	Rare	Minimal	Low

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Table 7-5: 'Activity Wise' Screening of Impacts during the Construction Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1.	Construction of road not in accordance with approved design	Short term	Likely	Moderate	Severe
2.	Degradation of air quality due to construction works	Short term	Likely	Moderate	Low
3.	Topography	Short term	Likely	Moderate	Low
4.	High noise levels and vibration from construction activities	Short term	Likely	Moderate	Mild
5.	Improper handling and/or disposal of hazardous and non-hazardous waste	Short term	Likely	Moderate	Low
6.	Untreated disposal of effluent from worker camps and construction sites	Short term	Likely	Moderate	Low
7.	Soil contamination,	Short term	Likely	Moderate	Low

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Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
	Erosion, and Sedimentation				
8.	Wildlife Loss	Short term	Likely	Minor	Low
9.	Sedimentation of Streams and Water Bodies	Short term	Likely	Minor	Low
10.	Water resources	Short term	Likely	Minor	Low
11.	Temporary yard Location and operation	Short term	Likely	Minor	Low
12.	Communicable diseases incl. COVID-19	Short term	Likely	Moderate	Mild
13.	Potential accidents and injuries to communities in the project area during construction works- Community Health & safety	Short term	Likely	Minor	Low
14.	Injuries to workers	Short term	Likely	Minor	Low

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Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
	from lack of necessary training and/or not using PPEs etc. (Occupational Health & Safety)				
15.	Graveyard and physical cultural resources	Short term	Likely	Minor	Low
16.	Labor influx	Short term	Likely	Minor	Low
17.	Traffic management	Temporary	Likely	Minor	Low

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Table 7-6: 'Activity Wise' Screening of Impacts during Operation Phase

Sr. No.	Potential Issue	Risk Levels			
		Duration of Impact (Long term/Medium term/Short term/Temporary)	Likelihood (Certain/ Likely/ Unlikely/ Rare)	Magnitude (Major, Moderate, Minor, Minimal)	Sensitivity (Very Severe/ Severe/ Mild/Low)
1	Air and Climatic Impacts	Short term	Likely	Moderate	Low
2	Potential Accidents due to high speed	Long term	Likely	Minor	Low
3	High noise levels	Short term	Likely	Moderate	Low
4	Impact on Social and Cultural Resources	Long term	Likely	Major	Mild

The 'activity-wise' screening of potential impacts during the design/pre-construction phase is provided in Table 4.4 while details are given hereunder.

7.7 POTENTIAL IMPACTS DURING THE DESIGN/PRE-CONSTRUCTION PHASE

7.7.1 Improper Road/Interchange Designing

Impacts

The possibility exists that in case the road/ interchange is not designed in accordance with international standards and guidelines; the American Association of State

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Highway and Transportation Officials (AASHTO) for road development, particularly with regards to compatibility with the local climate and keeping in view the hilly terrain, it could result in multiple potential impacts that could adversely affect the project area and economic losses. If the project design shall not take into account the consideration related to ground conditions, the geology, and the hydrogeology of the site, long-term potential environmental impacts may arise.

Consideration like the provision of culverts, water drains, side walls, etc is crucial; any fault may result in a possible traffic accident and road damage, and water and other operational complexities.

Mitigation Measures

The following design-related measures will be implemented to ensure the road/interchange operation does not result in the unanticipated, long term and potentially irreversible impacts:

- The road/ interchange has been designed in accordance with international standards and guidelines for road development (AASHTO).
- Consideration has been given to the stability of the sub-base, the base system to make all-weather roads. The subgrade and the base will be sufficiently stable as per international standards.
- The provision of appropriate culverts, box-culvert, side drains, water drains, side walls, etc. are given in the road design.
- Sign boards and road safety gadgets are given in the road design.

Residual Impact

The impacts of the road/ interchange design on a project are not expected to be significant. With the implementation of the mitigation measures outlined above, the environmental impact will be low in magnitude. Therefore, residual impact is expected to be not significant.

7.7.2 Improper Selection Of Camp, Asphalt, And Batching Plant Sites

Impacts

The duration of the interchange construction is expected to be long and a considerable amount of the workforce will be engaged. As a result, worker camps will need to be

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developed and ancillary facilities will need to be provided such as electricity, washrooms for labor with suitable effluent and sewage disposal facilities as well as water for their everyday use for drinking and bathing, etc.

The batching and asphalt plant location near any sensitive receptor may cause potential social and environmental impacts.

Mitigation measures

- To prevent a nuisance, specific locations shall be designated for the development of the labor camps. All necessary facilities and amenities shall be provided in these camps such as electricity, sufficient supply of water, solid and liquid effluent waste disposal facilities, etc.
- The use of proper planning while identifying locations for the labor camps will ensure there is minimal disturbance to all key receptors and the traffic is not disrupted by labor camps being set up roadside next to the construction sites.
- It shall be ensured that the labor camp, batching plant, and asphalt plant are situated at least 500m away from any populated area, or in cases, within the populated area the camp should be safeguarded with security persons to avoid any inconvenience to the locals.
- It shall be ensured that the batching plant and asphalt plant are equipped with pollution abatement technology (i.e. wet scrubbers or dry scrubbers).

Residual Impact

The impacts of improper selection of camp, asphalt, and batching plant sites on the project are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.7.3 Lack Of Integration Of EIA/EMP Requirements Into Construction Bid Documents

Impacts

- The bidding documents must reflect the requirement to select a qualified and experienced Contractor from the perspective of ensuring the implementation of required safeguards during project development.

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- Lack of contractor's environmental safeguard capacity or selection of environment non-responsive contractors may fail in EMP implementation and may be a source of some non-compliances.
- Contractors that do not possess the required capacity for safeguards management must not be pre-qualified and selected.

Mitigation Measures

- It will be ensured that the 'Safeguards unit' is active and operational in PIU.
- The existing 'Safeguards unit' at the PIU will be assigned the task to check that design and bid documents are responsive to key environmental, social, and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP.
- The bid documents must include the EMP and its implementation cost must be reflected in the BoQ.
- EIA/EMP implementation and monitoring requirements must be part of bidding documents and necessary contractual binding must be agreed upon by project contractors before the award of the contract.
- Project contractors shall have qualified and experienced environmental staff to plan, arrange, implement, monitor, and report EIA/EMP requirements.
- The Contractor will be required to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment. These procedures should be developed and approved by the PIU in collaboration with the CSC before the Contractor commences any physical works on the ground.

Residual Impact

The impacts of the lack of integration of EIA/EMP requirements into construction bid documents are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.7.4 Landscape

Impacts

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The physical scarring caused by clearing and levelling during project site construction activities could lead to alteration of soil quality by removal of topsoil, loses of plant cover and limited soil erosion induced by disturbance to native soil.

Mitigation Measures

To reduce physical scaring of the landscape, unnecessary widening and clearing of vegetation will be avoided. Greenbelt plantations will be maintained, and parking of construction vehicles will not be allowed on the median. Borrow areas will be selected in consultation and approval of the Project Director and would not be much deeper to avoid alteration of drainage and soil erosion. The borrow area will be leveled and topsoil restored.

Residual Impacts

The nature of impact is direct and its duration is short term in nature but takes time to rehabilitate the natural environment of the area

7.7.5 Relocation of Utilities

Impacts

Due to the proposed project, public utilities may affect and may disrupt public services and economics.

Mitigation Measures

The road construction is being done in the available RoW. No relocation of utilities is anticipated to be affected by the proposed project.

Residual Impact

The residual impact is expected to be not significant with the implementation of mitigation measures.

7.7.6 Natural Hazard Risks (Flooding, Earthquakes, Etc.)

Impacts

- Rainfall can cause flooding in the project area, particularly during the monsoon season, due to inadequate storm and sewer systems within the area. Floods in the study area in the past were triggered by extreme rainfall events.

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- Some projects are located in the seismic Zone 3 and thus there is a risk to the project related to seismic events. According to the Pakistan Seismic Zones Map, Chagai district(proposed project site) falls in Zone 2A, which means minor or no damage to property due to earthquakes

Mitigation Measures

- Required provisions in the project design, such as stormwater drainage, shall be incorporated into the roads' design to cater to extreme weather events.
- Similarly, the design is made keeping in view seismic Zone requirements.

Residual Impact

Not required

7.7.7 Land Acquisition

One of the major project related impact will be the land acquisition for the proposed project that will result in causing disturbance to the affected residents along the project area.

Mitigation

Careful alignment and route selection by the designer to minimize the impacts by avoiding the residences/houses of these families;

- Proper access should be provided to the farmers to cultivate the divided land at a minimum travel distance;
- For the land coming in the proposed project, the affected people will be provided with suitable compensations as per rules and regulations of Government of Punjab.

Residual impacts

The residual impact is expected to be not significant with the implementation of mitigation measures.

7.7.8 Cutting of trees

Impact

As Existing Motorway Bridge over Bucheki – Nankana Sahib Road is utilized for proposed new interchange without extension. Hence, no cutting of tree is involve.

Mitigation

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It may be ensured that the contractor will remain strict with the design and that no deviation from the design occurs during the implementation of the project. New trees will be planted at a construction site after the completion of the project.

Residual Impact

Not required.

7.8 POTENTIAL IMPACTS DURING THE CONSTRUCTION PHASE

7.8.1 Construction Of Road Not According To The Approved Design

Impacts

If the proposed interchange is not constructed in accordance with the finalized design and its corresponding design parameters, it could lead to several unanticipated impacts such as water accumulation on the road, road cracks, poor roadways, and road safety equipment will lead to accidents, etc.

Mitigation measures

The following mitigation measures will be implemented:

- Method statements must be prepared by the Contractor and approved by the Construction Supervision Consultant (CSC) before the commencement of construction works.
- The CSC must closely monitor the construction works being conducted by the Contractor to ensure the finalized design is implemented in full and the road design is developed completely in compliance with the approved finalized designs.
- Any variation by the Contractor from following the finalized design must be immediately highlighted and corrective measures must be implemented to ensure full compliance with the finalized design of the road.
- PIU shall ensure that construction activities are being carried out in compliance with project design following best international practices. It will closely review and monitor the activities of CSC and contractors involved in construction activities.

Residual Impact

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The impacts of the road rehabilitation design on the project are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.8.2 Air Quality

Impacts

- The construction will involve earthworks and transporting and dumping of dry material. This will likely lead to an increase in Suspended Particulate Matter (SPM) in and around the construction zones.
- Potential sources of particulate matter emission during construction activities include earthworks (dirt or debris pushing and grading), exposed surfaces, exposed storage piles, truck dumping, hauling, vehicle movement on unpaved roads, combustion of liquid fuel in equipment and vehicles, land excavation, and concrete mixing and batching.
- Vehicles carrying construction materials are expected to result in increased SPM levels near the haul roads. This can be of potential importance if the vehicles pass through areas with a high concentration of sensitive receptors, such as residential areas, in this particular case.
- At the construction yard, the dust levels are also expected to increase due to the unloading of construction materials. It shall be ensured that most of the excavated material will be used within the project, with minimal cut and fill material coming from outside the site.
- Poor air quality due to the release of contaminants into the workplace can result in possible respiratory irritation, discomfort, or illness to workers. Employers should take appropriate measures to maintain the air quality in the work area.
- The quantity of dust that will be generated on a particular day will depend on the magnitude and nature of the activity and the atmospheric conditions prevailing on the day. Due to the uncertainty in values of these parameters, it is not possible to calculate the quantity from a 'bottom-up' approach, that is, by adding PM10 emissions from every activity on the construction site separately.

Mitigation Measures

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The following mitigation measures will be adopted for the preservation of the environment:

- At the active road construction site and the immediately adjoining areas, water will be sprinkled every three hours and at a higher frequency if felt necessary, at all construction sites to suppress dust emissions if required.
- All heavy equipment and machinery shall be fitted in full compliance with national and local environmental standards.
- Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions.
- Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions.
- Vehicles transporting soil, sand, and other construction materials shall be covered with tarpaulin.
- Limitations to speeds of such vehicles as felt necessary. Transport through the densely populated area should be avoided.
- Concrete plants are to be controlled in line with statutory requirements and shall not be close to sensitive receptors.
- The stack height of generators will be at least 3 meters above the ground.
- Project traffic will maintain a maximum speed limit of 20 km/hr on all unsealed roads within the project area.
- A minimum distance of 300 meters will be ensured between batching plant(s) and the nearest community.
- The need for large stockpiles shall be minimized by careful planning of the supply of materials from controlled sources. Stockpiles should not be located within 50m of sensitive receptors and shall be covered with tarpaulin when not in use and at the end of the working day to enclose dust. If large stockpiles (>25m3) of crushed materials are necessary, they should be enclosed with side barriers and also covered when not in use.

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- Dust emissions due to road travel shall be minimized through good construction practices (such as keeping stockpiles downwind and away from communities) and sprinkling water over the access road.

7.8.3 Vehicular & Equipment Emissions

It shall be ensured that the following measures are taken to control emissions from vehicles being used in the construction activity:

- Periodically check and conduct maintenance of the construction machinery and haul vehicles. Generators, compressors, and vehicles used during construction works will be maintained in a good condition to ensure that emissions are kept to a minimum level.
- Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel-burning characteristics.
- Controlled technology generators and batching plants will be used to avoid excessive emissions.
- Burning of wastes at any site will not be allowed.
- The stack height of generators will be at least 3 meters above the ground.
- Training of the technicians and operators of the construction machinery and drivers of the vehicles.
- All types of machinery and generator must comply with the NEQS. Vehicles, which are not in compliance with NEQS, are not allowed to use.
- Periodic emission monitoring of vehicles, generators, and batching plants is proposed.
- Project activities should be planned to avoid harsh weather conditions.

Residual Impact

Implementation of the proposed mitigation measures is likely to leave no long-term residual impact on the ambient air.

7.8.4 Topography

Impacts

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The topography along the project area will change to some extent because of construction of project related structures such as embankments, culverts etc.

Mitigation Measures

Visual changes to the topography will be of short term in nature and do not require any mitigation measures, except that the project design should consider aesthetic concerns.

Residual Impacts

Not required

7.8.5 Noise Levels And Vibration

Impacts

- The road development will result in different construction equipment and machinery being used which will generate high noise levels at the project site and in the project area.
- The detailed mapping of sensitive receptors has been conducted and the types of receptors are provided earlier. However, any required mitigation measures that shall be proposed will be to control potential impacts on noise to prevent any long-term impacts within the project area.
- Each construction activity has its unique noise characteristics due to the use of different equipment items. The construction activities will include the use of a large number of trucks, generators, excavators, etc., which can generate significant noise.
- The equipment used for construction will be the major source of the noise.
- Since various modern machines are acoustically designed to generate low noise levels, high noise levels that might be generated will only be for a short duration during the construction phase.
- Depending on the construction equipment used and its distance from the receptors, the community, and the workers may typically be exposed to intermittent and variable noise levels. During the day, such noise results in general annoyance and can interfere with sleep during the night. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is

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noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

- Due to the various construction activities, there will be temporary noise impacts near the project site. The movement of heavy vehicles, loading, transportation, and unloading of construction materials produces significant noise during the construction stage. However, these increased noise levels will prevail only for a short duration during the construction phase.
- The mitigation measures listed below shall be implemented to minimize noise levels during the construction activity as far as possible.

Mitigation Measures

The following mitigation measures will be implemented:

- Equipment noise will be reduced at source by proper design, maintenance, and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by the use of proper silencers and mufflers.
- Excessive noise-emitting equipment will not be allowed to operate and will be replaced.
- Blowing of horns will be prohibited on access roads to work sites.
- As a rule, the operation of heavy equipment shall be conducted during daylight hours.
- Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.
- Well-maintained haulage trucks will be used with speed controls.
- The use of ear plugs and ear muffs must be ensured during construction. No employee should be exposed to a noise level greater than 85 dB (A) for more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- Before the issuance of hearing protective devices as the final control mechanism, the use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible.

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- Periodic medical hearing checks should be performed on workers exposed to high noise levels.
- All the equipment and machinery used during the construction phase should be well maintained and in compliance with NEQS.
- A grievance redress mechanism will be established.
- Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration-dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values. Exposure levels should be checked based on the daily exposure time and data provided by equipment manufacturers.
- Other sources of vibration at a construction site are rollers, compactors, or any loose part of machinery exposure which may cause serious injury or workplace sickness. No equipment and machinery with loose or vibratory parts will be allowed to work. Such issues will be fixed through maintenance of the machinery periodically. The use of rollers for land grading will be carried out during day times and with intermittent intervals to reduce the impacts of vibration on the surrounding environment.
- Considering the project setting, which is not in a congested rural environment and instead is a hilly terrain, there are no potential risks concerning vibration.

Residual Impact

Provided the proposed mitigation measures are implemented, the noise levels and vibration from construction activities will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.6 Waste Mnagement

The construction of proposed project inevitably will generate solid and liquid waste products potentially including:

- Inert waste – for example, uncontaminated roads and soil, concrete, masonry and bricks, wood and plastics.

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- Hazardous waste – acids and alkaline solutions, waste oils and oily sludge, batteries, asbestos, and bitumen.

In addition, uncontrolled discharges of sewage and 'grey water' (e.g. from washrooms and canteens) from construction sites and worker's camps may also cause odors and pollute local water resources. As well as being a cause of complaints by the local population, this may lead to contravention of local regulations and fines being imposed on the Contractor. The main construction waste produced will be Asphalt.

Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of this may contaminate the surface water sources such as drains, water channels etc. apart from soil contamination.

Estimated water demand for 100 workers is 4000liters/day and estimated waste water generated is 3200 liters/day[7]. This impact can be categorized as direct, moderate, or site. Specific, short term, temporary, high probability and reversible

Mitigation Actions

Domestic and chemical effluents from the construction camp will be disposed of by the development of on-site sanitation systems i.e. septic tanks (as shown in Figure 7.1). Where possible, surplus materials will be reused or recycled.

- Oils, fuels and chemicals (including bitumen, bridge deck waterproofing agents and concrete) are substances which are hazardous to human health. They need to be stored properly in correctly labeled containers, both within the construction camp and also at construction sites (e.g. bridges, culverts, etc.).
- Bitumen, oil and fuel should be stored in tanks with lined bunds to contain spillage. Proper storage and handling of hazardous materials reduces wastage and reduces the risk of spillage which could cause temporary or long-term contamination of the underlying soil and possibly pollution of groundwater and/or watercourses; some (e.g. concrete) may have serious impacts on freshwater fauna.

[7] Tentative work force requirement including client and contractor staff
= 100 x 40 =4000 liters/day
=100 x (80% of water consumption)= 3200liters/day

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- As well as being a cause of complaints by the local population, this may lead to contravention of local regulations and fines being imposed on the Contractor, Proper storage and management reduces the risk of vandalism and theft.
- Disposal of waste materials shall be undertaken by a waste management company contracted by the Contractor.
- The waste management company must have the required licenses to transport and dispose of both inert and hazardous waste (including medical) before any such waste is removed from the site.
- The Contractor will keep copies of the waste management company's licenses and provide waste transfer manifests at his campsite for routine inspection.
- The Contractor will also keep a record of the types and volumes of waste removed from the site every week.
- The contractor in coordination with the Environmentalist of the Supervision consultants will identify the appropriate places for sustainable disposal of asphaltic waste.
- To ensure all of the above conditions are met, the Contractor shall be responsible for the preparation of a Waste Management and Recycling Plan.
- The Plan shall include items relating to the safe handling and management of potential materials and wastes.
- A sewage treatment plant is the appropriate solution needed for an efficient way to deal with daily sewage wastewatergenerated in labour camps

7.8.6.1 Sewage Treatment Plant For Labour Camps

Labor camps are proposed to be constructed close to the project construction site. The average labor strength to be employed at the construction site will be 100. The water requirement for such labor is approximately 45 liters per day. In the project construction phase, the major source of pollutant which is contributed to water pollution in the environment is sewage from labor camps/colonies. Normally one community latrine can be provided per 20 persons. The sewage from the community latrines can be collected in sewage collection tanks. Disposal of this sewage daily is one of the major problems that occur mainly in construction sites where the common municipal sewage system connection is not available. A sewage treatment plant is the

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appropriate solution needed for an efficient way to deal with daily sewage wastewater.

Apart from the domestic sewage impurities labor camp also contains particles of Cement & Sand as the laborers take a bath or wash their hands, which makes the conventional sewage treatment process difficult. The sewage is proposed to be treated before disposal to avoid deterioration of the water quality of the receiving water body or it can be reused. Septic tanks are underwater sedimentation tanks for the primary treatment of domestic wastewater and fecal material through the process of biological anaerobic digestion or decomposition and change into settleable solid or semi-solid sludge.

The septic tank is one, two, three, or four compartments, generally 4rth compartment of the septic tank is used as a soak pit for water to drain out and go into the soil, the first compartment receives the wastewater, 2nd and 3rd compartment used for anaerobic digestion of waste. One end of the septic tank is connected to the inlet waste water pipe and the other end with an outlet pipe for the overflow of water, generally piped in T-shaped allowing waste water to enter and exit without disturbance.

7.8.6.2 Purpose of A Septic Tank

1. Deposition of settling solids in sewage by sedimentation.
2. Partial or complete digestion of sludge before disposal of sludge.
3. Storage of sludge and scum accumulated in between successive cleanings

7.8.6.3 How Does A Septic Tank Work?

A septic tank work on the principle of anaerobic digestion or decomposition of wastewater and fecal material by the action of several microorganisms like bacteria, decomposing it and changing the waste into settleable solid or semi-solid sludge. Wastewater enters the first Chamber of the tank, allowing the solid to settle and scum to float, the settled solids are anaerobically digested, reducing the volume of the solid. The liquid component flows through the dividing wall into Second Chamber, where

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further settlement takes place the excess liquid now relatively clean and dark in color comes out from the outlet pipe and goes into the sewage or soak pit[8].

7.8.6.4 Size of Septic Tank per Person: -

The septic tank should have size and capacity of 350 liters per person and in any case, its capacity should not be less than 2000 liters. Each person can flush 20 gallons of water per day into the septic tank. For the proposed project of construction estimated water demand for 100 workers is 4000liters/day and estimated waste water generated is 3200 liters/day[9]. Therefore,the septic tank will be constructed according to the generation of waste in labour camps.

7.8.6.5 Construction of a Septic Tank

The requirement to design a proper septic tank are as follow

1. The capacity of the septic tank should be sufficient enough to hold liquid taken from 130 liters to 70 liters per member.
2. For the best design of the septic tank, the mortar used at the wall of the septic tank should be used of thickness more than 20 cm, and concrete used below the septic tank should be of M15 or M20 grade.
3. The outside, inside faces of the wall and top floor of the septic tank, should be plastered with a thickness greater than 12mm of 1:3 or 1:4 grade of mortar. The concrete should be prepared waterproof and all the inside corners of the septic tank should be rounded giving a slope toward the center base of the septic tank for better extraction of a slug at the time of removing the slug. Also, the floor of the septic tank should be given a little slope (1:15) toward the inlet side.
4. The width of the septic tank should not be less than 750 mm.
5. The length should be provided 2 to 4 times the width of the septic tank.
6. The depth of the septic tank should be kept at 1000 mm to 3000 mm (+ 300 mm to 500 mm according to water level. But should not exceed 1800mm (+ 450 mm) for freeboard.
7. The minimum capacity of the septic tank should be 1 cubic meter
8. The detention period of septic tanks should be considered to be 24hrs (mostly).

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[8] Standard septic tank size for 4, 5, 6, 10, 15, 20, 25 and 50 users - Civil Sir
[9] Tentative work force requirement including client and contractor staff
= 100 x 40 =4000 liters/day
=100 x (80% of water consumption)= 3200liters/day

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9. For inlet pipe, an elbow or T pipe of 100mm diameter should be deep below the liquid at a depth of 250mm to 600mm, and for outlet pipe at a depth of 200mm to 500mm.
10. The inlet baffle wall should be at (1/5) the distance of the length of the wall. The baffle wall should be generally enlarged 150 mm above and 400 mm to 700 mm to scum level.
11. The roof of the septic tanks should be covered with an RCC slab of thickness 75 mm to 100 mm. If circular manholes are made then the diameter should be 500mm but if rectangular manholes are made then its dimension should be 600X450 mm for inspection and desludging.
12. The outlet pipes for ventilation purposes may be cast iron or asbestos and should be kept 2 meters minimum above the ground level and the diameter should be 50 mm to 100 mm. The topper open part of this pipe should be covered with a net or cowl to prevent the mosquito from entering through it.[10]

[10]Design Of Septic Tank Calculation - With Numerical For 20 User (civilconcept.com)

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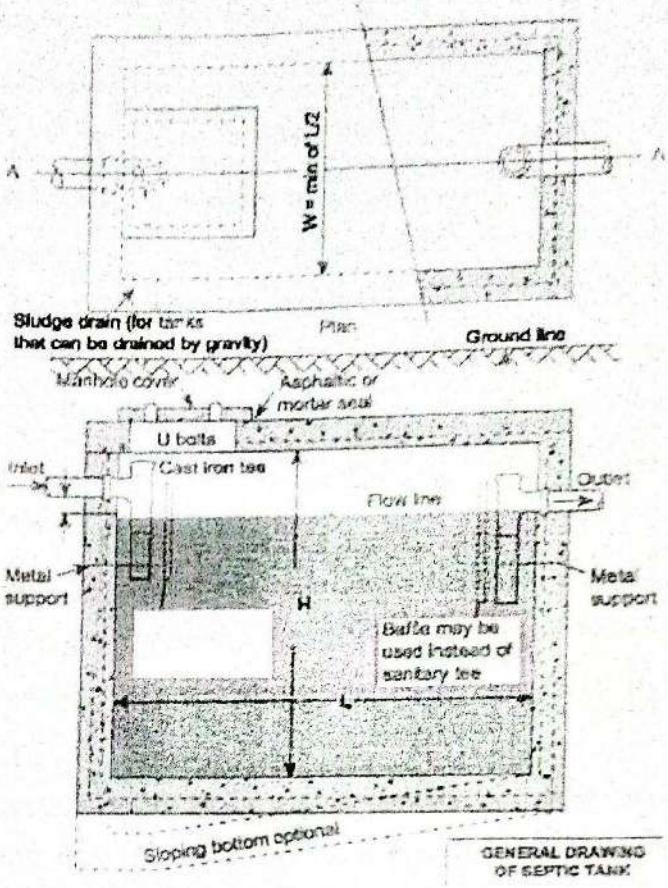


Figure 7-1: General Design Of Septic Tank

7.8.7 Waste/Construction Material Dumping Sites

Impacts

Due to construction activities waste will be generated at the construction site and contractors camp. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and the up to the extent possible the excavated materials will be reused, where applicable, for construction purposes. The solid waste generated during construction and campsites shall be safely disposed of in demarcated waste disposal sites. The solid waste generation is estimated to be 50 kg/day (as per 0.5 kg/capita/day waste generation)[11] for 100 construction workers for the proposed Project. Waste disposal sites should be identified before starting construction.

[11] Source the World Bank report 2012 .What a waste, a global review of Solid Waste Management. Based on UNEP estimation for waste generation in Asia Pacific

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Mitigation Measures

- The contractor shall submit and get approval for the waste management plan as well as the dumping site/s for construction waste disposal.
- The Contractor will keep copies of the waste management company's licenses and provide waste transfer manifests at his campsite for routine inspection. The Contractor will also keep a record of the types and volumes of waste removed from the site every week.
- The contractor in coordination with the Environmentalist of the Supervision consultants will identify the appropriate places for sustainable disposal of asphaltic waste.
- To ensure all of the above conditions are met, the Contractor shall be responsible for the preparation of a Waste Management and Recycling Plan. The Plan shall include items relating to the safe handling and management of potential materials and wastes.
- A waste management plan will be developed before the start of construction. This plan will cater to the sorting of hazardous and non-hazardous materials before disposal, placing of waste bins at the project sites for waste disposal, and an onsite hazardous waste storage facility i.e. designated area with secondary containment.

Residual Impact

The impacts of the lack of Waste/construction material dumping sites are not expected to be significant with the implementation of mitigation measures outlined above. Therefore, residual impact is expected to be not significant.

7.8.8 Hazardous & Nonhazardous Waste Management

Impacts

- During construction/civil works potential sources of waste will include spoils generated during road excavation, excavation waste for other civil works, domestic wastes (solid & wastewater), fuel or oil leakages or spills, onsite effluents from vehicle wash & cleaning, and cement spills.
- Waste disposal of materials containing contents of both hazardous and non-hazardous nature such as scrap wood, bricks, concrete, asphalt, plumbing fixtures,

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piping, insulation (asbestos and non-asbestos), metal scraps, oil, electrical wiring, and components, chemicals, paints, solvents, etc. can potentially become a serious environmental issue, particularly with the local contractors.

- Domestic wastes generated during the construction of the road will include sewage, grey water (from the kitchen, laundry, and showers), kitchen wastes, combustible wastes, and recyclable wastes from contractor camps.

Mitigation measures

- A waste management plan will be developed before the start of construction. This plan will cater to the sorting of hazardous and non-hazardous materials before disposal, placing of waste bins at the project sites for waste disposal, and an onsite hazardous waste storage facility i.e. designated area with secondary containment.
- Licensed waste contractors will be engaged to dispose of all non-hazardous waste material that cannot be recycled or reused.
- All types of combustible and non-combustible waste including plastic or glass bottles and cans will be temporarily stored on-site and later sold/handed over to a waste/recycling contractor who will utilize these wastes for recycling purposes.
- Waste management training for all site staff is to be included in Contractor's training plan.
- Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area should be equal to 120% of the total volume of fuel stored.
- Fuel and hazardous material storage points must be included in the camp layout plan to be submitted for approval. Hazardous material storage areas shall include a concrete floor to prevent soil contamination in case of leaks or spills. Fuel tanks will be checked daily for leaks and all such leaks will be plugged immediately.
- Designated vehicles and refueling points must be included in the camp layout plan to be submitted for approval.
- Hazardous waste will be initially stored on-site at the designated area and then handed over to EPA certified contractor for final disposal.

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- Record of waste generation and transfer shall be maintained by project contractors.
- Spill kits, including sand buckets (or other absorbent material) and shovels, must be provided at each designated location.
- At the time of restoration, septic tanks will be dismantled and backfilled with at least 1m of soil cover keeping in view the landscape of the surrounding natural surface.
- It will be ensured that after restoration activities, the campsite is clean and that no refuse has been left behind.
- Clinical wastes will be temporarily stored onsite separately and will be handed over to approve waste contractor for final disposal.
- Training will be provided to personnel for identification, segregation, and management of waste.

Residual Impact

Provided the proposed mitigation measures are implemented, the Hazardous & Non-Hazardous Waste Management during the construction phase will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.9 Soil Contamination, Erosion, And Sedimentation

Impacts

- The majority of the works proposed for the road may result in soil erosion and sedimentation. Spoils will be generated from the excavation activities, particularly during construction works. Potential impacts from spoils and their disposal are (i) land for disposal of spoil, (ii) potential erosion from the spoil areas and spoil material reaching the waterways, and (iii) aesthetic impacts. Excavated soil will be stored at the designated site and will be used for backfilling.
- During the project construction, spills of fuel, lubricants, and chemicals can take place while transferring from one container to another or during refueling. Also, during maintenance of equipment and vehicles, through leakages from equipment and containers and as a result of traffic accidents.

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- Depending on the nature of the material, location of the spill, and quantity of spill, the soil can get contaminated.

Mitigation measures

- Any drainage structures, culverts, or pipes crossing the project site may need to be modified or protected and the detailed designs must make provisions to protect or re-provision all infrastructures that may be affected by the construction works.
- It will be ensured that spill-prevention trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.
- Fuels, lubricants, and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags, and absorbent materials will be available near fuel and oil storage areas.

Residual Impact

Provided the proposed mitigation measures are implemented, the soil contamination, erosion, and sedimentation during the construction phase will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.10 Wildlife Loss

Impacts

During the construction phase, there will be considerable human interventions in the project area which can potentially affect the wildlife resources of the project area.No environmentally sensitive area is located in the vicinity of the project area. The project area has been under cultivation and human habitation for almost half a century, and the natural vegetation and habitats have been degraded in most areas. As a result, most wildlife species have either left the area or become locally extinct. Most

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of the animals found are common species that are highly adaptable and able to co-exist with people.

Mitigation measures

- A "no hunting, no trapping, no harassment" policy will be strictly enforced
- Wildlife protection rules will be included in the Camp Rules.
- Trading of wild animals or birds by project personnel will also be prohibited.
- Regular consultation with the area officer of the wildlife and forest department will be done during the construction phase.

Residual Impact

Provided the proposed mitigation measures are implemented, wildlife loss during the construction phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.11 Sedimentation Of Streams And Water Bodies

Impacts

The works proposed for development may result in soil erosion and sedimentation. Spoils will be generated from the excavation activities, particularly during the construction of a road. Potential impacts from spoils and their disposal are (i) land for disposal of spoil, (ii) potential erosion from the spoil areas and spoil material reaching the waterways, and (iii) aesthetic impacts. Excavated soil will be stored at the site and will be used as backfilling during operations.

Mitigation measures

Any drainage structures, culverts, or pipes crossing the project site may need to be modified or protected and the detailed designs must make provisions to protect or re-provision all infrastructures that may be affected by the construction works.

Residual Impact

Provided the proposed mitigation measures are implemented, the sedimentation impact during the construction phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.12 Water Resources

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Impacts

Water will be required during construction activities. Water will be procured from both ground and surface water resources. Water conservation practices will be utilized to reduce the overall water consumption during proposed project activities.

Proposed activities could affect the area's water resources in two ways:

- Reduction due to overuse, and
- Contamination (surface or groundwater)

Surface or groundwater quality may deteriorate if pollutants are mixed with surface runoff during rain and carried to water resources in the vicinity or seeped in the ground. Potential sources of pollution in such cases may include:

- Domestic waste (sanitary and kitchen discharge);
- Oil and grease from vehicles and machinery;
- Stored fuel, oil and other chemicals;

Sewage from the camp should go into an impermeable septic tank. The impermeable septic tank will prevent untreated sewage from polluting surface water.

Mitigation Measures

The mitigation measures described below will ensure that the project area's surface and aquifer resources are not significantly affected by project activities.

- The water extraction will be kept at minimum;
- A water management plan will be developed. The plan will also include strategies to minimize water use (and therefore volume of discharge) and maintain reserves;
- Follow good housekeeping practices with all machinery that may potentially discharge wastewater;
- No untreated effluents will be released to the environment
- Effluents from the camp offices and the residential camps will be treated in the septic tank before its disposal. The treated water (if confirming to PEQS) will be used for tree plantation or will be disposed-off through waste contractor (if effluent does not confirm to PEQS). The septic tank will be completely covered, so that surface runoff may not come in contact with the effluent.

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- Fuels, lubricants, and chemicals will be stored in covered and with bund walls, underlain with impervious lining.
- Spill prevention plan shall be followed to mitigate any kind of spill.

Residual Impacts

Further, proper implementation of the required mitigation and monitoring techniques will prevent any adverse water quality impacts. Residual impacts are foreseen to be negligible / low in this case.

7.8.13 Temporary Yard Location And Operation

Impacts

Temporary yard location and its operation may cause social disturbance and land contamination with oil and grease.

Mitigation Measures

Mitigation measures included are;

- Proper fencing of the yard
- Oil spill management plan at the site
- And rehabilitation at the end of the project is recommended.

Residual Impact

Provided the proposed mitigation measures impacts are short term and low. Therefore, no significant adverse residual environmental impacts are likely to occur

7.8.14 Communicable Diseases Incl. Covid-19

Impacts

- Communicable diseases such as COVID-19 and HIV may be introduced due to the immigration of workers associated with the project.
- Ministry of National Health Services, Regulations, and Coordination, GoP issued guidelines in April 2020 for the Health & Safety of Building and Construction Workers during the COVID-19 outbreak. These guidelines are prepared for the workers involved in building and construction work during the current epidemic of COVID-19. These guidelines provide the safety measure to be implemented at the construction site having a dusty environment, continuous flow of different

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materials, and make-shift type of arrangements for storage, food, and sanitation calls for the implementation of safety precautions at the very basic level of personal hygiene only.

Mitigation measures

A communicable disease prevention program will be prepared for construction workers or residents near the construction sites.

7.8.15 COVID-19-Specific Measures WHO

- All workers must perform complete sanitization at the site as per SOPs/guidelines issued by WHO and the national guidelines issued by the Government of Pakistan (GOP).
- All workers must wear a mask and gloves as soon as they arrive at the site and must keep wearing them at all times while present at the work site/hospital premises. As soon as workers arrive at the work site, their body temperature must be checked and in case any worker is assessed to be running a fever or suffering from the flu or cough, he must be informed to leave immediately and self-isolate for two weeks and not report for work until this two-week mandatory period has been completed.
- At the work site(s), social distancing measures must be strictly implemented and gathering of workers at any location at the work site(s) must be strictly forbidden. In case of workers not taking this measure seriously, strict penalties must be imposed to ensure implementation.
- The work tasks must be divided into shifts, as far as possible, to reduce the workforce present at the work site(s) at any one moment and improve the working speed/efficiency.
- All workers will be strictly advised to wash their hands as frequently as practicable and not to touch their faces during work.
- A supply of safe drinking water will be made available and maintained at the project site(s).
- Chlorinated disinfecting spraying must be conducted at the work site(s).

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- COVID awareness signboards must be installed at the camp clinic and the work site(s).
- Contact details of all workers will be kept in a register on-site to efficiently trace and manage any possible workers that might experience symptoms of COVID-19.
- Prohibition of entry for local community/any unauthorized persons at work sites.
- Proper hygiene practices in the toilets and washrooms will be implemented with proper and adequate use of soap and disinfectant spray.
- Social distancing must be maintained during the pick-up and dropping off of workers from their residences to and from the work site(s).

Residual Impact

Provided the proposed mitigation measures are implemented, the Communicable diseases incl. COVID-19 during the construction phase will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.16 Potential Accidents And Injuries To Communities In The Project Area (Community Health & Safety)

Impacts

The interchange construction will involve the use of considerable heavy machinery at the project site along with posing the risk of community members falling into trenches. In addition, the risk to commuters on the road during the construction works will be significant and thus many precautionary measures will be necessary to minimize the risk of possible accidents. Community Health & Safety may be compromised during road travel particularly at night hours if adequate barriers and lighting are not provided at construction sites.

Mitigation Measures

The following mitigation measures will be implemented:

- Work areas outside the project site, especially where machinery is involved, will be barricaded and will be constantly monitored to ensure that residents, particularly children stay away while excavated areas are being prepared for the

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road. Road-related infrastructure will be cordoned off. Also, no machinery will be left unattended, particularly in running condition.

- Local communities in the project area will be briefed on traffic safety.
- A speed limit of 20 km/hr will be maintained by all project-related vehicles and nighttime driving of project vehicles will be limited where possible.
- Educate drivers on safe driving practices to minimize accidents and prevent the spill of hazardous substances and other construction materials during transport.
- A contractor must take proper safety measures (placing warning tapes around excavations) to avoid people, especially children, accidentally falling into excavations.
- All the working platforms must be cordoned off with special care by well-trained skilled workers.
- A contractor will prepare a construction management plan which will include a hazard prevention and safety plan, which will address the health and safety of the people in the project area.
- PIU should ensure the contractor staff working on the project is well trained and educated in the Health, Safety, and Environment (HSE) hazards associated with their duties, and that of the public, in the project area.

Residual Impact

Provided the proposed mitigation measures are implemented, the community health and safety impacts due to construction works will be short-term and minor. Therefore, no significant adverse residual environmental impacts are likely to occur

7.8.17 Injuries To Workers From Lack Of Necessary Training And/Or Not Using PPEs (Occupational Health & Safety)

Impacts

- There is invariably an OHS risk when construction works for the road are conducted, and precautions will be needed to ensure the safety of the workers.
- The major OHS hazards expected during the proposed activities are as follows:
- Falls from height, especially when standing/working on ladders;

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- Slips, trips, and falls, especially while carrying heavy or bulky loads;
- Cuts and injuries caused by sharp instruments and tools;
- Psychological stress due to dissatisfaction at work due to issues with peers, superiors, etc.;
- General ill feelings as a result of work in confined spaces and the development of 'sick building syndrome

Mitigation Measures

The Contractor will be required to prepare and implement an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities. Construction contracts will include standard Worker Health and Safety measures and contractors will be bound to implement these fully.

- Monitoring will be required to ensure that the health and safety plan based on contract specifications is followed.
- Cement feed hopper areas will be inspected daily to ensure compliance with the requirement of dust masks.
- Surfaces (including flooring and work surfaces) in camps, kitchens, dining areas, and workshops should be solid and easy to clean. Flooring for work camps must be float-finished concrete or better.
- All drivers engaged by Contractors must hold a valid license for the vehicle they are operating.
- Work in a confined space shall be executed with available safety standards. Adequate monitoring and equipment shall be available to detect deficient oxygen levels.
- The Contractor shall submit to the Engineer of CSC for approval an emergency evacuation plan and practice the procedure annually.
- The Contractor shall submit to the Engineer of CSC for approval a site layout plan, identifying work areas, accommodation, kitchen, dining area, sanitary facilities, location of generators, plant and vehicle parking, transport routes through the camp, pedestrian routes through the camp, evacuation routes, emergency exits, batching plants, storage areas, waste facilities, etc.

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- Fire extinguishers should be provided throughout camps and work sites. Fire extinguishers should be inspected monthly and maintained as necessary.
- An adequate and reliable supply of safe drinking water shall be made available at readily accessible and suitable places including at all camps.
- The Contractor shall take samples from each supply of drinking water and arrange for analysis of these samples at a Punjab EPA-certified laboratory before their use by the Contractor's staff. The results of these tests for each supply must be submitted to the Engineer of CSC and must demonstrate that each water supply meets national and World Health Organization standards for drinking water.
- The Contractor shall provide and maintain adequate hygienic kitchens which are sheltered and separated from the living quarters. Kitchens shall include raised and washable surfaces suitable for food preparation.
- The Contractor shall provide and maintain adequate hygienic dining areas for staff. Workplaces and camps should be provided with both natural& artificial light. Artificial lighting should be powered by a generator in the event of power cuts.
- Public sensitization training should be provided to workers to avoid social conflicts between residents and the construction contractor, Occurrence of any such impacts can be avoided by community-sensitive project planning and implementation and through the effective involvement of local administration.
- All OHS protocols should be implemented in true letter and spirit.
- The contractor must appoint an OHS resource to implement, monitor and report the HSE management plan to the concerned authorities.
- The contractor must ensure the provision of a first aid facility at the construction site and camps by hiring medics and establishing a dispensary at the campsite.
- A reasonable number of first aid kits should be available on construction sites and within contractor camps.
- Site personnel will be provided with the appropriate type of personal protective equipment (PPEs). The contractor will ensure consistent use of PPEs.

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- Based on the type of hazard applicable during the proposed works at the site, the following mitigation measures for Occupational Health and Safety (OH&S) must be implemented:
- Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations. Mitigation measures related to rotating and moving equipment hazards for workers are provided below:
- Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions.
- Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards should be designed and installed in conformance with appropriate machine safety standards.
- Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance.
- Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms.
- Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords, and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:
- Marking all energized electrical devices and lines with warning signs;
- Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance;

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- Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for a maximum permitted operating voltage of the portable hand tools;
- Double insulating/grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits;
- Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas;
- Conducting detailed identification and marking of all buried electrical wiring before any excavation work.
- Welding creates an extremely bright and intense light that may seriously injure a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include:
- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific workstation (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.
- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated.
- Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area should be equal to 120% of the total volume of fuel stored.
- Storing flammables away from ignition sources and oxidizing materials. Further, the flammables storage area should be:
- Remote from entry and exit points into camps

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- Away from facility ventilation intakes or vents
- Have natural or passive floor and ceiling level ventilation and explosion venting
- Use spark-proof fixtures
- Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period.
- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in the use of smoking materials, cellular phones, or other potential spark-generating equipment).
- Providing specific worker training in handling flammable materials, and in fire prevention or suppression.
- Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. However, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls should be observed in the work environment when handling such chemicals:
- Corrosive, oxidizing, and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water-based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills.
- Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shields or goggles, etc).
- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash

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stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water.

Residual Impact

Provided the proposed mitigation measures are implemented, the worker health and safety impacts due to construction works will be short-term and minor. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.18 Graveyards and Physical Cultural Resources Impacts

Graveyards and burial sites are very sensitive for the local communities. The shifting of graves falling in the ROW may cause social disruption leading to possible conflicts, ultimately affecting the project works. No graveyards and physical cultural resources have been identified in the project area.

Mitigation measures

If evidence of any archaeological remains is found during the construction activities, the excavation work will be stopped immediately, and necessary next steps taken to identify the archaeological discovery based on the 'Chance Find' procedures will be adopted.

Residual Impact

Provided the proposed mitigation measures are implemented, the archaeological sites' impact during the construction phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.8.19 Labor Influx

Impacts

- Social invasion due to the large number of laborers in the area
- Spread of communicable diseases.
- Disturbance of local privacy

Mitigation measures

- The labor camp will be 500m away from any residential dwellings.
- Regular medical checkups of workers for HIV/AIDS.
- Fencing of a labor camp.

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Residual Impact

Provided the proposed mitigation measures impacts are short term and low. Therefore, no significant adverse residual environmental impacts are likely to occur

7.8.20 Traffic Management

Due to construction activity, there will traffic congestion at the entry/exit of the motorway. Since during the construction period, the existing motorway will be operational for traffic movement, therefore traffic management will not be a major problem.

Mitigation Measures

- Installation of Over Hanger Exit Signs as per drawing including RCC foundations complete with all respect and as directed by the engineer
- Installation of Gantry Signs as per drawing including RCC foundations complete with all respect and as directed by the engineer.
- The delineator, attached to the metal barriers, can show the outer contour of the highway when being illuminated by the car lamps, thus ensuring driving safety
- Object marking, a kind of reflective membrane pasted on the Guard Rail, overpass pier, and gantry-type signposts to warn the vehicles during the night.

Residual Impact

This impact is temporary and minor negative in nature and can be mitigated by providing a proper alternate traffic management plan during the construction activities. Impacts can also be mitigated by following measures provided by the engineer.

7.9 POTENTIAL IMPACTS DURING THE OPERATION PHASE

7.9.1 Operational and Management Manual

During the operational phase, the Project Manager will develop a comprehensive operational and Management Manual of the roads and an effective monitoring plan. Mistakes at the operational level or handling of operations by untrained staff can prove very risky and costly. Important points to be attended at the operational stage are as follows:

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- The strict application of the prescribed M&E plan
- Continuous evaluation of design efficiencies
- Understanding and training in Operational and Maintenance Manual
- Regular maintenance of engineering works (mechanical as well as civil).
- Continued Public consultation and feedback
- Refresher Training Courses for operational and maintenance staff

7.9.2 Air Quality

Impact

Highway activities can have a major impact on the local and regional air quality. The pollutants can seriously impair human health and ecological environment and other materials. The emissions include sulphur dioxide, oxides of nitrogen, carbon monoxide, carbon dioxide, and particulates (which may contain trace metals). The emission levels depend on the type and size of facility, the type and quality of fuel and the manner in which it is burned. A significant impact will be interpreted if the concentration of pollutants in the ambient air exceeds the PEQS. The impact will also be considered significant if the pollutants emission level as well as the ground level concentration exceed the values as set out by Punjab- EPD. It is obvious that the transport will be shifted from nearby roads to proposed Highway. Still there will be an increase in transportation. This distribution of traffic will share the air pollution load which will result in a slight change in existing air quality scenario in proposed project area.

Potential Impacts Impacts on local air quality may arise from the following project activities:

- Biomass Combustion due to traffic
- Particulate matter emissions results from unburned carbon and impurities in fuels

Likely impacts of these activities can include:

- Deterioration of local and regional air quality
- Respiratory diseases in local community

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- Global Warming (Increase in CO2 and NOx in the atmosphere can cause global warming)
- Acid Precipitation (impact on aquatic ecosystem of surface water and ground water through acidification).

Mitigation measure

The proposed mitigation measures to reduce the impacts on air quality during the proposed operation activities are:

- Use of cleaner fuels and if possible to renewable fuels
- Annual Environmental Audit based upon Tri–base assessment.
- Tree plantations in the area
- Comprehensive Operational and Maintenance Rules as per ISO standards should be prepared and implemented by the C&W.
- The strict application of prescribed Monitoring and Evaluation of the plan
- Regular maintenance of engineering works of road.
- Ambient air quality monitoring should be carried out during the operation phase.
- Regular road maintenance to ensure good surface condition.
- Regular vehicle checks to control/ensure compliance with air quality standards;
- Enforcement and penalties against traffic rules violators.
- Ambient air quality monitoring will be conducted to ensure the ambient air quality for the area will comply with the limits.

Residual Impact

If the mitigation measures are effectively implemented, the residual impact of the proposed activities on the area's air quality is expected to be low in significance.

7.9.3 Potential Accidents Due To High Speed

Impact

While the proposed project of the interchange at Bucheki to Nankana road will increase traffic and the potential for higher speeds may result in more road accidents.

Mitigation measures

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- Traffic calming measures and speed limit signage will be provided to reduce the impact of traffic through populated areas.
- Crossing areas will be marked and amber flashing lights installed in areas where some population exists when full traffic signals are not warranted.
- Improved traffic signage and road markings will be used to warn motorists of impending changes in road standards and to advise appropriate speeds.
- Properly designed traffic calming measures such as speed humps, speed signs and, possibly traffic signals will be installed where settlements are nearest.
- Traffic police should be trained to enforce road rules.
- Better enforcement of road rules and more stringent penalties should be sought.

Residual Impact

Provided the proposed mitigation measures are implemented, the accidents due to high speed during the operational phase will be short-term and low. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.9.4 Noise Levels

Impact

The construction of the interchange will result in different construction equipment and machinery being used which will generate high noise levels at the project site and in the project area. However, any required mitigation measures that shall be proposed will be to control potential impacts on noise to prevent any long-term impacts within the project area.

The assessment of the noise impacts on the sensory receptors that have been identified at various locations in the project area depends upon:

- Characteristics of the noise source (instantaneous, intermittent, or continuous)
- Time of day at which noise occurs, and
- Location of the noise source

Each construction activity has its unique noise characteristics due to the use of different equipment items. The potential sources of noise during the preparation, construction, and worksite closure phases for the project works include equipment,

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machinery, and transportation used for the construction activities. The equipment used for construction will be the major source of the noise.

The construction activities will include the use of a large number of trucks, generators, excavators, etc., which can generate significant noise.

Since various modern machines are acoustically designed to generate low noise levels, high noise levels that might be generated will only be for a short duration during the construction phase.

Depending on the construction equipment used and its distance from the receptors, the community, and the workers may typically be exposed to intermittent and variable noise levels. During the day, such noise results in general annoyance and can interfere with sleep during the night. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

Due to the various construction activities, there will be temporary noise impacts near the project site. The movement of heavy vehicles, loading, transportation, and unloading of construction materials produces significant noise during the construction stage. However, these increased noise levels will prevail only for a short duration during the construction phase.

The following mitigation measures will be implemented:

- Equipment noise will be reduced at source by proper design, maintenance, and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by the use of proper silencers and mufflers.
- Excessive noise-emitting equipment will not be allowed to operate and will be replaced.
- Blowing of horns will be prohibited on access roads to work sites.
- As a rule, the operation of heavy equipment shall be conducted during daylight hours.
- Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.
- Well-maintained haulage trucks will be used with speed controls.

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- The use of ear plugs and ear muffs must be ensured during construction. No employee should be exposed to a noise level greater than 85 dB (A) for more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- Before the issuance of hearing protective devices as the final control mechanism, the use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible.
- Periodic medical hearing checks should be performed on workers exposed to high noise levels.
- All the equipment and machinery used during the construction phase should be well maintained and in compliance with NEQS.
- A grievance redress mechanism will be established.
- Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration-dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values. Exposure levels should be checked based on the daily exposure time and data provided by equipment manufacturers.
- Other sources of vibration at a construction site are rollers, compactors, or any loose part of machinery exposure which may cause serious injury or workplace sickness. No equipment and machinery with loose or vibratory parts will be allowed to work. Such issues will be fixed through maintenance of the machinery periodically. The use of rollers for land grading will be carried out during day times and with intermittent intervals to reduce the impacts of vibration on the surrounding environment.
- Considering the project setting, which is not in a congested rural environment and instead is a hilly terrain, there are no potential risks concerning vibration.

Residual Impact

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Provided the proposed mitigation measures are implemented, the noise levels and vibration from construction activities will be short-term and moderate. Therefore, no significant adverse residual environmental impacts are likely to occur.

7.9.5 Social And Cultural Resources

Population and Communities

Impact

- The construction activities for the road will generate jobs for the local people. In addition, indirect economic activities will increase i.e., hotels, shops, and petrol pumps may come up along the highway during the operation stage.
- A large number of non-locals will come for working on various jobs; therefore there is a possibility of social or cultural conflict. It is recommended that the services of local skilled or unskilled local labor may be utilized as far as possible. The influx of non-locals may however have some positive impacts also, including the possibility of bringing awareness and cultural uplift to the Project Area.
- Business and trade activity will increase significantly providing economic benefits to the people living in the area.
- The improvement in existing transportation facilities will boost tourism in the area. The Project may impart different skills to the residents and training on the Project will help them in their future life hence human resource development will take place for the future progress of the area.
- Levels of necessities like health, education, and transportation are expected to be enhanced benefiting the people residing in the area.
- Road rehabilitation projects can lead to changes in the community or social environment around the road, influencing various aspects of lifestyles, travel patterns, and social and economic activities.
- The overall socioeconomic benefits of the Project being more than the negative impacts will result in raising the standard of living and alleviation of poverty in the project area.

Mitigation Measures

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The impacts on population and communities will be overwhelmingly beneficial from all project activities

7.9.6 Environmental and Social Benefits

Changes in Land Value

The proposed project is expected to appreciate the current land values of associated villages, towns and cities. Land owners will have an opportunity to sell their land on increased prices and start new businesses. This impact will be major positive in nature.

Employment

The project will generate directly hundreds of jobs during the construction phase of the project. The project operational phase will also generate new jobs. Most of these vacancies will be filled by Pakistani nationals. Similarly the construction and operation of the project will create far greater number of indirect income resources for example income resource for transporters for the transportation of the materials, procurement of goods from local market etc. Overall the proposed project will have a very positive impact on the employment opportunities in Pakistan

7.9.7 Additional Considerations

As an additional measure, the following steps will further enhance roadways environments where its related dividends will be continued to be received for a very long time far beyond the project life;

Unattended or Leftover Work The contractor might be failed to clean waste from all work areas, such as construction wastes left behind by workers and waste left blocking newly constructed culverts and other structures. The contractor may also fail to properly close or rehabilitate some borrow and disposal areas.

Mitigation Measures

Based on a careful inspection of the work areas the contractor and CSC will establish a remediation plan and exercise by the contractor if required.

Tree Plantations: Tree plantations on top of embankments and in RoW will serve as small forests and wood lots for the residents, having tangible benefits in the shape of timber, fuel wood, and fodder. Besides soil retention, erosion control, and biotic improvements, such plantations will also provide aesthetic and visual screens against

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sound, dust, wind, toxic emissions, vibrations, night glare, and pollution of waterways.

Environmental Training: Capacity building can be achieved through on-the-job training, short courses, training workshops, lectures, educational visits, and seminars. Such interactions include leading team members of PIU CSC, construction managers/supervisors, and other related agencies on road-related environmental issues.

Awareness Raising: Awareness about roads related to current and potential environmental threats for the public at large and roadside dwellers, in particular, requires due attention; the aspect neglected in the past. Enhanced education in road-related environmental issues and awareness raising can be achieved through campaigns by; Visual graphics, Print media, Seminars & workshops.

Community Participation and Initiatives: Wherever possible, the Deputy Director (Environment & Resettlement) along with the Social and environment expert of CSC must involve local communities, for contractors' camp locations, resource sharing with construction workers, and their choice of tree species. In this way, a sense of ownership will be inculcated in residents who will also protect core roads and their related resources. The past practices of isolated working methodology must transform into a participatory mode.

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7.9.8 Socio-economic Impacts on the Overall Project Area

In the ultimate analysis, the impacts of the project on social and economic activities in the Project area will be mostly positive. The economic analysis shows very high economic benefits compared to the cost. Salient economic benefits of the project are:

- The improved mobility of human and material resources leads to a better economy. The construction of roads in the area will not only provide markets for material resources but will also give the local population access to job markets.
- Boosting trade through ensured and enhanced capacity to take additional traffic.
- Increased economic activity with improved transport will ensure easy marketing of agriculture and livestock produce.
- With the improved economy, there will be further improvement in services in the area, and opportunities for employment, education, and healthcare, especially for women and children, will improve.
- Employment during the construction phase will employ and train a large number of unemployed youths. They will receive a lifetime benefit through skill training, capacity building, and poverty alleviation. Many semi and unskilled workers in the project area will be hired.
- As populations grow, the limited village lands and resources cannot sustain the local community. To sustain the future communities, villages, and settlements need to expand, this is only possible through transportation networks.

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Table 7-7: Characterization of Potential Environmental Impacts (*Construction Phase*)

Environmental Components	Impacts		Nature of Impact		Duration			Location			Likelihood			Reversibility		Significance				Consequences
	Positive	Negative	Direct	Indirect	Short Term	Intermediate	Long term	Local	National	Global	Low	Moderate	High	Reversible	Irreversible	Major	Minor	Moderate	Beneficial	
Air Quality		·	·		·			·					·	·		·				M
Noise		·	·		·			·					·	·			·			M
Surface Water Quality		·	·		·			·			·			·			·			L
Ground Water Quality		·		·	·			·			·			·			·			L
Soil Quality/Erosion		·	·			·		·				·		·			·			M
Solid Waste		·	·		·			·				·		·				·		M
Wildlife loss		·	·			·		·			·			·			·			L
Disturbance to Public Life		·	·		·			·			·			·			·			L
Occupational Health & Safety		·	·		·			·			·			·				·		L
Traffic Management		·	·		·			·			·			·			·			L
Local Economy and Employment	·		·			·			·			·		NA					·	

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Table 7-8: Characterization of Potential Environmental Impacts (Operation Phase)

Environmental Components	Impacts		Nature of Impact		Duration			Location			Likelihood			Reversibility		Significance				Consequence
	Positive	Negative	Direct	Indirect	Short Term	Intermediate	Long term	Local	National	Global	Low	Moderate	High	Reversible	Irreversible	Major	Minor	Moderate	Beneficial	
Air Quality		.	.				.	.				.			.		.			L
Noise		.	.				.	.			.				.		.			L
Local Economics	.		.				.	.					.		.				.	Positive
Traffic Situation	.		.				.	.					.		.				.	
Lifestyle and culture	.		.				.		.				.		.				.	
Community Development	.		.				.	.					.		.				.	

LEGEND

Levels of Negative Consequences					Levels of Positive Consequences		
High	Moderate		Low		Characterize impact	Positive	: Not applicable

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8 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT AND MITIGATION MEASURES

This section identifies the potential impacts of the construction of the interchange at Bucheki-Nankana Road, the project under consideration in this EIA Report.

8.1 PROJECT LOCATION

The proposed interchange is located near Nankana Sahib Interchange on M-3 at the intersection point of Bucheki and Nankana Sahib Road. The proposed interchange is located at a distance of 10 Km approx. from the Nankana Sahib Interchange and 26 Km approx. from the Jaranwala Interchange.

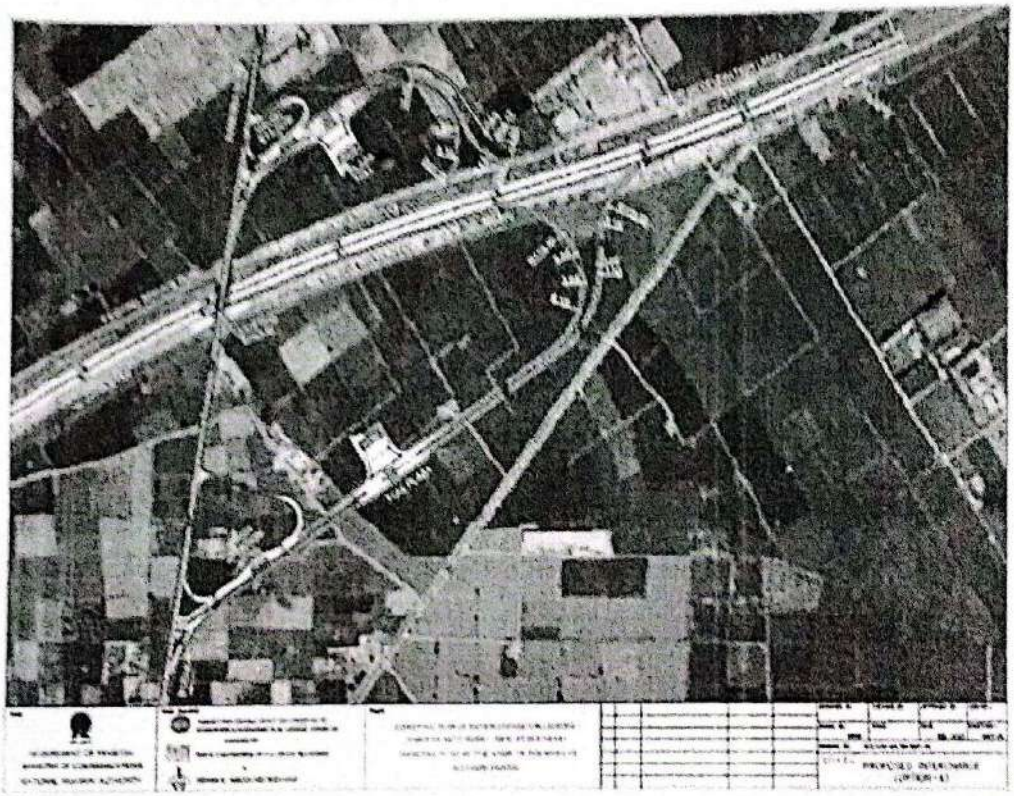


Figure 8-1: Layout Plan of Proposed Trumpet Interchange

8.2 POTENTIAL IMPACT SOURCES

Environment and social impacts attributable to the project can broadly be classified into those taking place during construction and those occurring during the operational phase. Some of these impacts can be anticipated and avoided through appropriate adjustments/provisions in the project design. Some can be mitigated by careful implementation of the project's Environmental Management Plan while some other can

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be adjusted by appropriately following the operational manual and effective collaboration with concerned stakeholders.

Construction related Impacts are heavily dependent on:

- The contractor's work practices, especially those related to the storage of construction materials and cleanliness of the work site;
- Cooperation between local communities and local authorities and the contractor in terms of observance of stakeholders and use of public space and utilities;
- Project management's enforcement of correct construction practices and standards;
- The quality of Monitoring and Reporting of EMP implementation.

Operational impacts of the proposed project are associated with the movement of vehicular traffic on it and allied activities. These include air and noise pollution, safety hazards, and other similar impacts.

For this Project, potential impacts are reviewed under construction and operational phases. The environment has been studied under the following subheads:

Physical Environment

- Land Resource
- Water Resource
- Air Quality
- Noise Level

Biological Environment

- Flora
- Fauna
- Fish
- Endangered Species

Socio-Economic Environment

Table 8.1 provides a checklist of potential impacts associated with the project activities. In general, these areas are divided into groups based on general environmental aspects which are affected or likely to be affected by the modification in the flow of traffic. The set of impacts based upon physical, biological, cultural, and social aspects have been classified as under construction and operational phases. Each subfactor has been marked as curable, reversible, or irreversible.

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Table 8-1: Assessment of Environmental and Social Impacts

ASPECTS	IMPACTS ASSESSED	ASSESSMENT								
		Slight			Moderate			Significant		
		1	2	3	1	2	3	1	2	3
Pre-construction phase										
	Topography							☐		
	Land acquisition		☐							
	Cutting of tree	☐								
	Natural hazards risks						☐			
1. Construction Phase										
Impacts on Soils and Land Resources	Site for disposal of waste construction material					☐				
	Unstable soil or similar unforeseen conditions		☐							
	Location of labor camps, material dumps, equipment yard, and approach road.		☐							
	Natural disasters heavy rains and floods, etc.					☐				
	Soil contamination from diesel and other spills from construction machinery								☐	
	Damage/blockage of drains, paths, roads, and cross drainage by moving machinery.					☐				
	Scouring of earthen embankment or concrete work edge				☐					
	Release of construction water on an unstable slope or any public/private property							☐		
	Release of construction water to any water structure such as a bridge/culvert.								☐	

1. Avoidable through design (Avoidance) : Curable
2. Mitigation through contractor's obligation or by EMP implementation (Curative) : reversible
3. Non-reversible, Permanent change (to be adopted) : irreversible

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ASPECTS	IMPACTS ASSESSED	ASSESSMENT								
		Slight			Moderate			Significant		
		1	2	3	1	2	3	1	2	3
	Impact of taking borrow martial from earth borrow site.								□	
	Impact on paths or roads used for transport of construction material.					□				
	Impact of stone quarrying.		□							
	Any blasting during Construction									□
Impacts on Water Resources	Sourcing of construction water.		□							
	Impact of surface water.		□							
	Impact of groundwater.		□							
	Impact of drinking water.		□							
	Diesel and other fluids spill over to the water body from machinery.				□					
	Damages from floods of streams.								□	
	Obstruction of the flow of water in any stream.		□							
	Effect on surface flow conditions in rains.		□							
Air Quality and Noise Pollution.	Dust, smoke, and other pollutants from construction Machinery including asphalt and concrete batching plant.					□				
	Dust or other emissions from stored material and spoil keeps.					□				
	Smoke from burning waste material or burning firewood.					□				
	Noise from the use of old or outdated machinery.					□				
	Noise due to any blasting.					□				
	Soil compaction due to labor camps and machinery yards.	□								
Impacts on	Damage to biological resources		□							

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ASPECTS	IMPACTS ASSESSED	ASSESSMENT								
		Slight			Moderate			Significant		
		1	2	3	1	2	3	1	2	3
Biological Resources	Damage to fisheries		☐							
	Impact on (adjacent) open land		☐							
	Impact on any migratory birds.		☐							
	Impact on endangered species.		☐							
Impacts on Socio Economic Cultural and Archeological issues.	Existing services education, health, electricity, and water supply communication.		☐							
	Local ethnicity, Tribal Tensions, communal rivalries		☐							
	Impact on the area under crops					☐				
	Land ownership / Land tenure system		☐							
	Access to construction material.		☐							
	Adverse effect on cultural and archaeological heritage (if any).		☐							
	Public safety at the construction site.					☐				
	Health and safety of labor and employees on construction site.					☐				
										☐
	Loss of livelihood due to loss of land and ancestral villages.		☐							
	HIV / AIDS and infectious diseases such as cholera and Jaundice in the laborers, employees, and nearby Public.		☐							
	Employment		☐							
	Women status: Exposure to employment and education opportunities.		☐							
	Hurdle in cultural Reunion.		☐							
	Hurdle in accessing market opportunities for agricultural produce.		☐							

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ASPECTS	IMPACTS ASSESSED	ASSESSMENT								
		Slight			Moderate			Significant		
		1	2	3	1	2	3	1	2	3
	Reduction in recreation opportunities.		□							
2. Operational Phase										
Monitoring and Evaluation as per the operational manual and monitoring plan	Compliance with the M&E plan.								□	
	continuous evaluation of design efficiency								□	
	Understanding and training of operational manual.								□	
	Environmental annual Audit								□	
	Regular Maintenance								□	
	Staff welfare								□	
	Continuous public consultation					□				
	Continued gender issues and women consultation.					□				
	Refresher courses for operational staff.					□				

8.3 DESCRIPTION OF IMPACTS AND MITIGATION MEASURES

8.3.1 Disposal of Waste Construction Material

Impacts

The project area is comparatively flat. These may be surplus earth or waste construction material that needs disposal.

Mitigation Measures

The construction waste material will be disposed of in selected barren spots as allowed/approved by Resident Engineer and level so that it becomes useful. No waste material will be thrown into the nullah or other surface water bodies.

8.3.2 Sitting of Labor Camps, Material Depots, Equipment Yards, and Approach Roads

Impacts

Because of the availability of public/private land on either side of the road sections siting of labor camps material depots, equipment yards, and approach roads will not cause any

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serious problems. Therefore, this is a matter of low significance that can easily be mitigated.

Mitigation Measures

The contractor will, in consultation with RE, select the siting for all those facilities within the public land. The camp / other facilities will be set up on flat land without much natural vegetation, at least 250 m away from any community. Satellite images can also be used to select suitable sites, record the pre-construction conditions, and monitor the condition of these sites during and after the construction phase.

8.3.3 Natural Disasters: Heavy Rains, Floods, and Earthquakes

Impacts

Natural disasters such as heavy rains, floods, or earthquakes can potentially impact the project works especially the area in the vicinity of the water body and bridges.

Mitigation Measures

The contractor in consultation with RE and the local community will resolve the issues, in the best interest of the NHA. Neither party will however be held responsible for any force majeure.

8.3.4 Contamination from Diesel and Oil Spills from Construction Machinery

Impacts

Any leakage or spillage of diesel, oil, or any other chemical will contaminate the soil which may in turn impact the water sources, nearby community, and/or productive land.

Mitigation Measures

- A contractor will apply strict rules on his workers and labor to ensure that no spills or leakages are caused. All fuels, oils, and bitumen will be stored appropriately, with concrete padding and bunding for containment in case of leakage. If the spills or leakages do take place, it must be followed by the treatment prescribed below as per the degree of spill or leakages.
- Moderate Spills are defined as spills of volume less than or equal to 200 liters to be contained and controlled using shovels, sand, and native soil. These equipment and materials are to be made available at campsites during the operation. The contaminated soil is to be excavated and stored in a burn area lined with an

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impermeable base. Depending on the volume, the contaminated soil is either disposed of by burning in the burn pit or by specialized treatment such as bioremediation.

8.3.5 Damage to Roads, Cross Drainages

Impacts

Damage to roads and cross-drainages can arise through the carelessness of the heavy machinery drivers or operators. Such carelessness can cause considerable damage to paths, roads, and drainages if the drivers/operators are not made aware, trained, and bound to be careful. It is a concern of moderate significance but can be mitigated through care and regulation.

Mitigation Measures

The contractor will prepare standard operating procedures and impose strict control over operators and drivers of all types of vehicles to minimize any damage to roads or structures. Should any damage take place, the contractor will carry out repairs immediately. An effective sinology and a good traffic plan can reinforce the instructions to drivers.

8.3.6 Earthen Embankments or Concrete Work, Edge Scouring

Impacts

Poor design and inappropriate construction procedures can potentially damage embankments, concrete works, or road edges. The impact is moderately significant but can easily be mitigated.

Mitigation Measures

Edge scouring of earthen embankments or concrete work must first be dealt with at the design stage. Wherever such a situation is anticipated, aprons should be provided to secure edges and specifications must be kept of high standards. During the construction phase, this aspect should be addressed through appropriate construction methodology and employing appropriate techniques such as protection walls and rip rap. The contractor will repair all damages to the earthen embankments, concrete works, or pavement edges caused by the construction works. During the operation phase, appropriate measures need to be incorporated into the Operational Manual.

8.3.7 Impact of Borrowing Material from Earth Borrow Sites

Impacts

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A large quantity of earth will be removed from borrow pits located within the designated/approved areas by the NHA. This can potentially cause loss of soil/land productivity, uneven terrain, and altered drainage.

Mitigation Measures

The borrow areas will be selected after obtaining approval from the RE. The contractor will ensure that the borrowing does not cause loss of soil/land productivity, uneven terrain, and altered drainage. Wherever possible/necessary, these places will be leveled and planted with trees using appropriate planting technology/methodology.

8.3.8 Impact on Roads / Infrastructure Used for Transport of Construction Materials including Asphalt, Bitumen

Impacts

Transport of construction machinery, construction material, and construction workers will cause additional wear and tear on the roads/infrastructure and raise considerable dust. This impact will be moderately significant and can be adequately mitigated.

Mitigation Measures

The contractor will be responsible to repair any damage caused to the local infrastructure by the construction activities. Water sprinkling will be carried out where necessary to minimize dust emissions.

8.3.9 Source of Drinking Water

Impacts

The construction activities can potentially damage/affect the drinking water sources of the communities. The usage of unsafe water by construction workers can cause health problems.

Mitigation Measures

It will be ensured that the drinking water sources of the communities are not affected. The contractors will repair/replace/compensate for any damages caused by the construction activities. The contractor will make arrangements to supply safe drinking water to its staff and workers.

8.3.10 Dust and Gaseous Emissions from Construction Machinery or Asphalt Plants

Impacts

The construction activities and operation of vehicles and machinery will release exhaust emissions and also raise dust.

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Mitigation Measures

The contractor will ensure that its vehicles, machinery, and generators are properly designed and maintained, and comply with the applicable PEQS. The asphalt plant will not be operated without a properly functioning dust control system such as a wet scrubber and will be located away from any residential or commercial settings. Water will be sprinkled where necessary to control the dust emissions.

8.3.11 Smoke from Burning of Waste Material or Burning Firewood

Impacts

A large number of big and small fires in the labor camp and the burning of waste can produce smoke and smog which can cut off visibility, reduce visibility and cause suffocation along with causing diseases of the respiratory tract including cancer.

Mitigation Measures

The contractor will use clean and smoke-free fuel in the labor camp. Cutting and burning trees/shrubs for fuel will be prohibited. Instead, gas cylinders should be used in the labor camp for cooking purposes. Similarly, waste burning will not be allowed. The contractor will prepare a waste management plan and have it approved by the RE.

8.3.12 Noise

Impacts

The construction activities will generate noise, which can potentially affect the communities and also the construction workers.

Mitigation Measures

The contractor will strictly follow the environmental quality standards for ambient noise. All necessary measures such as noise barriers will be taken to reduce the noise, particularly near the communities. Personal protective equipment (PPE) will be provided to the construction workers and its usage will be made mandatory.

8.3.13 Disposal & Impact of Milled Asphaltic Material

Impacts

The project activities may potentially generate surface-milled asphaltic material disposal which may cause potential environmental impacts of water through the leaching process and solid waste material, therefore, proper utilization or disposal of the material is mandatory for sustainable development.

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Mitigation Measures

Reclaimed material can be used in the asphaltic base course or shoulders. Generally, 15–20% of the material can be usable. However, this may be done with the permission of NHA. As the project shall be implemented in a segmented phase it's suggested that the contractor will devise a disposal plan for sustainable disposal of the material. With the consultation of the local community during project implementation some barren places can be identified for the burial of this material. It is also suggested that some latest techniques for the reclamation of Milled Asphaltic Material may also be adapted for the utilization of this material on unpaved areas.

8.3.14 Damage to Biological Resources (Flora and Fauna)

Impacts

The project activities may potentially cause some disturbance to the wild species of the area; however, this impact is not significant. The area has already undergone modification because of human settlements and associated vehicular traffic, therefore most of the wild fauna species would have already left the area.

Mitigation Measures

No killing/hunting/trapping of wild animals will be allowed. Compensation will be paid for any tree cutting on the private land. Compensatory tree plantation will be carried out for Forest Department-owned trees and each tree removed, five saplings will be planted. Borrow material will be obtained without causing any damage to the natural vegetation. Since the project will be executed on the alignment option presented above only a small amount of tree cutting is expected to be cut. Removing all the growth, trees, bushes leveling dressing, and disposal of excavated material will be allowed as per instruction of the Engineer-in-charge and complete in all respects as per drawing and specification and to the approval of the Engineer-in-charge.

8.3.15 Land Acquisition

Impacts

Land required for establishing the contractor's facilities including camp, workshop, plants, borrowing earth material, and dumping excess spoil will be acquired directly from private landowners by the contractor. The provisions of the Land Acquisition Act, of 1894 will not be invoked for contractor's facilities including camp, workshop, plants, borrowing earth material, and dumping excess spoil as the acquisition of the land will be

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temporary and will be covered by short–term lease agreements between the landowners and contractors under the approval of the Project Engineer. Rental terms will have to be negotiated to the satisfaction of the landowners concerned. On the other side, for the construction of an interchange on the Abdul Hakeem – Lahore Motorway (M-3) at Bucheki – Nankana Sahab Road to connect Bucheki, Nankana Sahab, and surrounding areas with the Motorway (M-3).and other structures of the project as per design standards/site requirements, the land will be acquired.

Mitigation Measures

- The staff of the NHA and supervisory Consultants will monitor the process of restoration and ensure, through the terms of the construction contracts, that landowners are compensated according to the terms of the lease agreements, and that the restoration actions agreed upon by the contractors are duly carried out. The photo–documentation of the existing land before temporary acquisition should be available, which will be beneficial to resolve the restoration conflicts between the landowner and contractor.
- Similarly, before the commencement of construction activities, the Contractor will carry out a baseline survey for selecting the campsites, dumping sites, and public and community / privately owned utilities, in conformity with the requirements of project implementation. Project facilities, viz., construction camp and workshop will be located at a minimum distance of 500 m from an existing plantation, and settlements. This limit will be 1,000 m in the case of batching plant.
- As far as possible, waste/barren land i.e. areas not under agricultural, residential, or forestation use, and natural areas will be used for borrowing material (if required) and setting up project facilities.
- Where the use of agricultural land is unavoidable for the borrowing of earth material, the top 30 cm of the plough layer will be stripped and stockpiled for redressing the land after the required borrowed material has been removed. In case deep ditching is carried out, the top 1 m layer of the ditching will be stripped and stockpiled. The ditch will initially be filled with scrap material from construction and then leveled with the stockpiled topsoil to make it even with the rest of the area. It shall be ensured that the scrap does not contain any material that may produce obnoxious material that would contaminate soil or water resources.

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- Barren lands or valley-side slopes will be used for dumping the excavated spoil material. Appropriate sites have to be located along the road for this activity.
- These facilities will be regularly monitored and cleaning activities implemented during the operation phase to improve the cross-drainage facilities of the area.

8.3.16 Infrastructure within RoW

Impacts

No public infrastructure such as schools, hospitals, or offices falls within RoW. Budgetary provisions for a campsite, asphalt and batching plant will be made accordingly.

Mitigation Measures

The cost of these utilities may be included in the project's main cost.

8.3.17 Increased Risk of Accidents Caused by Partial Closure of Road during Construction

Impacts

During construction activities, traffic flow will be disturbed. At sections passing through populated areas, there will be limited scope for providing diversion tracks for the mobility of local and thorough traffic. As a result of construction the traffic volume will increase during the operation stage, and there may be safety hazards for the locals residing along the edge of the road as well as vehicular traffic.

Mitigation Measures

- Proper site-specific measures will be carried out in consultation with supervisory consultants to ensure the safety of the population residing along and around the project corridor. Traffic Management Plan (TMP) prepared in this report will be implemented by the Contractor with the approval of the Project Engineer.
- Necessary measures will be taken to ensure the safety of traffic during construction, including barricades (including signs, pavement markings, flags, and lights) erected as required by the NHA and set up as per local regulations.
- The construction work will be managed such that part of the carriageway at a time is upgraded leaving the other part available to serve one-way traffic. Construction work will be carried out in small stretches instead of long stretches.

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- Periodic inspections will be made by the contracted firm particularly in monsoon season to identify the landslide areas and their remedial measures. In case of any landslide contracted firm will clear the road within a minimum time. For this purpose, the firm should be fully equipped and there should be a contingency plan in case of any emergency/natural disaster.

8.3.18 Safety and Health Hazards

Impacts

The occurrence of accidents/incidents during construction activities, particularly from excavation activities is generally common. The workers and general public residing along the project corridor or near the work sites will particularly be at risk. In addition, contractor staff while on work may get injuries.

Mitigation Measures

The construction workers will be trained in construction safety procedures, and social awareness, equipping all construction workers with safety boots, helmets, gloves, and protective masks, and monitoring their proper and sustained usage. The contractor will ensure the provision of medicines, first aid kits, vehicles, etc. at the campsite.

8.3.19 Restricted Mobility of Local Population

Impacts

During the construction phase, the general mobility of the residents and their livestock in and around the project area is likely to be hindered. Likewise, access to natural resources may be affected. This particularly implies to women folk and children. Construction activities, particularly excavation and movement of haul trucks and machinery may disrupt the existing tracks leading from the main road to settlements. This will limit the accessibility of the local population to the main road.

Mitigation Measures

- The contractor will ensure that the mobility of the local communities and their livestock is not hindered by the construction activities. The contractor will provide crossing points on the road at appropriate places to facilitate the people going across the road for their daily work and having free access to natural resources.
- Generally, the contractor will avoid using the village tracks for hauling the construction material. However, if it is unavoidable, the existing ones will be

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widened, overlaid with shingle, or surface treated to accommodate local as well as contractors traffic under the approval of the Project Engineer.

8.3.20 Social Conflicts and Employment of Locals on the Project

Impacts

The presence of outside construction workers may cause some degree of social disruption and even active disputes with the local community as a result of social/ cultural differences. This particularly relates to the disruption of the privacy of women folk working in the fields or even in the yards of their houses, should the house lie at lower elevations than the working sites. Likewise, the risk of theft of the community assets by the Contractor workers and vice versa may occur.

Mitigation Measures

Good relations with the local communities will be promoted by encouraging Contractors to provide opportunities for skilled and unskilled employees to the locals, as well as on–the–job training in construction for young people.

8.3.21 Spread of Communicable Diseases amongst the Project Labor and Adjoining Population

Impacts

The presence of a large number of construction workers and other associated personnel may lead to the spread of communicable diseases such as Covid–19, HIV/AIDS, and hepatitis.

Mitigation Measures

The contractor will arrange awareness programs for communicable diseases in the field camps on regular basis by a qualified expert/doctor. The contractor will provide PPE, i.e. masks, and proper sanitation facilities to all the workers. The contractor will provide recreational facilities such as playing volleyball or football after work hours. Similarly, he will provide indoor recreation in terms of radio and TV at the eating place. The Contractor will ensure regular medical checks–of the camp staff from a qualified doctor on fortnightly basis. If any person is found affected with any of the transmittal diseases will be immediately shifted from the camp to the hospital for a detailed checkup and treatment. The cost will be borne by the Contractor. The contractor will restrict his permanent staff to mix with the locals to avoid any social and health problems.

8.4 OPERATIONAL AND MANAGEMENT PHASE

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During the operational phase, the Project Manager will develop a comprehensive operational and Management Manual of the Highway and an effective monitoring plan. Mistakes at the operational level or handling of operations by untrained staff can prove very risky and costly. Important points to be attended at the operational stage are as follows:

- Comprehensive O&M Rules as per ISO standards
- The strict application of the prescribed M&E plan
- Continuous evaluation of design efficiencies
- Understanding and training in Operational and Maintenance Manual
- Annual Environmental Audit based upon tri–base assessment.
- Regular maintenance of engineering works (mechanical as well as civil).
- Staff Welfare
- Continued Public consultation and feedback on that
- Continue attention to Gender issues and women's consultation
- Refresher Training Courses for operational staff

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9 ENVIRONMENT MANAGEMENT PLAN (EMP) AND ENVIRONMENT MONITORING PLAN

9.1 GENERAL

Environmental assessment of any development project plays an important role in sustainable project implementation. The proposed project is the construction of an interchange at Bucheki-Nanakan road therefore, a detailed assessment was carried out in accordance with the Punjab Environmental Protection Agency (PEPA). To comply with the regulatory requirements of PEPA a comprehensive EMP has been devised for its implementation during the project execution.

Purpose and Objectives of the EMP The primary objectives of the EMP are to:

- Achieve NHA Corporate HSE goals
- Facilitate the implementation of the mitigation measures identified in the EIA.
- Define legislative requirements, guidelines and best practices that apply to the project.
- Define the responsibilities of the project proponent.
- Define a monitoring mechanism and identify monitoring parameters in order to: Ensure the complete implementation of all mitigation measures.

  Ensure the effectiveness of the mitigation measures.
- Define requirements for environmental monitoring and auditing.
- Provide a mechanism for taking timely action in the face of unanticipated environmental situations.
- Identify training requirements at various levels.

9.2 ANTICIPATED ENVIRONMENTAL IMPACTS

The project activities will involve the Construction of the new road in all cases. Since the candidate road project will mainly include the construction of a road the project is unlikely to cause any significant adverse environmental impacts.

Potential issues during the pre-construction stage are delays in obtaining required clearances and permits for the establishment and operation of facilities such as hot mix plants and stone crushing plants. Anticipated impacts during construction which are

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typical of road construction projects include the generation of dust from earthworks; noise and exhaust from the operation of equipment/machinery/vehicles; generation of construction waste as well as wastes from construction and worker camps; water contamination and water supply issues; occupational health and safety issues with the workers and local communities. Key benefits of the project will be better connectivity through enhanced road quality and safety. Given this, the main long-term environmental impact will be increased greenhouse gas emissions from the increased traffic.

Mitigation measures that will be proposed to address these anticipated impacts will include but not be limited to wet spraying to control dust; limiting working hours to minimize disturbance; regular maintenance of vehicles involved in construction; reuse or proper disposal of construction debris; maintenance of proper hygiene and safety standards and facilities in the camps and working areas; development and implementation of an erosion control and silt management measures; and compensatory plantation. These anticipated impacts will be addressed through mitigation measures provided in the Environmental Management Plan (EMP) which will be made mandatory for the contractor to implement. Further institutional mechanisms will be established between the Executing Agency, Construction Supervision Consultants, contractors, and other concerned agencies to ensure all unanticipated environmental impacts are appropriately addressed

9.3 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

This section provides an organizational structure for environmental management during the proposed project operation and defines the roles and responsibilities of the various players for the duration of the project. The proposed project includes the following organizations:

NHA as the project proponent and owners of the EMP;

Project construction contractor(s) as executors of the EMP during construction phase of the project;

Operation & Maintenance (O&M) team as executor of the EMP during the operational phase of the project. These organizations will have the following roles and responsibilities during the project.

Roles and Responsibilities of NHA

National Highway Authority (NHA) as project proponent will be responsible for ensuring the implementation of the EMP. NHA will be responsible for the overall environmental performance of the project. Project proponent will monitor the environmental

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performance of the project to ensure that the project is carried out in accordance with governing legislation, project proponent corporate policies and recommendations of this EIA. Details of specific NHA personnel involved in the project are given below:

Project Director:

Project Director will be responsible for the successful implementation of the Project. He will be assisted by the Supervision Consultants. Project Director will have a Deputy Director for the said project.

Deputy Director (Environment) will be assisted by Assistant Director (Environment) for the execution of Environmental Management Plan (EMP) for the Project. Deputy Director (Social and Land/Resettlement) will be responsible for the land acquisition and resettlement related issues.

Executive District Officer (E.D.O. Revenue) will be assisted by D.D.O (Revenue), Assistant Revenue Officer and Patwaris in assessing the award price for land acquisition to the affectees. The responsibilities of Director (Environment) may be briefly described as follows:

- To coordinate with regulatory agencies including PEPD, EIA consultant, local NGOs, that could assist the NHA in independent reviews of environmental and social compliance;
- To supervise environmental and social assessment reports, and provide substantial inputs and guidance to the EIA consultant;
- Supervise Project design consultant to get the approval of EIA from the EPD Punjab; To ensure that the design consultant has incorporated all the mitigation measures proposed for the design phase in the design and included in the contract documents;

Specifically, before the start of the Project, the NHA's Deputy Director (Social and Land/Resettlement) will ensure that the following activities are carried out in a transparent manner and according to the acceptable standards:

- Identifying and verifying Project affected persons (PAPs) on the basis of specified documents;
- Identifying which public facilities and utilities need to be relocated;
- Identifying alternative resettlement sites for PAPs outside the ROW;
- Carrying out a consultation and dissemination campaign with regard to compensation procedures, entitlement packages, and proposed alternative resettlement sites;

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- Preparing individual entitlement files;
- Preparing and approving compensation budgets;
- Ensuring that an adequate notice period is given to PAPs before shifting;
- Providing shifting assistance to displaced squatters and to assist squatter owners to salvage their facilities; and
- Approve the SSEMP prepared by the contractor prior to the commencement of civil works

Director (Environment, Social and Land/Resettlement):

The Director (Environment) will be the overall incharge for handling NHA's obligations with respect to the EMP. The Director (Environment) will depute one Deputy Director (Environment) for the Project, who will be responsible for ensuring that the provisions of the EMP and SiteSpecific Environmental Management Plan (SSEMP) are implemented.

Roles and Responsibilities of Contractors

NHA will appoint design consultants, supervision consultants, construction contractor(s) for the construction, testing and commissioning of the proposed project including the auxiliary facilities.

Design Consultant:

Design consultant will ensure that all the mitigation measures designated for the design phase are incorporated in the design and included in the contract documents. Supervision Consultants: Supervision consultants appointed by the Project Director (NHA) will be headed by a "Project Manager".

Supervision consultant

Supervision consultant nalong with his team will supervise the Project contractors to ensure quality of work and fulfilment of contractual obligations. The Supervision Consultant (SC) will provide one Environmental Specialist/ Monitoring Consultant (MC) who will:

- Ensure that all the environmental and social parameters/provisions comply with the applicable standards;
- Ensure that day-to-day construction activities are carried out in an environmentally sound and sustainable manner;

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- Organize periodic environmental training programmes and workshops for the Contractors' staff and NHA site staff in consultation with the NHA; and
- Develop "good practices" construction guidelines to assist the Contractors and NHA staff in implementing the EMP;
- Assist NHA as required in developing the bi-annual environmental monitoring reports;
- Assist NHA in reviewing the SSEMP developed by the contractor

Construction Contractor:

EMP will be made a part of the contract agreement and the contractor will ensure that all Project activities are in compliance with the EMP and NEQS.

Operations and Maintenance (O&M) Contractor:

Similarly, Operations and Maintenance (O&M) team will be appointed during operational phase of the project. These contractors will be responsible for implementation of, or adherence to, all provisions of the EMP and with any environmental and other codes of conduct required by project proponent. Overall responsibility for environmental performance of the operation will be the liability of the senior management of the contractors. Site managers of the contractors will be responsible for the effective implementation of the EMP

An environmental specialist from the Project Supervision Consultant, if a supervision consultant is involved, will provide technical support to the environmental expert. An external monitor will conduct periodic external monitoring of EMP implementation. Environmental awareness and EMP implementation training will be held for contractors and Supervision Consultants.

9.4 MONITORING AND REPORTING

NHA has the responsibility for undertaking environmental due diligence and monitoring the implementation of environmental mitigation measures for the project. The due diligence report as well as monitoring the implementation of the environmental management plan needs to be documented systematically.

The EMP will have both internal and external monitoring. The monitoring reports will document progress made in EMP implementation, with particular attention to compliance with each component of EMP. Monitoring during construction will also be the responsibility of the NHA. Monitoring will relate to compliance with construction

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contracts, the effectiveness of mitigation measures, and complaints (also known as "Project Performance Monitoring" or Compliance Status Report), and the state and health of nearby environmental resources (also known as "Ambient Environmental Monitoring").

Monitoring during operation should be conducted on an as-needed basis.

9.5 ENVIRONMENT MANAGEMENT PLAN (EMP)

This EMP has been formulated to avoid, and mitigate anticipated environmental impacts for the road sections :

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Table 9-1: Environmental Management Plan (EMP)

Activity	Impact	Potential Impact	Where the impact will occur	When the impact will occur	Magnitude of impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
DESIGN & PRECONSTRUCTION ACTIVITIES								
Alterations of the drainage pattern of the site	Avoid dumping spoiled materials on nearby Water Bodies	Physical Impact	To be checked all along the project corridor	At planning Stage	Low	▲ Design of cross drainage structures would be carried out to avoid alteration of drainage pattern. The design would be done considering a 50-year return flood level to avoid overtopping the roads and maintain natural drainage	Contractor	NEA Supervision Consultant
Cultural Environmental Sensitive properties	Impact on houses and shops etc. along the proposed RoW	Social Impacts	To be checked all along the project corridor	At planning Stage	Low	▲ Construction activities avoid any interference with cultural heritage environmentally sensitive sites including houses and shops etc. ▲ In case of	NEA in bid documents for Contractor, Environment Specialist	NEA Supervision Consultant

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						unavoidable interference prior notification and consultation are needed for consensus on options e.g. start of construction work		
Planning site activities	Construction causes danger to workers, locals	Community Health & Safety	To be checked all along the project corridor	At planning Stage	Low	↓ Prepare Community & Health Safety	Contractor	NHA / Supervision Consultant
Damage to trees (Flora) along the RoW	Cutting off trees and bushes of different species	Ecological Impacts	Within the ROW	At planning stage	Medium	↓ A sufficient amount of planting will be done on both sides. ↓ If a tree of rare species is growing within the ROW and is required to be removed. It will not be filled but uprooted and transplanted in close	Contractor	NHA/ Supervision Consultant

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						consultation with the forest department. + Efforts should be made to save as many trees as possible even if they are young or poll stage. Proper irrigation and maintenance of plants will be done.		
CONSTRUCTION PHASE								
CONSTRUCTION WORKS								
Grievances	Social Impact	Social Disputes	Valid for the entire construction area throughout the construction period	Throughout The project	Low if recommendations are followed	+ Officials in charge of people's Grievances will be designated. + A leaflet outlining environmental protection measures and listing grievance contact points will be Distributed.	PMU, Contractor	NHA, supervision consultant, Contractor, Grievance Specialist

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
						✦ Community leaders will be given detailed information on the grievance management process ✦ NGOs will be informed in the same manner as the community leaders.		
Construction Camps	Physical	Damage of topsoil Contamination related to fuel storage and fueling operations Sewerage related contamination Waste Management	Valid for the entire construction area throughout the construction period	Throughout project	Minor if recommendations are followed	✦ Proper construction camp management in compliance with Construction Camp Management Plan ✦ Proper waste management in compliance with Waste Management Plan ✦ Proper spill management in compliance with Spill Management	Design Engineer, Contractor	NHA, supervision consultant Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
						Plan	Implementation	Supervision
Public Utilities	Social Impact	Possibility of Damage to gas or water pipelines, cropland. Disconnection & distortion of the phone line	All along the construction site	During Construction	Medium	↓ All public utilities likely to be impacted, such as gas and/or water pipes, power and/or phone lines, etc. must be relocated to suitable places, in consultations with respective agencies proper compensation will be paid to the land owners.	Contractor	NHA, Environment Specialist, Contractor
Site selection and operation of construction camp. Store materials Human activities on-site Travel to/from	Socio-cultural Environmental Acceptability to public/owner; Friction with residents	Sanitary waste disposal, solid waste (Kitchen waste) disposal, fuel leakage. Noise and additional	Several sites along the roadside for construction campsites	Throughout construction period	Minor if recommendations are followed.	↓ Prior consultation with the local Contractor need to obtain NOC for sitting work camps & workshop, or an agreement made with the landowner	Contractor	NHA, supervision consultant Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
construction camp		traffic. Water usage of pollution				↓ Site construction to be supervised ↓ Proper storage and fencing/locking of storage rooms containing hazardous material ↓ Setting up of complaints office, advertising ways to voice complaints		
Site restoration after the contract completion	Loss of roadside vegetation/assets and plantations if any in an area of scarce biodiversity and dissatisfaction with rehabilitation measures after completion	Loss of Plants in an area with already scarce biodiversity, and loss of functional benefits from roadsides plants	All along the route, campsites	Long-lasting	Moderate	↓ Manage design to minimize removal of roadside plantation ↓ Apply flexibility in the decision in reducing locally the shoulder with. ↓ Plan for compensatory planting for each felled 10 plants of similar/local flora	Design Engineer, Contractor	NHA, supervision consultant Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
						species - The contractor will provide a plan for removal & rehabilitation of the site upon completion - Photographic and botanical inventory of vegetation before clearing the site - Disallow introduction of exotic species or species with known environmental setbacks (e.g Eucalyptus etc.)		
Creation and burning of wastes at or near campsites	Solid-liquid waste generated and air pollution associated with burning garbage	Air pollution associated with burning garbage	Along campsites	throughout construction	Moderate	- Disallow sitting for the work camp, including waste dump sites, at distances closer than 300m to any	Contractor	NHA, supervision consultant Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						inhabited areas - Incorporate technical design features for refuse collection containers at sites that would be minimized burning impacts - Devise a plan for the safe handling, storage, and disposal of harmful materials - Disallow burning		
Construction Activities and Accident Risks through transportation of material through labor	Health & Safety	Minor And major injuries, can even lead to fatalities in case of ignoring safety practices	Various construction sites throughout the project corridor	During construction	low	- Safety signals will be installed on all temporary routes During construction. Strict enforcement of traffic rules and regulations. - Workers will be provided safety	Contractor	NHA, supervision consultant Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						project time frame, activities causing disruption, and temporary arrangements for public relief must be ensured.		
Loss of Access	Traffic congestion	Air pollution & fatigue	Various construction sites throughout the project corridor	During Construction	Minor if properly mitigated	↓ Alternatives and temporary accesses will be provided at all interchanges, bridges, and culverts, in congested areas. Such diversions will have proper drainage facilities.	Contractor	NHA, Environment Specialist, Contractor
Health and safety at the workplace	Health risks if work conditions provide unsafe and/or unfavorable work conditions	Worker injury	Valid for the entire construction area throughout the construction	At the establishment of campsites and the construction period	High	↓ Drainage, sanitation, and waste disposal facilities will be provided at workplaces. Drainage will be maintained to avoid	Contractor	NHA, Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
			period			water logging, which leads to mosquitoes and disease. - Suitable sanitation and waste disposal facilities will be provided at camps using septic tanks and soakage pits, etc. A sufficient water supply will be maintained at camps to avoid water-related diseases and to secure workers' health. - Health education & preventive medical care will be provided - to workers. - Routine medical checkups of workers to avoid Communicable		

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
						disease ↓ Provide basic medical training to specified work staff, and basic medical services and supplies to workers ↓ Layout plan for campsite indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents ↓ Work safety measures and good workmanship practices to ensure		

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						no health risks for laborers - Protection devices (ear muffs) will be provided to the workers operating in high noise-generating machines, blasting - Proper maintenance of facilities for workers - Regular pest control measures in dormitories - Obligatory warning of work staff if pest hazard is imminent or detected - Awareness campaigns for protection from AIDS / HIV / Hepatitis		

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impacts is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
Digging borrow pit areas	Physical environment	Borrow pit collect water, material mosquitoes	The entire length will require fill to raise the level of the carriageway	Early in construction	Low	✦ Used approved borrowed areas. Borrow roads made good on completion of the contract ✦ Inspection of sites ✦ Borrow pits shall be dewatered and fences should be provided as appropriate, to minimize health and safety risks.	Digging borrow pit areas	NHA, supervision consultant Environment Specialist, Contractor
Laying of asphalt	Physical Environment	Emission of dust and fumes from asphalt plant; Runoff of hydrocarbons during "curing" period	In the asphalt batching plant area, One length of road where surface laying is taking place	In later stages of construction Within 48 hours of laying asphalt	Low if the laying of asphalt does not occur in the rain	✦ Ensure Workers use appropriate clothing ✦ Lay asphalt during dry periods	Contractor	NHA, supervision consultant Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
Quarrying materials	Physical environment	Cuts scar natural hillsides	In mountain section	During construction	Low fill should be available	✦ Use existing quarry sites	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Construction of structures, bridges/culverts.	Socio-cultural	Severance to the local population	At points where the road crosses established tracks	During construction	Low provision for crossings is gives	✦ Ensure provision of adequate crossing points ✦ Work on irrigation canals shall be kept to a minimum to avoid disrupting water supplies to croplands. Damaged irrigation canals shall be repaired immediately.	Contractor	NHA, Environment Specialist, Contractor
Planting trees	Ecological	Introduction of appropriate species	Alongside new road	After Construction	Medium	✦ Use Forest Departments to select appropriate plants. Require approved plan to be	Forestry Department	NHA, supervision consultant Environment Specialist,
	Socio-cultural	Trees create a safety hazard	Where trees are planted	Once trees have matured	Medium			

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
						prepared and used - Planting scheme to include shrubs close to the road as a barrier		Contractor
Removal of Construction Camp	Socio-cultural	Adverse effects on residents	At camps	After completion of construction	Low if correct closure plan implemented	- Supervise and enforce closure plan Monitor	Contractor	NHA, supervision consultant Environment Specialist, Contractor
[redacted]								
Clearing site	Damage not restored on departure	Loss land	Site in contractor custody	Completion stage	Medium	- Borrow roads made good on completion of the contract - Supervise and enforce closure plan. Monitor	Contractor	NHA, supervision consultant Environment Specialist, Contractor
[redacted]								
Drinking water	Water born disease	Workers/labor health	Const camp	Throughout construction period	Medium	- The contractor will ensure the Provision of safe drinking water to all the	Contractor	NHA, supervision consultant Environment

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
						workers/labor + Water quality should conform to PEQS/WHO standards + Should be reconfirmed once during the construction phase		Specialist, Contractor
Wastewater discharges	Water pollution	Contamination of water sources	Contractor Campsites	Throughout construction period	Low	+ Suitable sanitation and waste disposal facilities will be provided at the camp using a septic tank linked with soaking pits. + All discharges should comply with PEQS through a certified laboratory + Should be verified monthly	Contractor	NHA, supervision consultant Environment Specialist, Contractor
Noise from	Physical	Noise and	Valid for the	At the	High	+ Maintenance of	Contractor	NHA,

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Project Activities	Type of Impacts	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
construction equipment	Construction site including road approaches	vibration nuisance to surrounding communities. The impact will be mainly limited to pile driving and compaction of the access road.	entire construction area throughout the construction period	establishment of campsites and the construction period		vehicles, equipment, and machinery will be regular and to the satisfaction of the Engineer, to keep noise from these at a minimum. All vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked and will not exceed the prescribed limit of PEQS		supervision consultant Environment Specialist, Contractor
Vehicular movement and operation of	Emissions from construction vehicles and	Dust and other emissions	Workshops at Contractor	Throughout construction period	Low	↓ All temporary service and access roads will be	Contractor Approved Labs	NHA, supervision consultant

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
machinery	machinery, cause public health risks, nuisance, and other impacts on the biophysical environment		Campsites			regularly to minimize dust generation: Haul roads to be dust controlled, and all vehicles carrying loose friable material to be covered - All machinery and plants will be placed at min. 300m in downwind direction to human settlements - All vehicles, equipment, and machinery used for construction be regularly maintained to ensure that the pollution emission levels conform to the PEQS - Air quality parameters will be		Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impact on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						monitored at determined sites monthly ↓ Incorporate design features enabling the continuation of traffic flow and traffic jams ↓ Water will be sprinkled to avoid kick-off dust.		
Generation of Dust	Dust generation from construction types of machinery causes health risks to operating workers, impacts the biophysical environment	Dust emissions from the crusher and screening plant Emission of dust and fumes from the asphalt plant	At sites of plants, crushers	Throughout construction period	High	↓ Ensure precautions to reduce the level of dust emissions from, mixers, plants, crushers, and batching plants, e.g. providing dust extraction units. Crushers are to be fitted with dust suppression equipment. Plant to	Contractor	NHA, supervision consultant, Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impacts is likely to happen	When the Impacts is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
						have suppression equipment. - Water will be sprayed in lime/cement and earth mixing sites - Work safety measures like dust masks and appropriate clothing will be used to ensure no health risks for operators - Equipment be well maintained - Asphalt plants are located 300m away from populated areas (downwind) and may have a wet scrubber - Water Sprinkling will be carried out		
Transportation	Physical	Dust and	Throughout	During	Low	- Vehicles delivering	Contractor	NHA,

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
of materials, and other construction activities that create dust and emissions		emissions from machinery cause health risks to operators and impacts the biophysical environment	Project Road Construction sites near the major settlements	construction		loose and fine materials like sand and fine aggregates shall be covered to reduce spills on existing roads. - Ambient air quality monitoring be carried out in accordance with the EMP - If monitored parameters are above the prescribed PEQS–limits suitable control measures must be taken		supervision consultant, Environment Specialist, Contractor
Disposal of waste from rehabilitation works	Physical Health Risk	Degrading Soil and Water Quality	Project Road Construction sites near the major	Construction	Low	- All construction waste collected - The site is kept tidy and no waste will be allowed to build up	Contractor	NHA, supervision consultant Environment Specialist,

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
			settlements			in the yard. - Disposal sites are to be kept away from the localities (preferably 300 meters / at least 500 meters)		Contractor
Access to sensitive areas of the fragile ecosystem	Poaching on wildlife plants, disturbance of nullah habitats	Disturbance to the ecologically sensitive areas adjacent to or near roads	Near nullah banks	Throughout construction period	Low	- The use of firewood for cooking and execution of works be prohibited - No open fires are allowed - Restoration of vegetated areas - The strict instruction from the Contractor to work staff (particularly the cooks) concerning poaching local wildlife	Contractor	NHA, supervision consultant, Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						↓ Signage for wildlife crossing to raise attention ↓ Assist in public awareness programs ↓ Special bushes/plants for sandy areas along the roadway ↓ Patrolling and enforcement		
Use of local resources and products	Competition for natural resources, e.g. with farmers, livestock raisers, and nomads for range land & water		Agricultural areas with tube wells and canal irrigation limited water availability	Throughout construction period	Low	↓ Water supply/sanitation facilities labor not exacerbate the existing shortages and environmental hazards; Contractors should primarily seek its sources of water by deep well boring at 4–5 locations in the due	Contractor	NHA, Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impact is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
						distance (min. 1 km) from local user's wells. + Ensure labor does not exploit adjacent forest resources is a ban on tree cutting		
Roadside Landscape Development			Various construction sites throughout the project corridor	During Construction	Low	+ Avenue plantation of mixed specie aesthetic trees, shrubs, and aromatic plants will be carried out.	Contractor	NHA, Supervision consultant, Environment Specialist, Contractor
Roadside Amenities			Various construction sites throughout the project corridor	During Construction	Low	+ The provision of bus shelters, bus bays, petrol pumps, restaurants, recovery areas, and truck stops as per detailed design will be carried out. + Road furniture	Contractor	NHA, supervision consultant, Environment Specialist, Contractor

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Project Activities	Type of Impact	Potential Impacts on the Environment	Where the Impact is likely to happen	When the Impacts is likely to Occur	Magnitude of Impacts	Mitigation Measures	Institutional Responsibility	
							Implementation	Supervision
						including footpaths, railings, traffic signs, speed zone signs, wildlife warning boards, etc. will be erected at suitable places		
Cultural Properties	Socio economic / cultural		Various construction sites throughout the project corridor	During Construction	Low	✦ All cultural properties will be enhanced and access roads will be provided, wherever required	Contractor	NHA, supervision consultant, Environment Specialist, Contractor

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Table 9-2: Environmental Monitoring Plan

Environmental Quality	Parameters	Details of Location	Standards/ Guidelines	Responsibility	Monitoring Frequency	Monitoring Duration
Air Quality	PM_{10}, Stacks (exhausts) emissions of vehicles/equipment used for construction (CO, NO_X, SO_X Smoke)	Construction area along the road	PEQS	Contractor	One Time during the Construction hours on each section of the road	Continuous for 24 hours or one full working day
	PM_{10} all parameters as mentioned in PEQS for air	Three locations along the road	PEQS			Continuous for 24 hours or over one full working day
Water Quality	Drinking / Ground Water: Total Coliforms, Fecal Coliform, Total Colonial count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) and all parameters as mentioned in PEQS for drinking water quality	Up to five locations along the road	National Drinking Water Quality Standards	Contractor	One time during the construction period on each road package	Grab sampling
	Surface Water: pH, TDA, Total Hardness, Nitrate, Chloride, Sodium, grease & Oil	Up to five locations along the road	PEQS	Contractor	One time during the construction period on each road package	Grab sampling

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Environmental Quality	Parameters	Details of Location	Standards / Guidelines	Responsibility	Monitoring Frequency	Monitoring Duration
Waste Water	Wastewater: pH, TSS, BOD_5, COD, and all parameters as mentioned in PEQS for effluents	Up to five locations along the road	PEQS		One time during the construction period on each road package	Grab Sampling
Noise Levels	Noise Levels on dB (A) Scale	At the equipment yard and construction site and during pile driving 7 meters from the noise source	PEQS	Contractor	Once a month during the construction period on each package	24 hours @ 15 seconds internal over 15 min every hour, then averaged
		Not less than one location 15 meters from the edge of the pavement and at locations of all potentially affected sensitive receptors	PEQS for Noise			24 hours @ 15 seconds internal over 15 min every hour, then averaged
For Operation Phase						
All Environmental Aspects	All Environmental Parameters	On all Road sides	PEQS	Executive Engineer of the area	As per EPA Laws	As per EPA Laws

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Table 9-3 Environmental Management Cost

Environmental Component	Quantity	Amount PKR	Details	Remarks
A. Environmental Management Cost				
Health & Safety Measures: This will include the provision of Personnel Protective Equipment (PPEs) (Shoes, Gloves, Goggles, Helmets, First Aid Kit, etc) to be provided at the site for workers	Lump sum	**2,000,000.00**	The workers are required to provide the PPEs for work site safety precautions and to avoid any safety hazards.	Amount to be included in the Project Budget.
B. Environmental Monitoring Cost				
(i). Air Quality Monitoring (as per EPA Standards)	30	615,000	01 samples @ Rs. 20500/sample	Amount to be included in Project Budget
(ii) Water Quality Monitoring (as per EPA Standards)	15	187,500	01 samples @ Rs 12500/sample	Amount to be included in Project Budget
(iii) Noise Level Monitoring (as per EPA Standards)	30	45000	01 samples @ Rs 1500/sample	Amount to be included in Project Budget
Sub-Total (B)		**847,500**		
C. Training to Staff and Cost of Environment Manager • In–country training of three officers in the road–related environmental issues. • Training Workshops of the projects for NHA, PIU, Supervision		**3,000,000.00**	Training related to the EHS and Ergonomics etc for awareness	Required for implementation of true spirit of EMP

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Environmental Component	Quantity	Amount PKR	Details	Remarks
Consultants, Contractor & others • Training for data analysis, management, and application to the job scenarios of three officers.				
A. Tree Plantation Roadside Tree Plantations of Endemic / Local Species		**6,000,000.00**	Landscaping around the road, establishment of green belt and compensation plantation will be done.	Required for implementation of true spirit of EMP
B. Solid Waste Management Excavated Material Disposal Hazardous Material Handling and Storage		**5,000,000.00**	Solid Waste management according to pollution prevention principles.	Amount to be included in the Project Budget.
Total Environmental Management And Monitoring Cost In PKR (A + B + C + D + E)		**16,847,500.00**	**Summing up A, B, C, D, E**	**Amount to be included in the Project Budget**

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9.6 ENVIRONMENTAL MANAGEMENT TEAM ALONG WITH THEIR ROLES AND RESPONSIBILITIES

- Administrative arrangements for the implementation of the project.
- Ministry of Communication and NHA are sponsoring and executing agencies respectively. NHA will hire Government approved Contractor for the execution of the Civil works. However supervisory consultant will also be engaged for quality execution work. NHA owns project staff will remain full-time at the project site up to the completion of the project.

9.7 TREE PLANTATION PLAN

Tree planting is often used to enhance the appearance of roads and to provide a natural buffer between the road and adjoining land. If trees are selected without due consideration to the special needs of roads, they can generate safety and sustainability problems. Inappropriate species can cause environmental damage. Tree plantations on top of embankments and rights-of-way will serve as small forests and wood lots for residents, having tangible benefits in the form of timber, fuel wood, and fodder. Besides soil retention and erosion control, such plantations will also provide aesthetic and visual screens against sound, dust, wind, toxic emissions, night glare, and pollution of waterways.

The basic purpose of afforestation/plantation of suitable species in the project area is to reduce the risk being made due to different construction activities for the proposed Project. The expected risk made will be compensated by the planting of saplings to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk being made but will also increase the Green cover, carrying capacity, and aesthetics of the area along with many positive aspects and impacts. Plantation will be done after the construction, work immediately.

The plantation of indigenous trees species is highly important to maintain biodiversity and ecological balance. It is also important to prevent global warming, soil erosion, and pollution. Afforestation purifies the environment and helps in reducing the carbon dioxide level. Along with the importance of construction, the afforestation activity will further help in enhancing the socio-economic condition of the area and project sustainability.

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A tree plantation plan has been prepared for the proposed project keeping in view the design and length of the project. This plan is based on the best possible estimations and can be modified accordingly at the execution stage.

9.7.1 Importance of Tree Plantation

- Trees contribute to their environment by providing oxygen, improving air quality, climate amelioration, conserving water, preserving soil, and supporting wildlife.
- Trees control climate by moderating the effects of the sun, rain, and wind.
- Leaves absorb and fill the sun's radiant energy, keeping things cool in summer.
- Trees also preserve warmth by providing a screen from harsh wind.
- Trees also lower the air temperature and reduce the heat intensity of the greenhouse effect by maintaining low levels of carbon dioxide.
- Both above and below ground, trees are essential to the ecosystems in which they reside.
- Trees absorb and store rainwater which reduces runoff and sediment deposits after storms. This helps the groundwater supply recharge, prevents the transport of chemicals into streams, and prevents flooding.
- Trees, shrubs, and turf also filter the air by removing dust and absorbing other pollutants like carbon monoxide, sulfur dioxide, and nitrogen dioxide

9.7.2 Objectives

- To Restore native species
- To improve the quality of air and reduce its pollution
- To add color to the landscape and enhances the beauty of the environment
- To uplift the quality of our living environment through active planting, proper maintenance, and preservation of trees together with other vegetation.
- To Protect and conserve the flora and fauna of the project area.
- To attract rain which is a positive impact on the project area.
- To reduce sedimentation by plantation in the project area which will act as protection all against wind-born dust particles

9.7.3 Plantation Plan

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For plantation, two plans have been recommended as "Minimum Requirement" with 1 row of plants on each side of the road, and, "Desirable Requirement" with 2 rows of plants on each side of the road. Details of both the plans are given below:

i) Minimum Requirement: Two rows of plants (one row on each side) will be raised at the proposed interchange site . Plant to plant distance will be kept as 2 meters, so there will be 500 plants in one row of one Km length..

ii) Desirable requirement:

Four rows of plants (two rows on each side) will be raised of the proposed interchange. These plants are to be planted along the side roads and within the loops. Native species would be planted like sheesham, (dalbergia sissoo), keekar (acacia arabica), shareen (albizzia lebbck) and) and no invasive/ exotic species would be introduced

9.7.4 Trees Recommended

Tree plantation plan has been prepared for the proposed project keeping in view the design and length of the project. This plan is based on best possible estimations and can be modified accordingly at the execution stage.

Following tree species are recommended, in general, for planting to create aesthetic as well as shade effect along the roadside. It is also recommended that 4 to 5 years old plants should be procured for the purpose.

Table 9-4 Trees Recommended For Planting

Sr No.	Local Name	Scientific Name
1.	Bari	Ziziphus jujuba
2.	Kikar	Acacia Nilotica
3.	Sheesham	Dalbergiasisso
4.	Shareen	Albizzia lebbck

Landscaping around the road, establishment of green belt and compensation plantation will be done. The estimated cost for raising plants, earthwork, procurement of manures, continued supply of water to young plants throughout the year, and its maintenance for five (5) years is Rs. 6,000,000.The cost is tentative and provided on fhe basis of available data which may be updated by the implementing agency as per actual, during implementation

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9.8 TRAFFIC MANAGEMENT PLAN

Contractors will develop and adhere to Traffic Management Plans throughout the construction phase of the Project. Safety of site access roads and intersections with classified road networks is paramount. Safe sight distance and appropriate signals will be maintained. Suitable vehicles parking and storage area will be provided onsite and maintenance of construction vehicles will be provided onsite, with regular inspection of the lighting system, brakes, and tires.

The construction activities can potentially impact the residents and the use of construction vehicles on the roads in the project area. A Traffic Management Plan will be implemented that will aim at ensuring uninterrupted traffic during construction hours. Where applicable to the activities being undertaken, contractors will identify measures in their Traffic Management Plans consistent with the measures described below related to:

- Road Safety Signs
- Speed limit signs
- Control of and restrictions for Project roads;
- Access roads to be decommissioned after Project use; if available
- Traffic control measures;
- brake checks;

9.8.1 Objectives of TMP

The traffic must be managed to ensure:

- The continuous, safe, and efficient movement of traffic for both the public and workers.
- The capacity of the Local Roads is maintained,
- Delays and disruptions are kept to a minimum.

9.8.2 Responsibilities of Workers

Workers include logistics workers, operators, drivers, and so on.

Their responsibilities include:

- Follow workplace traffic instructions and safety warnings or signage's at the workplace;
- Attend workplace traffic safety and health training or briefing sessions
- Only operate plant or equipment if they hold valid licenses, possess the relevant safety certification, and have been given the authorization to do so

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- Observe emergency procedures, instructions, and arrangements as established and instructed
- Operate equipment with care and do not use equipment (including vehicles) beyond their capacity or designated purpose
- Use all safety devices and PPE as provided
- Never misuse, interfere with, or modify any of the devices or equipment
- Report any damage, malfunction, or suspected defect of plant, equipment, safety device, or PPE to their respective supervisor
- Report accidents, incidents, diseases, and any workplace hazards to the supervisor or person–in–charge
- Suggest ways to improve traffic safety at the workplace if they identify any lapses during work.

9.8.3 Advance Warning Area

The warning system must change the driver's normal expectation of the roadway situation, and inform him of what to expect.

9.8.4 Signing

Warning signs are intended to provide adequate time (and distance) for the driver to perceive and react to the condition ahead.

9.8.5 Flags / Warning Lights

Red flags attached to a sign attract attention during daytime operations and should be considered for application on the first warning sign. Flash warning lights add emphasis during nighttime operations.

9.8.6 Rumble Strips

Rumble strips present vibratory and audible warnings, which alert drivers. They are used with the first warning sign or any other arrangement approved by the Engineer.

9.8.7 Speed Reduction

A basic principle of good temporary traffic control is that traffic movement should be inhibited as little as practical. Drivers will reduce their speed only if they perceive a need to do so.

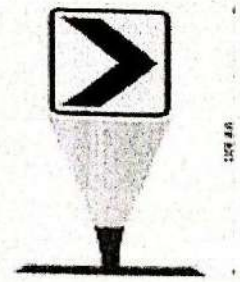
9.8.8 Requirement for Transition Area

- Tapers

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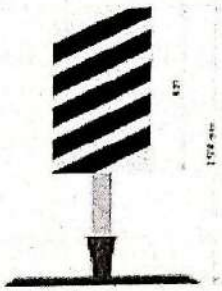
- Channelizing Devices
- Chevron Sign

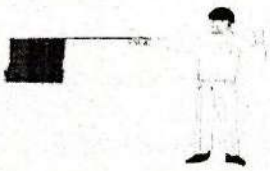
The Chevron sign should be used on curves and tapers to supplement other devices and provide additional emphasis and guidance for the motorist. Spacing shall be such that at least three Chevron signs are always visible to the motorist. Chevron signs shall be mounted on flexible supports.







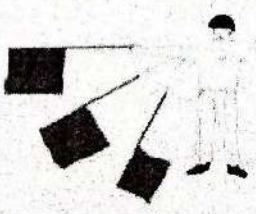


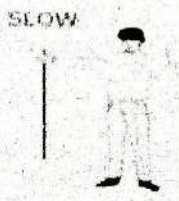












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Figure 9-1: Chevron Signs

9.8.9 Buffer Area

The Buffer Area separates traffic flow from the work activity. It provides a recovery space for errant vehicles and safety for workers. Design guidelines for the buffer space include:

The buffer space length must be at least as long as the taper length.

Channelization devices shall be spaced every 10 meters along the parallel portion of the buffer area.

9.8.10 Working Area

It is preferred that an approved barrier by NHA be used to separate traffic from the Work Space. Concrete portable crashworthy safety barriers are an example of a barrier that prevents vehicles from penetrating work areas, and also minimizes vehicle occupant injuries. However, the type of barrier to be used can be decided at the site depending upon the duration of work in the working area, availability of material, and traffic volume.

9.8.11 Termination Area

The downstream end of the work site may require a closure taper to reduce the chance of a vehicle coming from the opposite direction entering the work site at high speed. The closure distance from the work site, including the taper, is usually a distance of 50 meters.

9.8.12 Flagging Procedures

Flaggers must be well trained and must be provided frequent relief during the flagging operation. The flagger must wear a reflective safety vest and should be positioned at least 150 meters upstream of the work site. The illumination must be provided when flaggers are operating during nighttime conditions. In preparing a layout of traffic control devices, the used distance guidelines are shown in the application diagrams. Beginning at the Work Area, workers work back through the Buffer Area, the Transition Area, and the Advance Warning Area.

Typical application diagrams are presented on the following pages for a variety of highway conditions. These are not intended as a substitute for engineering judgment. Typical applications can be altered, when necessary, to fit the conditions of a particular temporary traffic control zone.

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Upon completion of the above procedure, the supervising Engineer at a site must inspect the field, the location where the initial sign in the Advance Warning Area is to be placed. The initial sign must be visible to oncoming traffic for a long distance. If necessary, additional signs must be placed to assure good visibility.

A trained person is proposed to be assigned the responsibility for safety at the work site. He must monitor operations when the site is initially opened and at routine intervals, both day and night, and assure that all traffic control elements are effective in providing safe conditions for both motorists and workers. He is expected to implement changes, when necessary, to assure safe conditions.

9.9 MUCK DISPOSAL PLAN

Environmental Management Plan for the disposal of muck generated by the construction. The Plan was developed based on the specifications and recommendations provided in the Manual for Developing Environmental Management Plans for Works under Concession, published by the Ministry of Public Works (2004). In particular, it establishes the environmental considerations for operating the muck disposal sites to be implemented during the road construction phase.

9.9.1 Objective

The objective of the Environmental Management Plan is to provide data on the location of the muck disposal sites, the related activities of the construction phases, the identification and assessment of associated impacts, the control, mitigation, and restoration measures, and the monitoring plan.

The selection of locations, the design, and the management practices relating to the muck disposal sites were all based on technical, environmental, and safety criteria

9.9.2 Location

In selected barren spots as allowed/approved by Resident Engineer.

9.9.3 Description of Activities and General Environmental Criteria

The activities and environmental criteria associated with the setup, management, and abandonment of the muck disposal sites are discussed below, based on the Manual for Developing Environmental Management Plans for Works under Concession.

The measures adopted during the setup, operation, and abandonment phases of the muck disposal sites will be implemented by the works contractor.

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9.9.4 Muck Disposal Site Setup

The activities involved in setting up the muck disposal sites include :

(i) Identifying the Work Areas

The location of the muck disposal site followed the environmental criteria.

(ii) Topographic Layout

The filling sites have been located adjacent to natural elevations so that the filling terraces will provide continuity to the area's general morphology. When setting up the disposal sites, care will be taken to ensure that the height of the dumps and their final form at closure adapt to the topographical features of the area where they are located.

(iii) Rehabilitating Access Roads for Muck Disposal Operation

As long as the muck disposal sites are operational, access to the deposit areas will be controlled. The public roads to be used to access the muck disposal sites will be rehabilitated with the traffic solutions and signaling proposed by the study of the road capacity

(iv) Installing Safety Signs

Safety signs will be installed for the protection of workers and visitors.

9.9.5 Muck Disposal Site Operation

Deposition Mechanisms

During the operation phase of the muck disposal sites, the following measures will be adopted to protect the environment:

- People who are not involved in the works and animals will not be allowed in the muck disposal sites. For this purpose, fences with gates and controlled access points will be installed.
- The areas surrounding the muck disposal sites, as well as the access roads, will be kept clean of excavated material, dampened, and perfectly passable.
- All roadways used by project-related equipment and vehicles will have an adequate signaling system.
- Equipment and vehicle traffic will be restricted to the access points and roads designated for Project works. The contractor will be responsible for clearly delimiting

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the roadways and parking areas to be used for carrying out activities, and ensuring that unauthorized areas are not used.

- Dumping of organic waste, scrap, wood, paper, mud, petroleum derivatives, and hazardous waste will be prohibited.
- Burning of waste material will be prohibited.
- The muck disposal sites will not accept construction debris. The latter will be transported to an authorized dump site.

i. Equipment

The operation of the muck disposal sites requires the following equipment :

Dump trucks and Haulage trucks will transport waste to the disposal sites.

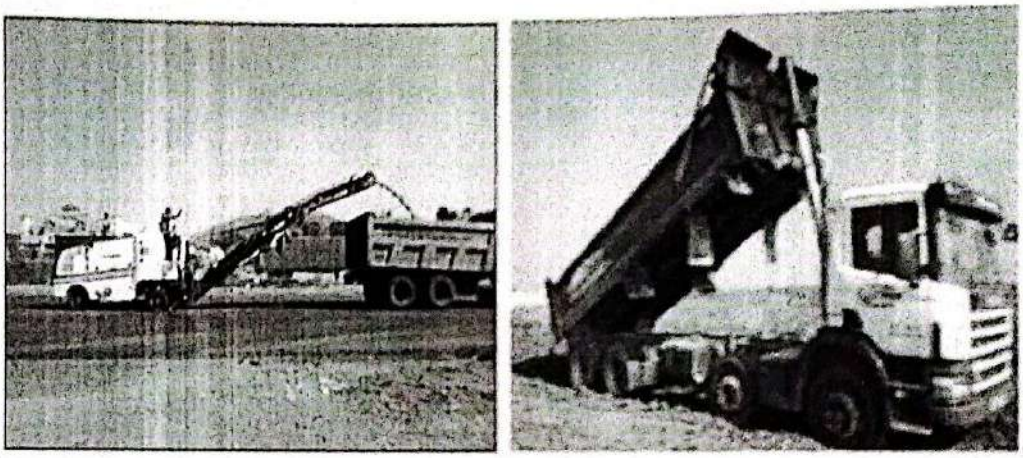


Figure 9-2: Machinery Used for Disposal of Muck

ii. Muck Disposal Site Abandonment

Site abandonment activities include :

- The final shape of each deposit will fit into the local topography. The terraces will be leveled to form a flat surface, and the slopes resulting from the piling and compacting of the waste material will be graded. The finished slopes will not exceed 30% to prevent landslides and water erosion.
- All temporary structures or facilities set up by the contractor will be removed, together with the signaling system.
- Sterile material will be covered with soil from the slopes of the dump itself, the roads, and the above-groundworks. The thickness of the cover will be at least 20 cm.

iii. Period of Use

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The period of use will vary across muck disposal sites, depending on the rate of progress of the work front, and the site's storage capacity and shape.

In general, muck disposal sites will operate parallel to the daily activities at the work fronts.

To the extent possible, disposal site activities involving the use of equipment will be carried out during the day.

9.9.6 Rainwater Management

Although the construction period will produce inert material, the residual water that could eventually result from the contact of the muck with rainwater will be controlled as follows:

- The ground surfaces of the muck disposal sites will be graded so that rainwater runoff is directed outward.
- Trenches dug along the perimeter of contact between the sites and the ground surface will stop runoff from adjacent terrains

9.10 BATCHING AND ASPHALT PLANT MANAGEMENT PLAN

The Contractor shall ensure the use of a relatively new, well-maintained hot mix plant (batch type) so that any emission conforms to the PEQS norms and be fitted with a dust extraction unit to avoid prolonged engine-powered equipment illness. The hot mix plant, WMM plant, batching plant, generator set & crusher shall be located more than 500 m from any community or residence. The concessionaire has to obtain necessary consent/clearance from the state pollution control board to operate the hot mix plant, WMM plant, batching plant & crusher before the commencement of works. All vehicles, equipment, and machinery needed for construction will be regularly maintained to ensure that pollution emission levels conform to PEQS norms. All vehicles will be fitted with silencers. Construction vehicles, machinery & equipment will move or be stationed in designated areas to avoid compaction of the soil to ensure the preservation of the topsoil for agriculture.

Where it is necessary to use some such substance that can cause injury to the health of the workers, the contractor shall provide suitable protective clothing or appliances to his workers, viz. Earplugs, helmets, or dust masks. Additionally following management measures will be adopted :

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- The asphalt plant will be equipped with pollution control devices. According to the specification; no gas emissions will result from the asphalt plant operation itself.
- Insuring proper operation conditions such as sufficient flame volume, and clean combustion to ensure lowers VOCs are produced.
- Provide the workers with all safety measures; including masks, ear muff, gloves, and other safety means and periodic medical testing.
- Periodic maintenance and replacement of filters of the asphalt plant and generator wherever possible
- Staff and persons who will be working within the noisy zone, they will be supplied with personal protective equipment (PPE) in order not to impair their health as a result of overexposure to noise. It is expected that all the noise generated during asphalt plant operations is within the required norms. Moreover, the plant generators are all fitted with noise-reduction equipment. The placement of a noise breaker screen at the site will also be further investigated if needed.
- The sludge waste, it's dealt with by the asphalt plant manager to use to pave some surfaces to reduce dust emission, or it can be reused and utilized through recycling back into the asphalt.
- The domestic wastewater generated by the working staff at the asphalt plant will be disposed of in a septic tank which is acting as a holding tank with sealed bottom and walls and drained from time to time into wastewater septic Tanks. An official permit from the municipality will be gained by the contractor to dispose of this waste. Wastewater from wash basins (gray water) will be collected separately where there will be two separate sewage networks and used for irrigation and water sprinkling activities.
- The following measures will be adopted to ensure the effectiveness of safety within the premises.
- To prevent bitumen burns it will be compulsory for the workers handling hot bitumen to wear full–body protection.
- All transportation, handling, and storage of bitumen will be handled by experienced personnel.

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- The dust from the manufacturing processes may pose respiratory hazards, hence protective air masks will be provided to the operators of the loading and unloading of the aggregates.
- Ear–muffs will be provided to those working at the plant.
- A first aid kit will be available on-site for the workers in case of an emergency.
- The material safety and data sheets (MSDS) for each chemical will be accessible on the site and displayed.
- Safety signs will be posted throughout the site and entry and exit will be marked clearly.
- Regular health checks will be conducted for employees and staff working at the asphalt plant.

9.10.1 Training

All supervisory and site personnel are to receive training on batch and asphalt plant management as required by the regulations. In-house training of personnel on management issues will form part of the site induction process. Reinforcement of such will occur daily by supervisory plant personnel and management during routine visits. The company currently has a manager and two plant supervisors who are responsible for the management of the company's existing facilities.

9.11 HEALTH AND SAFETY PLAN

This Health and Safety Plan provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted at the site. HASP Supplements will be generated as necessary to address any additional activities or changes in site conditions which may occur during construction.

9.11.1 Health & Safety Rules of the Site

All site personnel shall adhere to General Safety Rules, during construction operations. In addition, the housekeeping and personal hygiene requirements will also be observed.

9.11.2 Housekeeping

During site activities, work areas will be continuously regulated for the identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) before

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disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Again, it's advisable to rotate monthly with an acid foamer. Especially in the dirty zone, it is important to follow the correct procedures

Remove all visible debris manually (with a shovel and brush)

- High-pressure wash with foam lance
- Rinse
- Allow drying
- Disinfect

9.11.3 Smoking, Eating, or Drinking

Smoking, eating, and drinking will not be permitted inside any controlled work area at any time. The workers will first wash their hands and face immediately after leaving controlled work areas (and always before eating or drinking).

9.11.4 Personal Hygiene

The following personal hygiene requirements will be observed:

- **Water Supply**

A water supply meeting the following requirements will be utilized:

- **Potable Water**

An adequate supply of potable water will be available for personal consumption. Potable water can be provided in the form of water bottles, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified to distinguish them from non-potable water sources.

- **Non-Potable Water**

Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

- **Toilet Facilities**

A minimum of one toilet will be provided, with separate toilets maintained for each sex except where there is less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities, on-site facilities are not required.

- **Washing Facilities**

Employees will be provided washing facilities (e.g., buckets with water, etc.) at each work location. The use of water and hand soap (or similar substance) will require by all

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employees following exit from the Exclusion Zone, before breaks, and at the end of daily work activities.

- **Stop Work Authority**

All employees have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions. Whenever the site person determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Upon issuing the stop work order, the site person shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Safety Professional has concurred that workplace conditions meet acceptable safety standards.

- **First Aid Facility**

Adequate first aid facility will be available at the site

9.11.5 Awareness

Staff working at the facility shall be given information to help them to identify the risks and take necessary measures of safety and protection during their work. To create awareness, personnel at the facility shall be briefed through handouts, in-house seminars, and mock safety drills. Particular areas of interest shall be:

- Moral Obligation
- Hazard Recognition
- Importance of Personnel Protective Equipment (PPEs)
- Accident Prevention
- Importance of HouseKeeping
- Machine Guarding
- Fire Fighting

9.11.6 Use of Safety Equipment

The purpose of personal protective equipment (PPE) is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. The use of Personal protective equipment (PPEs) will be made mandatory.

Following Personal Protective Equipment (PPEs) will be provided to the workers:

- Safety Helmet
- Safety Shoes/Dry Shoes
- Dust Mask

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- Safety Gloves
- Safety Jackets
- Earmuffs
- Insulating Gloves and Suits

9.11.7 Training and Capacity Building

Under the Environmental Management and training, it is proposed to provide a "Three Level Hierarchical Structure" for environmental and safety management. The responsible person should be given proper training for capacity building.

The first level shall comprise professionals from the managers and supervisors and they will be responsible for monitoring and recording air emissions parameters, water quality parameters, noise level, and occupational health and safety to ensure and confirm that the operational works comply with Punjab Environmental Quality Standards (PEQS). Unit administrative personnel will submit records to enforcement, as required ensuring compliance with environmental and occupational health and safety regulations and No objection certificate (NOC) conditions. A well-trained person will provide training and equipment to monitor effluent and emission quality compliance with PEQS. The second level shall be the over sighted function to be performed by the Senior Management Officer, the Director, Administrative Officer, and with the feedback of the Environmental and Safety Staff, shall be responsible for providing direction and training, to keep personnel up to date on equipment operation, environmental control, monthly safety meetings for administrative personnel, training on firefighting emergency response and emission and effluent quality monitoring. Administrative personnel and Environmental Health and safety staff should have to well informed of new environmental regulations and safety precautions.

On the third level, the Executive Director should hold meetings and communications regularly with responsible personnel to keep them informed about the status of Quality, Environment, Health, and Safety issues in the building. The responsible staff should maintain a proper record of all these issues.

The responsibilities of the Environment Manager, Health and Safety Officials, and relevant staff are as follows:

- To ensure the implementation of all the planned mitigation measures during the operational stages of the proposed project and ensure that the proposed project is implemented in an environmentally friendly manner, causing the least harm to the existing environment.

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- To organize regular monitoring programs of emission, effluent, noise, occupational health, and implementation of safety measures, etc.
- To develop operational guidelines and implementation schedules.

Receiving complaints from residents and institutions and assisting the local environmental authorities including Environmental Protection Department (EPD), Punjab

9.11.8 Safety Training

Skilled, semi-skilled, and un-skilled staff will be provided with proper training about the work and safety practices that need to adopt during the process activity stakeholder

10 CONSULTATION AND INFORMATION DISCLOSURE

10.1 GENERAL

This section describes the outcomes of the stakeholder consultation process as part of the EIA report. The feedback from communities and other stakeholders, directly or indirectly affected by the project, was collected to adjust and improve the project's design, planning, and implementation, and help the implementation agency ensure the project's environmental and social sustainability. The consultation process was carried out in accordance with the requirements of the Punjab EPA on public consultation.

The objectives of this consultation process were :

- To disseminate information on the project and expected project impact, both long–term and short–term, among primary and secondary stakeholders,
- To gather information on relevant issues so that the feedback received could be used to address these issues at an early stage,
- To determine the extent of the negative impacts of different project activities and to suggest appropriate mitigation measures.

10.2 PROPONENTS ENVIRONMENT MANAGEMENT TEAM

All possible impacts and mitigation measures related to the project were discussed with the proponent, management team, and all the stakeholders like

- Project Contractor
- NHA
- Service providers
- HSE
- Civil Workers
- Environmentalist

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- Grievance Redress Committee (GRC)

Proponent assured us to take all suggested mitigation measures to control any discrepancy that arose in the project and to make the project environmentally friendly. The following points were discussed during the public consultations: project components, project activities, and impacts as detailed below.

- Needs, priorities, and feedback of the population regarding the project.
- Employment opportunities and livelihoods of communities.
- Contractor's camps and access to them
- Potential environmental issues
- The basis for determining the rates of the land, houses, and other infrastructure

10.3 THE RESPONSIBLE AUTHORITY

i)	Sponsoring	Ministry of Communications
ii)	Execution	National Highway Authority
iii)	Operation and Maintenance	National Highway Authority
iv)	Concerned federal ministry	Ministry of Communications

10.4 OTHER DEPARTMENTS AND AGENCIES

The impact analysis is detailed with the management, local community, educational institutes, health institutes, hospitals, and NGOs. All issues were discussed related to the implementation of the project. Scoping sessions, focused group discussions, and wayside consultations were held with the relevant stakeholders in the area.

10.5 ENVIRONMENTAL PRACTITIONERS AND EXPERTS

Project Management Unit visited the project site, had discussions with stakeholders, and consulted with the local people of nearby and other villages to evaluate the project's socio-economic impacts. People of the area belong to different professions mostly belong to employment, own businesses, doctors, some abroad, in Army, teaching, agriculture, etc. women were also consulted for their point of view regarding the betterment of the area by this project, some of them communicated but according to the social value of the area, they mostly hesitate to communicate comfortably and get pictured. People provide a massive information about the project and have positive remarks regarding the project development. Maximum local people, responsible authorities, and other departments were consulted.

10.6 IDENTIFICATION OF MAIN STAKEHOLDERS

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During Environment and social impact assessment in the field, a series of consultations were carried out with a wide range of stakeholders including affected farmers, residents, departmental officials, the business community along the route, road users, students, and the general public. All these stakeholders have different types of stakes according to their stated and vested interests and involvements in various aspects of the project.

The aims of community and stakeholder consultations and information dissemination with PAPs during social impact assessment and EIA preparation were to:

- introduce project details, objectives, proposed implementation plan and strategies, and potential impacts to the community members;
- identify the communal property and public infrastructure and facilities likely to be affected;
- identify the vulnerable social groups that may require special support;
- Identify various socially and culturally acceptable resettlement and other mitigation alternatives.

10.7 IDENTIFICATION OF STAKEHOLDERS

Two types of stakeholders can be distinguished: primary and secondary as detailed below:

10.7.1 Primary Stakeholders

The primary stakeholders are the ones directly affected by the project, as well as the general public residing in the project area. Accordingly, the consultations/ focus group discussions were conducted with primary stakeholders to share information about the proposed project, and its expected impacts and to understand stakeholders' concerns by considering the category of stakeholders.

10.7.2 Secondary Stakeholders

The secondary stakeholders are the representatives of Government Departments / Agencies involved in the planning, design, implementation, and operation of the project, including various government departments such as :

- Local Government Department
- Forest and Wild Life Department
- District Coordinating Office-Additional (ADC)
- Pakistan Red Crescent Society

10.8 STAKEHOLDER CONSULTATION PROCESS

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The overall strategy for stakeholder consultation is as shown in the table below :

Table 10-1: Process of Stakeholder Consultation

STAKEHOLDER	CONSULTATIONS		
Primary Stakeholder	↓ Information gathering and data collection. ↓ Information sharing about the project (disclosure) ↓ Opinion seeking (concerns and expectations) ↓ Grievance redress	↓ Focus Group Discussions ↓ Formal and informal Community meetings	↓ Baseline Study ↓ Impact Assessment ↓ Inventory of Losses
Secondary Stakeholder	↓ Participation in the process ↓ Information gathering Authentication and validation of the processes verification of the record	↓ One-on-one meetings ↓ In-depth interviews ↓ Group meetings	↓ On need basis

Stakeholder consultation for this project was a planned process. The meetings were conducted to inform stakeholders about the project and how it may affect their lives/activities, and to record their concerns, whether real or perceived. Through the use of various tools, the study team tried to involve the stakeholders in active decision–making. However, due to pandemic situations, no large gathering was done.

10.9 PRIMARY STAKEHOLDERS CONSULTATION

Apart from gathering quantitative data throughout the project site, a survey of the area of influence and a survey of the project's affected people and other local communities were conducted to share information about the project and record people's concerns/ feedback associated with this project. As the proposed activities are providing better transport facilities by constructing a new road, fewer APs are anticipated during the assessment.

10.10 TOPICS FOR DISCUSSION

The following points were discussed during the public consultations: project components, project activities, and impacts as detailed below.

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- Needs, priorities, and feedback of the population regarding the project.
- Employment opportunities and livelihoods of communities.
- Contractor's camps and access to them
- Potential environmental issues
- The basis for determining the rates of the land, houses, and other infrastructure, if falling in the RoW.

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Table 10-2 List of Primary Stakeholder's Consultations in the Project Area

SR. NO.	NAME	ADDRESS	AGE (Y)	PROFESSION	EDUCATION	COMMENTS
1.	Ali Ahmad Raza	Bucheki	38	Business	Primary	This project will create jobs opportunity for the locals and the value of the nearby land will also increase
2.	Ghulam Ahmad	Bucheki	40	Shopkeeper	Graduation	It is good for the economic and social life of the area. The road will provide easy market access.
3.	Asif Malik	Bucheki	35	medical store	Graduation	People will be able to reach big cities easily. This road will link the people of two provinces. Economy of the area will be boasted village at people will never migrate to big cities
4.	Ahmad Shahzad	Bucheki	31	Labor	Primary	We are thankful to the respective authority who have taken such a good step for the progress of this area we hope it would have some fruitful outcomes.
5.	Waseem	Bucheki	18	Student	F.A.	The neighborhood individuals will partake in the advantages of the detour as it joins numerous provincial regions
6.	Atif Mumtaz	Bucheki	36	Shopkeeper	Graduation	Although there will be increase in traffic load and it will enhance the pollution level but in other hand this project will create jobs opportunity as well and provide the safe route to the locals.
7.	Abrar Ahmad	Bucheki	24	Job	F.A.	We are thankful to the respective authority who have taken such a good step for the progress of this area we hope it would have some fruitful outcomes

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Table 10-2 List of Primary Stakeholder's Consultations in the Project Area

SR NO.	NAME	ADDRESS	AGE (Y)	PROFESSION	EDUCATION	COMMENTS
1.	Ali Ahmad Raza	Bucheki	38	Business	Primary	This project will create jobs opportunity for the locals and the value of the nearby land will also increase
2.	Ghulam Ahmad	Bucheki	40	Shopkeeper	Graduation	It is good for the economic and social life of the area. The road will provide easy market access.
3.	Asif Malik	Bucheki	35	medical store	Graduation	People will be able to reach big cities easily. This road will link the people of two provinces. Economy of the area will be boasted village at people will never migrate to big cities
4.	Ahmad Shahzad	Bucheki	31	Labor	Primary	We are thankful to the respective authority who have taken such a good step for the progress of this area we hope it would have some fruitful outcomes.
5.	Waseem	Bucheki	18	Student	F.A.	The neighborhood individuals will partake in the advantages of the detour as it joins numerous provincial regions
6.	Atif Mumtaz	Bucheki	36	Shopkeeper	Graduation	Although there will be increase in traffic load and it will enhance the pollution level but in other hand this project will create jobs opportunity as well and provide the safe route to the locals.
7.	Abrar Ahmad	Bucheki	24	Job	F.A.	We are thankful to the respective authority who have taken such a good step for the progress of this area we hope it would have some fruitful outcomes

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8.	Ghulam Nabi	Bucheki	47	Railway	Matric	It is very good initiative taken by the authority but they should not destroy the environment and there should be green belt around the project area
9.	Zahid Hussain	Bucheki	45	Shopkeeper	Middle	This project will create jobs opportunity for the locals and the value of the nearby land will also increase
10.	Adeel Rehman	Bucheki	27	Shopkeeper	F.A.	This is an acceptable advance accepted by the public authority as they are going improve the road condition and we trust this venture will create occupations opportunities for local people
11.	Abdullah	Bucheki	22	Shopkeeper	Masters	I hope this a good step to improve the local area
12.	Sheikh Irfan	Bucheki	48	Shopkeeper	Matric	This project will create job opportunities for the locals
13.	Shafeeq Ahmad	Bucheki	20	Student	F.A	This project will provide job opportunities and will improve this area lifestyle
14.	Hussain Akhter	Bucheki	25	Hotel Owner	Middle	This project will create jobs opportunity for the locals and it will have positive outcomes
15.	Murad Khan	Bucheki	48	Shopkeeper	Graduation	This is good step taken by the authority this project will increase the socio–economical value of the region
16.	Arif Malik	Bucheki	42	LPG Sales Agent	Matric	The local people will enjoy the benefits of the road
17.	Ali Raza	Bucheki	25	Shopkeeper	Matric	Although there will be increase in traffic load and it will enhance the pollution level but in other hand this project will create jobs opportunity as well
18.	Hamza Iqbal	Bucheki	50	Butcher	Matric	This is good step taken by government Insha'Allah this will be beneficial for locals

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19.	Ali Khawar	Bucheki	25	Labour	Middle	This project will create job opportunity for the local so we believe this is good step taken by government
20.	Jawad Bashir	Bucheki	30	Food Stall	Graduation	It is very good initiative taken by the authority but they should not destroy the environment and there should be green belt around the project area
21.	Abdul Rehman	Bucheki	35	Job	M.A.	This project will create jobs opportunity for the locals and it will have positive outcomes
22.	Mian Rao	Bucheki	44	Tailor	F.A	National Highway Authority works very well from Environmental and social points of view. We hope this project will create jobs opportunity as well it will not have any adverse impact on the locals.
23.	Arif Ahmad	Bucheki	33	Shopkeeper	Matric	This project will create job opportunities for the local so we believe this is good step taken by government
24.	Abdul Riaz	Bucheki	45	Driver	Middle	This is a good step taken by the government it will have some fruitful outcomes.
25.	Iqbal Ahmad	Bucheki	34	Railway	Graduation	This is a good step taken by the government Insha`Allah this will be beneficial for locals.
26.	Naseer Malik	Nankana Sahib	19	Student	F.A	We are glad that socio affordable worth of this space will build we demand Job inclination should be given to the nearby individuals
27.	Iqbal Ahmad	Nankana Sahib	19	Student	1st Year	By the construction of this road safe route facilities to M-4 will be achieved that will be benefitted by locals.
28.	Naseer Malik	Nankana Sahib	29	Shopkeeper	Masters	The local people will enjoy the benefits of the road.

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29.	Kashif Gujjar	Nankana Sahib	26	Teacher	M.A.	This is a good step taken by the government it will have some fruitful outcomes.
30.	Muhammad Iqbal	Nankana Sahib	26	Labor	–	We believe This project will have positive impact on the environment as well as on the locals.
31.	Muhammad Shahbaz	Nankana Sahib	42	Police Officer	Masters	National Highway Authority works very well from Environmental and social point of view. We hope this project will create jobs opportunity as well it will not have any adverse impact on the locals.
32.	Rohan Malik	Nankana Sahib	25	Shopkeeper	F.A.	It is very good initiative taken by the authority but they should not destroy the environment and there should be the green belt around the project area.
33.	Idrees Ahmad	Nankana Sahib	28	Driver	F.A.	This project will create jobs opportunity for the local and the value of the nearby land will also increase.
34.	Shaukat Malik	Nankana Sahib	30	Shopkeeper	Matric	We are happy that socio economical vale of this area is going to increase we request Job preference should give to the local people.
35.	Adnan Rana	Nankana Sahib	28	Shopkeeper	F.A.	During the construction and operation phase of the road SOPs should be follow strictly and they should work for the protection of environment.
36.	Muhammad Bilal Butt	Nankana Sahib	48	Private Job	Matric	This project will have positive impacts on this area as well trade in this area will increase due to this road.
37.	Asmat Mahmood	Nankana Sahib	45	Police Officer	M.A.	This project will provide job opportunity and will improve this area life style as well.

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38.	Ali Hamza	Nankana Sahib	33	Police Officer	B.A.	We are happy that socio economical vale of this area is going to increase we request Job preference should give to the local people.
39.	Aizaz Mahmood	Nankana Sahib	32	Shopkeeper	Middle	This project will create job opportunities for the locals.
40.	Waqazs Murtaza	Nankana Sahib	25	Shopkeeper	F.A.	We hope this project will have positive impact on the locals.
41.	Shaheer Ahmad	Nankana Sahib	22	Pesticide Trader	F.A.	We believe This project will have positive impact on the environment as well on the locals.
42.	Waleed Akbar	Nankana Sahib	38	Motorcycle Showroom	Primary	National Highway Authority working very good regarding Environmental and social point of view. We hope this project will create jobs opportunity as well it will not have any adverse impact on the locals
43.	Muhammad Asif Rao	Nankana Sahib	35	Shopkeeper	–	We are thankful to the respective authority who have taken such a good step for the progress of this area we hope it would have some fruitful outcomes.
44.	Shahbaz Chohan	Nankana Sahib	25	Student	Graduation	This project will provide job opportunity and will improve this area life style as well linkage with the big cities to the villages.
45.	Atif Akbar	Nankana Sahib	38	Motorcycle showroom	F.A.	This is good step taken by the government as they are going construct road and we hope this project will generate jobs opportunity for the locals.
46.	Shah Ahmad	Nankana Sahib	31	Govt Job	Graduation	I hope this a good step to improve the local area.
47.	Murtaza	Nankana Sahib	32	Vegetable	-	This project will create job opportunity for the local so we

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				Merchant		believe this is good step taken by government.
48.	Waheed Akbar	Nankana Sahib	38	Shopkeeper	Graduation	The local people will enjoy the benefits of the road.
49.	Hameed Ahmad	Thatta Essa	25	Shopkeeper	Intermediate	This project will create job opportunity for the locals so we believe this is good step taken by the government.
50.	Waseem Arif	Thatta Essa	24	Student	B.Sc.	Better transport facility will be available better chance of employment will be available during construction and after construction roadside business will be generated.
51.	Adnan Waqar	Thatta Essa	32	Medical Store	B. Pharmacy	Although there will be increase in traffic load and it will enhance the pollution level but in other hand this project will create jobs opportunity as well.
52.	Mujtaba Rasool	Thatta Essa	29	Job	Intermediate	This is good step taken by the authority as well local people will enjoy its benefit of the road this project will increase the socio– economical value of the region.
53.	Asif Ali	Thatta Essa	35	Food Stall	Matric	This project will provide job opportunity and will improve the area life style.
54.	Nadeem Ahkter	Thatta Essa	26	Driver	–	This is good step taken by government Insha'Allah this will be beneficial for locals.
55.	Naveed Ahmad	Thatta Essa	35	Shopkeeper	Matric	Better transport facilities will be available. It will connect many areas to main Highway.

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56.	Aslam	Thatta Essa	40	Shopkeeper	F.A.	During the construction and operation phase of the road SOPs should be follow strictly and they should work for the protection of environment.
57.	Ahmad Shahzad	Thatta Essa	31	Fruit Stall	–	This is good step taken by the authority as they will generate jobs opportunities as well local people will enjoy its benefit of the road this project will increase the socio–economical value of the region.
58.	Subhan Malik	Thatta Essa	26	Driver	Middle	This project will have positive impacts on this area as well trade in this area will increase due to this road.
59.	Shahmeer Hussain	Thatta Essa	25	Student	F.A.	During the construction and operation phase of the road SOPs should be followed strictly and they should work for the protection of environment.
60.	Akhtar Nadeem	Thatta Essa	50	Security Guard	F.A.	This is good initiative taken by the government we request for the job purpose the locals should be priorities.
61.	Zakir Hussain	Thatta Essa	49	Private Business	Masters	This venture will set out positions freedom for local people and it will have positive results. Through this financial state of the space will likewise improve.
62.	Waqar Hameed	Thatta Essa	28	Shopkeeper	Graduation	We believe this project will have positive impact on the environment as well on the locals.

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10.11 CONSULTATION OUTCOMES

Overall, people expressed their wish for the construction of the road and their support for the proposed project. The construction of the interchange project was welcomed by the people as it will reduce traffic congestion and minimize other road hazards along the selected road section. Local communities demanded that they should be part of a continuous consultation process, together with other stakeholders, during different stages of the project including design, construction, and operation. The concerns raised by the stakeholders/communities are described below:

- The design of the road must meet national standards.
- Damage to any structure, if any should be properly compensated.
- The waste material should not be dumped into the surface water body or along the road.
- Avoid undue delays in road construction and ensure that project works are carried out at a stretch rather than piecemeal.
- Avoid dumping construction material along the highway and median.
- Adopt measures to minimize dust, smoke, and noise pollution, and to control spillages from construction machinery.
- Carry out construction activities preferably at night to avoid traffic jams/hazards.
- A proper traffic management plan should be provided during construction activities.
- Job opportunities should be provided to the locals during construction activities.
- The safety of residents along the road should be ensured.
- Erect cautionary and information signs.
- Control over–speeding, overloading, traffic disorders, and violations of traffic regulations; construct speed breakers where required.
- Prohibit commercial vendors and squatters from encroaching on the ROW.
- Ensure that cross–drainage pipes and culverts are regularly cleaned.
- Regularly remove accumulated piles of rubbish from the ROW.

10.12 REDRESS OF STAKEHOLDERS' CONCERNS

Most of the concerns raised by stakeholders have already been incorporated into the project's design and will be implemented through mitigation measures as described below :

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SUGGESTIONS/ CONCERNS OF STAKEHOLDERS	PREVENTION METHODS
Road Safety	Road safety audits and improved road markings/signage and demarcation of accident-prone junctions will be made to improve the horizontal and vertical geometry and reduce conflicting movement during operation, particularly along inhabited stretches of road.
	Roadside furniture and traffic control devices, including information and cautionary signs, signals, traffic diversion, and flow markings will be provided, to ensure pedestrian safety during construction and operation.
	Adequate drains will be designed to cater to the road drainage
Road Construction	Construction vehicles will remain confined within their designated areas of movement.
	Good relations with local communities will be established by encouraging contractors to provide opportunities for skilled and unskilled employment to locals, as well as on–the–job training in construction for young people.
	The solid waste generated during construction and at campsites will be properly managed and safely disposed of only at demarcated waste disposal sites approved by supervision consultants.
	Contractors will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination.

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SUGGESTIONS / CONCERNS OF STAKEHOLDERS	PREVENTION METHODS
	All necessary measures will be taken to ensure the safety of traffic during construction, including barricades (including signs, pavement markings, flags, and lights) erected as required by the NHA. All such barricades will be set up as per local regulations.

The stakeholders supported the project, provided that environmental and social issues are addressed through mitigation measures.

11 GRIEVANCE REDRESS MECHANISM

11.1 GENERAL

The stakeholder or affected people's concerns, complaints and grievances about the project's environmental performance will be received, recorded, and replied to in a systematic way using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to all segments of the affected people at no cost and without retribution. NHA will establish a Grievance Redress Committee (GRC) to facilitate resolution of complaints by Affected People (APs) and grievances about the project's environmental performance, in line with the requirement of National and provincial requirements. The GRC will be coordinated by the Deputy Director – Env of NHA. The GRC will address affected people concerns and complaints promptly, using an understandable and transparent process.

Following are the specific objectives of establishing Grievances Redress Mechanism;

- Ensure better safeguard mechanism for implementation of project;
- Resolve environmental and social grievances in the project area;
- Build up relationship of trust between the project proponent and the stakeholders; and
- Ensure transparency in dealing with stakeholders including affected people through a proper communication mechanism.

11.2 GRIEVANCE REDRESS COMMITTEE (GRC)

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NHA will establish a Grievances Redress Committee (GRC) to facilitate resolution of complaints raised during implementation of the project. The GRC will address affected people's concerns and complaints promptly using an understandable and transparent process. The terms of functioning of GRC will be as follows;

- Provide support to the affected persons and stakeholders in solving the problems;
- Resolve grievances preferably on the first day of hearing or within one week, in case of complicated issues may require additional time;
- Coordinate with the Affected Persons (APs), getting proper and timely information on the solution worked out for grievances;
- Study the normal occurring grievances and advise Project Director of the Project on remedial measures/actions to avoid further occurrences

GRC meetings will be held in NHA, PD Office or other locations agreed by the committee. If needed GRC members will conduct filed visits to verify and review the issues in dispute.

11.3 COMPOSITION OF GRC

The GRC will work directly under the supervision of the Director of Environment of NHA.

The following members are recommended to form a GRC to look into environmental matters.

- DD Environment –NHA
- Representatives from Affected People (APs)
- Environmentalist of Supervision Consultant / Contractor

Director Environment will nominate one Deputy Director as a member of GRC and shall act as Project Environmental Grievance Officer (PEGO).

He will review the case on merit and address the problem in accordance with prevailing rules/ procedures applicable to such grievances as per Environmental Management Plan (EMP). The PEGO will then refer the case to GRC for a final decision, on whether to update and make necessary amendments in EMP. The GRC will deliver its decision within thirty (30) days of registration of the case. If the affected person does not receive a response from GRC within thirty (30) days of the registry of the complaint, he/she can appeal to the Director of Environment, who should act on the complaint/ grievance within two weeks of the day of its filing. If the affected person is not satisfied with the decision of the Director of Environment, then it can be referred to higher authorities / relevant govt. departments for its resolution. As a last resort, he/she may submit the complaint to Punjab EPA. The flow chart of the proposed redress mechanism is shown in Figure 11.1

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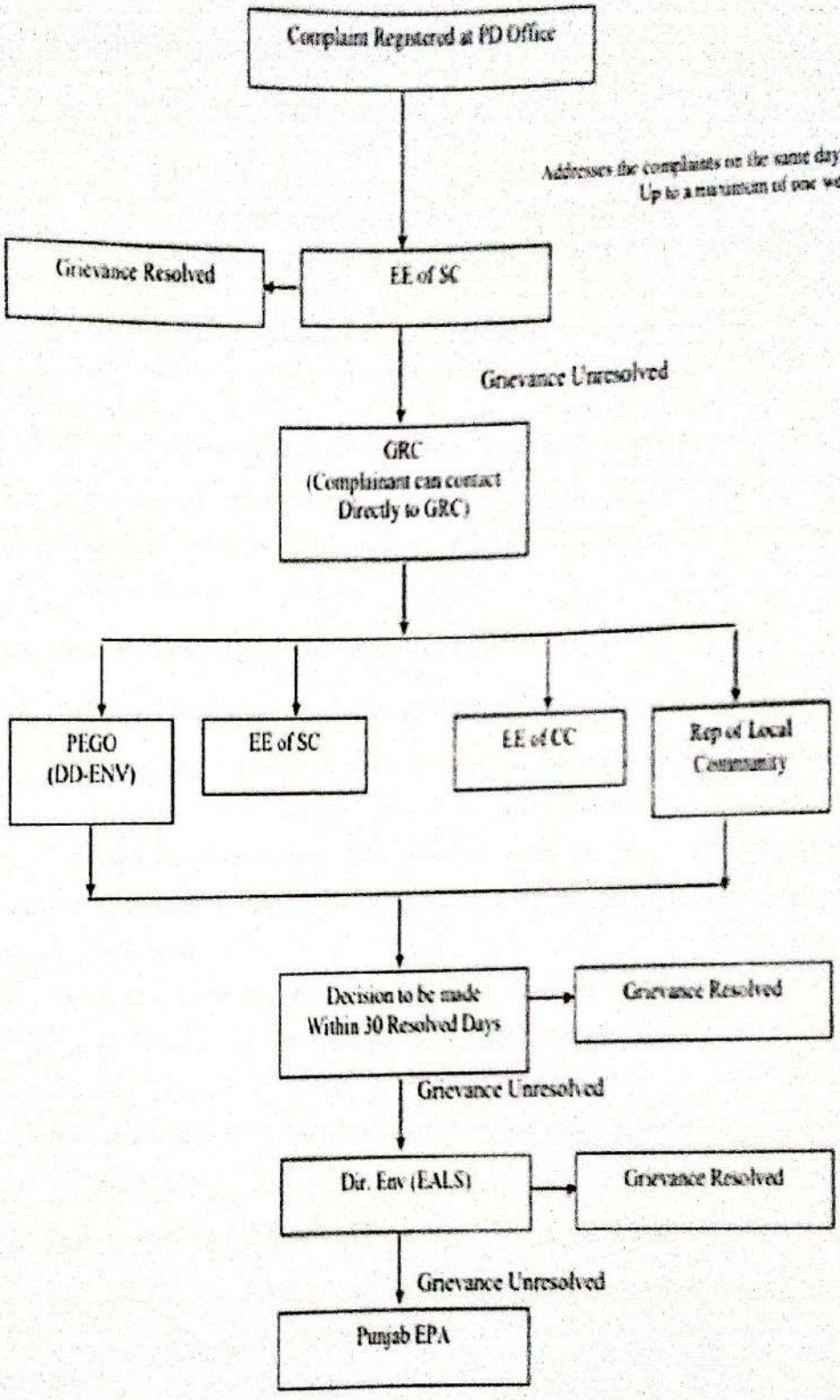


Figure 11-1 Flow Diagram of Proposed Redress Mechanism

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11.4 RESPONSIBILITIES OF GRC

The responsibilities of GRC will include the following:

- The GRC shall review, consider and resolve grievances related to environmental issues during implementation received by the PD office – NHA.
- Environmental Specialist is responsible for conducting investigations on these grievances.
- Any grievances presented to the GRC should ideally be resolved on the first day of the hearing or within one week, in case of complicated issues requiring additional investigations.
- GRC is empowered to take a decision that is binding on NHA and considered final.

GRC meeting will be held in the NHA, PD office, or other locations agreed by the committee. If needed GRC members will conduct field visits to verify and review the issues in dispute.

11.5 PROCEDURE FOR REDRESS OF GRIEVANCES

Suggested procedures to be adopted for the redressal of the grievances are given below:

- Project Affectee will submit his/her application to the Field Implementation Unit for consideration. Within 15 days of the receipt of the complaint, action will be taken up for redressal of the grievance. Wherever policy matters are involved, the case will be referred to the appropriate authority or committee appointed by the Project to decide the matter.
- In case some response to the complaint is not received within 15 days of the receipt of the complaint, the complainant may also send a reminder within 15 days' notice to take legal remedial measures.
- All complaints received in writing or written when received verbally will be properly recorded and documented.

11.6 PROPOSED MECHANISM FOR GRIEVANCE REDRESS

Under the Project, the following will be established or appointed to ensure the timely and effective handling of grievances:

- A Public Complaints Unit (PCU), will be responsible to receive, log, and resolve complaints.

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- A Grievance Redress Committee (GRC), is responsible to oversee the functioning of the PCU as well as the final non–judicial authority on resolving grievances that cannot be resolved by the PCU.
- Grievance Focal Points (GFPs) have educated people from each community that can be approached by the community members for their grievances against the Project. The GFPs will be provided training by the Project in facilitating grievance redress.

Details of the proposed mechanism are given below:

(i) Project Management Unit (PMU)

The overall responsibility for the implementation of the Environmental Management / Monitoring Plan rests with the Project Management Unit (PMU) along with the assistance of the Environmental Unit (EU) of the PMU. The EU consists of the Director of Environment & Sociology, the Deputy Director of Environment, and the Deputy Director of Sociology. PMU will assume overall responsibility for ensuring:

That while executing the contract and undertaking the construction all environmental norms, regulations, and requirements promulgated by Punjab Environmental Protection Act (PEPA), Punjab Protection Agency (EPA) for the work site and adjacent areas are fully respected and implemented and overall responsibility for implementation of EMP. Ensure that Contractor and Construction Supervision Consultants appoint a dedicated environmental officer and allied staff. PMU will also ensure that all environmental personnel is authorized to implement the socio-environmental policies and requirements of the EMP.

(ii) Environment Unit (EU) of PMU

- The Environmental Unit (EU) within PMU will monitor Project performance.
- The EU will function in coordination with the Construction Supervision Consultants and will receive reports from them on behalf of PMU.

(iii) Head PMU / The Project Director

The Project Director shall provide or arrange the logistics including communication, transport, and accommodation to all visiting persons/teams experts from any of the above monitoring units and shall coordinate with the contractor(s) to facilitate the visits/inspections.

(iv) Contractor

The contractor will be responsible for the implementation of the project EMP. The contractor will ensure that EMP for the project is implemented fully and must be

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integrated into the Project implementation and made an integral part of the contract document. Any default damages so caused will be remediated by the contractor at his own cost and expenses. In case the contractor fails to rectify the damage the employer will remediate at the risk and cost of the contractor. The amount will be determined by the Construction Supervision Consultants and will be adjusted from the amount due to the contractor.

(v) PCU – Function and Structure

PCU will be set up as part of the environment, health, and safety department of the Project. A senior official with experience in community and public liaison will lead the unit. Two assistants, one male, and one female will be responsible for coordinating correspondence and preparing documentation work and will assist the senior official. The senior official will be responsible to review all documentation. The PCU will be responsible to receive, log, and resolve grievances. Given that the female community members have restricted mobility outside of their homes, the female PCU staff will be required to undertake visits to the local communities. The frequency of visits will depend on the nature and magnitude of activity in an area and the frequency of grievances.

(vi) GRC – Function and Structure

The GRC will function as an independent body that will regulate PCU and the grievance redress process. It will comprise of:

- Officials of environment, health, and safety of the proposed Project.
- A senior engineer is responsible to oversee the contractors.
- Two literate representatives from the communities residing near the project site;
- Representative of the local government. If not, this would be the District Coordinating Officer (DCO) or an appointed representative;
- A senior member of the local civil society with experience in community relations;
- A female member of the local civil society.

The GRC will meet once every three months to review the performance of the PCU; the frequency can be changed depending on the nature and frequency of grievances received. The performance will be gauged in terms of the effectiveness and the timeliness with which grievances were managed. In case there are any unresolved or pending issues, the GRC will deliberate on mechanisms to resolve those and come up with solutions acceptable to everyone.

11.7 ENVIRONMENT AND SOCIAL COMPLAINTS REGISTER

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The consultant's environmental team will maintain an environment & social complaint register at the campsite office to document all complaints received from the local communities. The register will also record the measures taken to mitigate these concerns. The final report will be communicated to the Environmental section of PMU.

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12 CONCLUSION AND RECOMMENDATIONS

The planned interchange will largely contribute to the economic and social development of the bucheki to nankana sahib and adjoining areas as well as Pakistan on a larger scale. It will bring more population into the stream of benefits, which in turn will change the social complexion of people around this highway. This link will bring about further revolution in the road transport and time saving journey for passengers. It will also contribute to ensure smooth and efficient movement of trade, goods and traffic in relatively shorter time. Where the proposed project will help towards achieving this objective, the environmental study of the project area requires that potential environmental effects due to the proposed project are evaluated, mitigation measures required to minimise or obviate these impacts are assessed, implemented and monitored. Any residual impacts are assessed for their significance. These requirements have been addressed in this EIA, which has covered in detail the following:

The proposed project activities;

- Alternatives considered in finalizing the project;
- Environmental conditions of the project area;
- Potential environmental effects of the proposed project activities on the physical, natural and socio-economic receptors.
- Mitigation and monitoring measures that will help in avoiding or minimizing these impacts.

After assessing the significance of potential impacts, it has been concluded that if the project activities are carried out as described in this report, and the suggested mitigation measures are implemented, the proposed project will not have a significant impact on the area's natural and socioeconomic environments. Hence, this EIA concludes that the upon implementation of the mitigation, the residual impacts of the proposed operation will be low and careful implementation of the provided EMP will ensure that environmental impacts are managed and minimised and all statutory requirements are met by the project proponent.

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GLOSSARY

Air Quality	Measurement of the pollutants in the air; a description of the healthiness and safety of the atmosphere.
Area Of Influence	Area of influence is the overall area affected by the Project, including, for example, construction camps and lay-down areas. The percentage of habitat impacted is by reference to the national area of such habitat. In practice it is not possible, nor is it intended to try, to calculate these percentages. Instead, this criterion is used to provide an approximate indication, based on professional judgment and available knowledge, of the proportion of any one type of habitat that may be affected, primarily to highlight where a large proportion of habitat is affected
Consultation	Consultation refers to the two-way transfer of information or joint discussion between project staff and the affected population. Systematic consultation implies a sustained and rigorous sharing of ideas. Bank experience shows that consultation often yields the best resettlement alternatives, fruitful procedures for continued participation, and independent information on actual conditions for implementation.
Disclosure	The action of making new or secret information known
Environmental Management	Attempt to control human impact on and interaction with the environment to preserve natural resources
Environmental Audit	An analysis of the technical, procedural, and decision-making aspects of an EIA is carried out sometime after a proposal has been implemented.
Evaluation	The making of a judgment about the amount, number, or value of something; assessment.
Exploration	Exploration is the act of searching for the discovery of information or resources
Geology	A science that studies rocks, layers of soil, etc., to learn about the history of the Earth and its life
Ground Water	Aquifers are currently being used as a source of drinking water or those capable of supplying a public water system. They have a total dissolved solid content of 10,000 milligrams per liter or less, and are not "exempted aquifers."
Haulage	Haulage is the commercial transpiration of goods and materials

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Hazardous	Substance or material, which could adversely affect the safety of the public, handlers, or carriers during transportation
Household	People residing under one roof, using the same hearth, and operating as a single economic unit.
Impact	Effect on someone or something
Jurisdiction	The extent of the power to make legal decisions and judgments.
Land Acquisition	The process whereby a person is compelled by a public agency to cede all or part of the land a person owns or possesses, to the ownership and possession of that agency, for a public purpose in return for compensation.
Mitigation	The action of reducing the severity, seriousness, or painfulness of something
Monitoring	Supervising activities in progress to ensure they are on course and on schedule in meeting the objectives and performance targets
Occupational Health	Maintenance of the highest degree of physical, mental, and social well-being of workers in all occupations by preventing departures from health, controlling risks, and adaptation of work to people, and people to their jobs
Project Area	The area specified by the funding and/or implementing agency according to the Official Gazette Notification and includes the areas within the administrative limits of the Federal or Provincial Government.
Proponent	A person who advocates a theory, proposal, or course of action.
Proposed Project	It is a document that is used to convince a sponsor that a project needs to be kicked off to solve a particular business problem or opportunity. It describes in depth, how the project is going to be commenced so that the sponsor understands what is involved early.
Rehabilitation	Include all compensatory measures to re-establish; at least lost incomes, livelihoods, living, and social systems. It does not include the payment of compensation for required assets.
Resettlement	This means all measures taken to mitigate any adverse impacts, resulting due to the execution of a project on the livelihood of the project-affected persons, and their property, and includes compensation, relocation, and rehabilitation.
Scope	The extent of the area or subject matter that something deals with or to which it is relevant
Scoping	An exercise involving the preliminary identification of the environmental issues surrounding a project that requires an assessment. Scoping should take place soon after the project has passed the Initial Review. Scoping identifies

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	the potential impacts which are to be addressed in detail by the assessment. Scoping will usually initiate the public consultation/public participation process.
Social Environment	It includes the culture that the individual was educated or lives in and the people and institutions with whom they interact.
Stakeholders	Include affected persons and communities, proponents, private and public businesses, NGOs, host communities, and EPA.
Topography	Details of the surface features of the land. It includes the mountains, hills, creeks, and other bumps and lumps on a particular hunk of earth.

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ANNEXURE-A

Pictorial View Of Traffic Survey

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PICTORIAL VIEW OF TRAFFIC SURVEY

A pictorial view of the traffic counts and OD survey is as follows:

Traffic Count Survey





5 December 2022





6 December 2022





7 December 2022

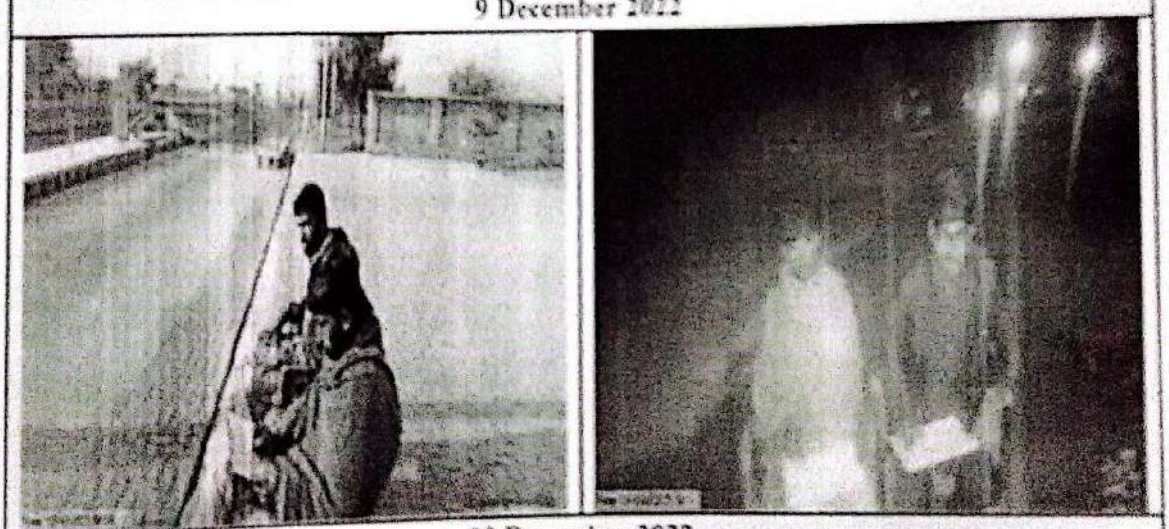
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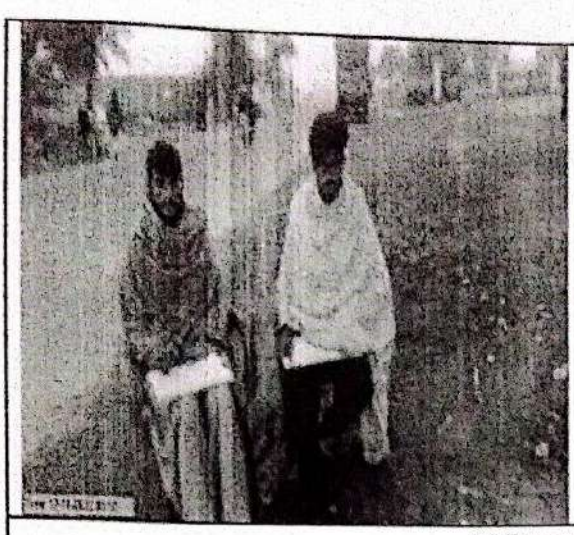


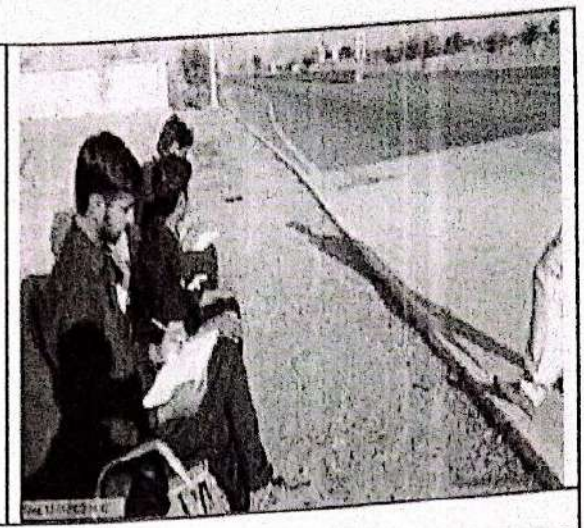
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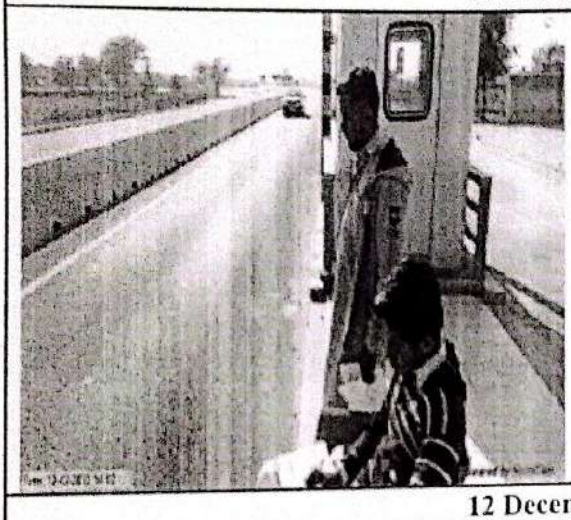
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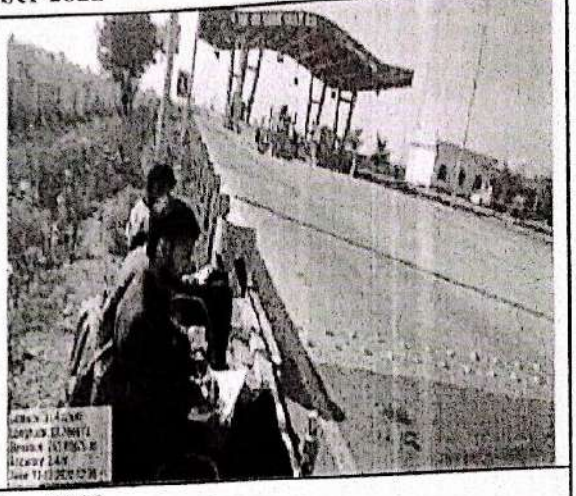
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Origin Destination Survey



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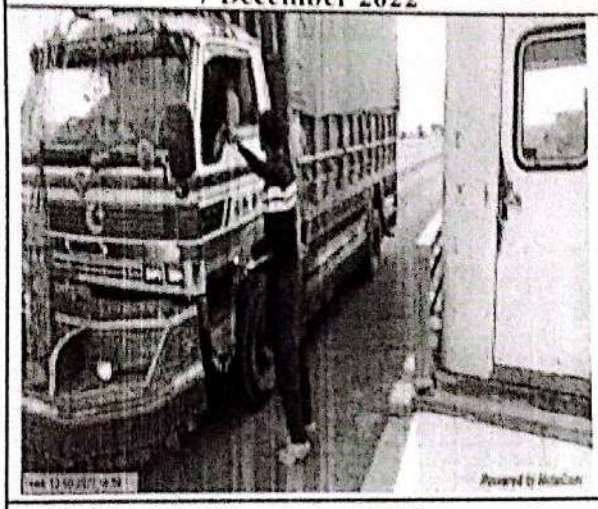
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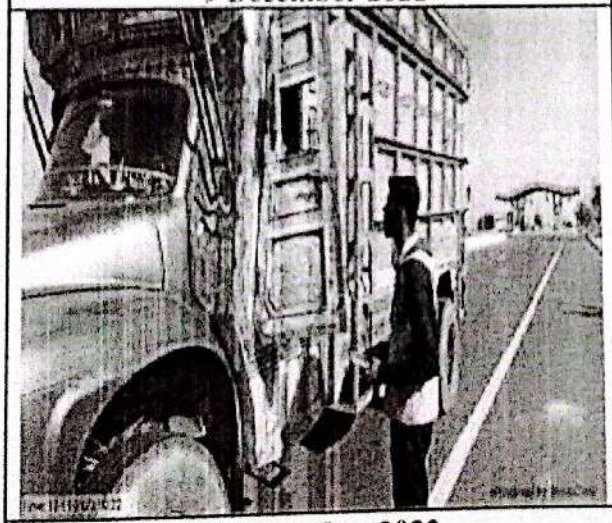
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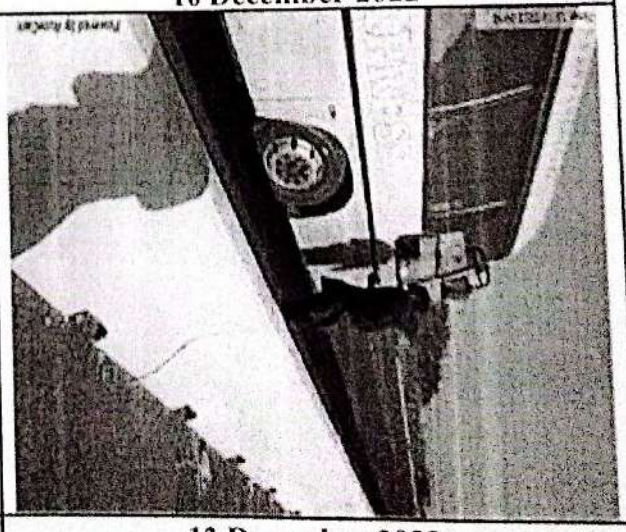
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ANNEXURE-B

Recycling Plan

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Recycling Plan

While the need for construction and maintenance of roads and other highway facilities remains a key factor in the socio-economic development of a society, it has over time began to pose negative externalities on the environment. Road pavement construction often involves the exploration of high volumes of materials (mostly aggregates) and mass haulage which result in increased emissions of greenhouse gases

The rate at which the construction industry explores and consumes non-renewable natural aggregates and other industrial products such as bitumen, lime, and cement during construction and rehabilitation of road pavements has over time proven to be environmentally degrading and non-sustainable. This, alongside the issues of high solid waste generation and inadequate disposal, has led to series of studies by various researchers to find methods to integrate these solid wastes as alternative materials in road construction and maintenance

Construction materials consist of debris that is generated during construction, renovation, and demolition of roads, and bridges. Heavy and bulky materials like the following are some examples of construction materials:

- Concrete
- Asphalt
- Metals
- Bricks
- Rocks

Adequate practical utilization of these materials will lead to significant improvements in the recycling rate of these waste. This concept effectively reduces land requirements for landfills, preserves natural aggregates against depletion, and reduces construction and maintenance costs while improving certain performance

Benefits of reducing disposal of construction materials

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1. Employment creation and an increase in economic activities in recycling industries. This will also increase the business opportunities within the local community, in areas where deconstruction and selective demolition are used.
2. Reduction in overall project expenses through avoided purchase costs and donation of recovered materials to qualified charities, which offers a tax benefit. Transportation costs also come down with onsite material reuse.
3. Fewer disposal facilities which reduce associated environmental issues.
4. Conserve landfill space.
5. The environmental impact associated with the extraction and consumption of virgin resources and the production of new materials is offset.

Reduce, Divert and reuse and Recycle Materials

Construction materials can be diverted from disposal by practicing source reduction, salvaging, recycling, and reusing existing materials.

1. Reduce

With source reduction, the life-cycle of material use, energy use, and waste generation can be reduced. The highest priority should be given to address solid waste issues. Source reduction prevents waste from being generated in the first place. Reducing construction debris also conserves landfill space, reduces the environmental impact of producing new materials, and can cut down the overall project expenses through avoided purchase.

2. Divert and Reuse

Raw construction debris can be diverted and used as a resource. Some materials that can be diverted include:

- Landscape and land clearing debris
- Asphalt pavements
- Gravel and aggregate products
- Concrete

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- Recovering used but valuable construction materials for further use is an effective use to save money and conserve natural resources. It has the following benefits:
- Maximizes the recovery of materials
- Conserves finite forest resources
- Provides employment opportunities
- Allows communities to create local economic activities around manufacturing or reprocessing salvaged materials

3. Recycle

Many construction debris can be recycled. Concrete and rubble are often recycled into aggregate and concrete products. Metals like steel, copper, and brass are also valuable resources to recycle.

There are three methods for waste recycling:

1. **Site-separated**: This uses multiple boxes for each type of waste. Separating construction waste on the job site gives immediate feedback to everyone on the job and can help to ensure that the project's recycling goals are met. Site separation also promotes a responsible atmosphere on the job site and is the best method for diversion goals. It does, however, take up more space and requires a high level of supervision.
2. **Commingled recycling**: This type of recycling uses one container. The hauler sorts everything off-site. This makes it easier for the field staff to manage waste on-site. Commingled recycling requires little storage space and is the best option for sites that are tight on space.
3. **Hybrid recycling:** This type of recycling combines site-separation and commingled recycling. For instance, one box for concrete, and one box for non-recyclable waste. Hybrid recycling represents the best of both worlds. It optimizes the weight vs. sorting effort. The total number of boxes can be reduced by working in phases. It reduces work for sorting haulers, which reduces hauling fees.

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For each project, the construction manager needs to assess the project requirements and site location to determine the best waste recycling method to use. Some questions to help with this are as follows:

- How many waste containers do you have room for?
- What will be their location on-site?
- Will you use a trash chute?
- Is it a high-rise site?
- Is it a high construction project?
- Will there be enough staff onsite for required supervision
- Will there be changes in the waste generated during the project?

Engineers and construction companies should promote sustainable and ecofriendly construction. They should carry out regular site inspections to verify that all construction waste management measures are in place and working properly. Haulers should create monthly construction reports on time. Waste recycling and hauling should be monitored on a weekly basis. Most importantly, the actual performance should meet or exceed the project goals on a frequent basis.

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ANNEXURE-C

Solid Waste Management Plan

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Solid Waste Management Plan

Management of solid waste is one of the most important issues during the construction phase of the project. It is estimated that around 46 workers will be accommodated at construction camps (a total of about 01 campsite) during the construction phase. As a general rule, the water consumption will be about 40 liter/capita/day and will subsequently generate about 70 to 80% of this water as sewage. Based on this water consumption around 4 m3/day of water will be utilized for washing, cooking, and bathing purposes at each campsite which will generate approximately 3.2 m^3/day of sewage at each of the construction camp sites. In addition, each construction camp site will generate about 50 kg/day of solid waste at the site @ 0.5 kg/capita/day. The major components of the workers' camp waste are garbage, putrescible waste, rubbish and a small portion of ashes and residues, wastewater from camps toilets and washing yards, etc. The construction waste will include wastewater, oil spillage from machinery, and solid waste (damaged or spoiled materials, temporary and expendable construction materials, etc.). Insecure and unhygienic disposal of wastes may cause the degradation of soil, land, and water resources. However, a criterion has been developed for solid and hazardous waste management at the site. The criterion for a plan is as follows:

- All the anticipated solid wastes should be collected through a properly designed solid waste management system. Enough containers should be placed inside the camps and within the construction area for the collection of various types of waste.
- These containers will help the component separation of various types of waste at the source. Classification will be based on organic waste, recyclable waste, reusable waste (for resource and recovery), and waste for disposal sites. Based on the conditions of the region, organic waste should be frequently collected to avoid odor problems.
- Recyclable, reusable, and waste for disposal sites should be collected twice a week and on alternate days and should be transferred to a properly designed disposal site.
- A special strategy for safe handling, storage, and use of hazardous substances/materials should be developed and ensured at the site;
- The sewage system for camps shall be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewater;

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- Lined wash areas shall be constructed within the campsite or at the site, for the receipt of wash waters from construction machinery;
- Medical waste and construction waste should be handled with care;
- Pesticide use shall not be allowed at the site and for clearance of row;
- Construction waste i.e. Waste concrete, bricks, cement, etc. should be disposed of at the designated areas; and.
- Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse, and recycling to reduce quantity of the waste for disposal.

Based on the above guidelines, the Contractor(s) will be responsible for the preparation of the Waste Management Plan before the commencement of construction activities and its implementation at the site after the prior review and approval from SC and the proponent

During the rehabilitation and widening of the construction and demolition waste is likely to generate. The contractor shall be responsible to manage all kinds of waste during the implementation of the project.

Storage/ Collection and Reuse of Construction and Demolition Waste

This waste is best stored at the source, i.e., at the point of generation. If they are scattered around or thrown on the road, they may not only obstruct traffic but also add to the workload of the local body. The following methods shall be adopted such as:

Clearing and Grubbing (C&G):

The material collected after C&G at the site is stored within the ROQ or at an approved disposal site so that waste does not get scattered and does not become an eyesore.

The waste material is carted to a disposal site in tippers properly covered and disposed of at the disposal site.

Scarified / Dismantled Bituminous Material:

The material collected for the scarification of the bituminous road or from the dismantling of the existing road is stored at the site and preserved.

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These materials may be mixed in the required percentage with GSB material to achieve the desired gradation and may be utilized in the medial filling. The material is carted by tippers to the stockyard and preserved for reuse.

Dismantled Concrete/Bricks Waste:

The materials are collected from different locations of the dismantling of bridges and other structures during road construction.

They are generally heavy and bulky and require a huge effort to handle such type of waste.

The material is generally stacked at or near the site and later disposed of in suitable locations.

The suitable and reusable materials are stacked separately for reuse.

Oil/ Battery/ Tyre Waste:

The oil waste is collected in the oil interceptor constructed at each workshop location. Further, the oil is collected in the drums. Similarly, the batteries/ Tyres that are out of service and become un-usable are stored in a safe place

Those wastes when collected in sufficient amounts are generally sold in the market for re-use. Hazards to the surroundings due to such waste are prevented and income to the pocket is added by just good practices

The proper record of such waste must be maintained at the site.

Waste from hot Mix Plant (Aggregate Dust):

The aggregate waste is collected near the plant and a considerable amount of waste shall be re-used as filled in the bituminous works. Dust at the plant site is to be reduced to a considerable extent.

Settling Tank Waste (Concrete Batching Plant):

The waste generated at the batching plant is allowed to settle in the settling tank. Further, this will be collected and reused for the haul road to the plant site.

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This helps in the reduction of dust during the movement of heavy vehicles. Further, the haul road shall be regularly watered and kept moist.

Organic Waste from Kitchen/Workers' Mess:

The waste generated in the kitchen at the campsite is to be collected in a properly covered container (20 kg /day)

The waste is further carried away and disposed to the municipal committee waste disposal areas and after that shall be sent for composting.

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ANNEXURE-D

Hazardous Waste Management Plan

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Hazardous Waste Management Plan

Management of hazardous waste is one of the most important issues during the construction phase of the project. The construction waste will include wastewater, oil spillage from machinery, and solid waste (damaged or spoiled materials, temporary and expendable construction materials, etc.). Insecure and unhygienic disposal of wastes may cause the degradation of soil, land, and water resources. However, a criterion has been developed for hazardous waste management at the site. A special strategy for safe handling, storage, and use of hazardous substances/materials should be developed and ensured at the site.

Chemical Waste

The maintenance and servicing of construction plant, equipment and vehicles involve the use of a variety of chemicals and generate chemical wastes. The possible chemical waste that would be generated during the course of construction works includes:-

- Oil and grease associated with plant maintenance;
- Hydraulic fluid from plant machinery;
- Scrap batteries from vehicle maintenance; and
- Used paint, cleaners, solvents used in maintaining mechanical equipment.

It is difficult to quantify the amount of chemical waste that would arise from the construction activities since it would depend on the Contractor's on-site maintenance requirements and the amount of plant utilized. However, it is anticipated that the quantity of chemical waste, such as lubrication oil and solvent produced from plant maintenance, would be small. Nonetheless, the amount of chemical waste to be generated including the frequency of trips for disposal would be specified in the Wastes Management Plan (WMP) to be prepared by the Contractors.

Management of Waste

As stipulated in the Waste Disposal (Chemical Waste) (General) Regulations, chemical wastes arisen during the construction phase may pose environmental, health and safety hazards if not stored and disposed of appropriately. These hazards may include:-

- Toxic effects to workers;

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- Adverse impacts on water quality from spills; and
- Fire hazard.

With the implementation of good waste management practices at the site, adverse environmental impacts would not be expected to arise from the storage, handling and transportation of workforce wastes.

Construction waste poses a great danger to the environment. For this reason, construction industries need to find suitable methods to manage construction materials that generate waste during construction activities. Using trash chutes to get waste out of the site is one good way of safe waste disposal. The handling, storage and disposal of chemical waste will follow the Code of Practice on Packaging, Labelling and Storage of Chemical Wastes published by EPD

- For spills of hazardous materials, follow cleanup instructions on the package or, if applicable, the Safety Data Sheet.
- Consult with local waste management authorities about the requirements for disposing of hazardous materials.
- Never remove the original product label from the container—it contains important safety information.
- Follow the manufacturer's recommended method of disposal, which should appear on the label.
- Never mix excess products when disposing of them, unless the manufacturer specifically recommends doing so.
- For soils containing hazardous substances, consult with state or local solid waste regulatory agencies or private firms to ensure proper disposal. Some landfills might accept contaminated soils, but they require laboratory tests first.

Maintenance Considerations

An effective waste management system requires training and signage to promote awareness of the hazards of improper storage, handling and disposal of wastes. Site superintendents should be aware of worker habits and inspect storage areas regularly. They may need to spend extra management time to ensure that all workers are following the proper procedures.

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Construction staff should inspect storage and use areas and identify containers or equipment that could malfunction and cause leaks or spills. In addition, it is important for staff to check equipment and containers for leaks, corrosion, support or foundation failure, or other signs of deterioration, and test them for soundness. Construction staff should immediately repair or replace any defective containers.

Effectiveness

Waste management practices are effective only when all construction staff follow them consistently. In storage and use areas, site superintendents should post the guidelines for proper handling, storage and disposal of construction site wastes. In addition, site superintendents should ensure that workers receive training in these practices to ensure that everyone is knowledgeable enough to participate.

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ANNEXURE-E

Borrow Area Management Plan / Restoration And Rehabilitation Plan

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Borrow Pit Management Plan

The borrow pit management plan will include restoration measures for the site after decommissioning, such as removal and stockpiling of topsoil layers. If monitoring determines that natural regeneration is insufficient on restored sites, the contractor should use direct seeding of native leguminous species. Where borrow pits are to be left open, for their use in regular maintenance programs, the responsibility for their management should be assigned to the government entity / local authority in charge of road maintenance and compliance with the borrow pit management plan monitored.

After a site has been disturbed due to road construction activities, it is the responsibility of NHA to restore the site. It is accepted that restoration may take many years to achieve. However NHA has a responsibility to ensure that the environmental value of our road corridors is maintained for future generations to appreciate. This guideline discusses factors influencing successful site rehabilitation and restoration of disturbed areas.

Site Rehabilitation

Site rehabilitation should ensure that all disturbed areas caused by construction and maintenance activities are restored, leaving a stable environment that is conducive to the establishment of landscapes characteristic to the area.

Rehabilitation Hierarchy

In developing the rehabilitation objectives, indicators and completion criteria for the borrow pits and access roads, the following hierarchy has been used to prevent or minimize environmental harm:

- Avoid disturbance that will require rehabilitation
- Reinstate land to pre-disturbance condition as closely as reasonable and feasible, to facilitate pre-disturbance land use, or otherwise as agreed with the landholder
- Propose lower value land use as required and as agreed with the landholder.

Rehabilitation Objectives

The objectives of this rehabilitation strategy are to:

- Ensure a final landform is produced that is safe, stable and non-polluting, as well as free draining and compatible with the post construction phase land use
- Ensure topsoil and subsoil are managed to conserve the seedbank, nutrients, and to encourage the establishment of proposed revegetation

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- Ensure that disturbed areas are to be rehabilitated as close as reasonably practicable to their pre-disturbance condition or otherwise as agreed with the landholder
- ensure that rehabilitation works comply with and are undertaken as per relevant regulatory requirements
- Establish a set of indicators and a rehabilitation monitoring program to ensure successful rehabilitation
- Establish agreed criteria where rehabilitation is deemed successful by relevant authorities and key stakeholders

Restoration

The aim of restoration is to get a seed mix that will provide an initial protective canopy cover using short lived annual grasses backed up by grass species that are likely to be durable and persistent. It is an important component since vegetation acts to reduce dust and wind erosion, suppress weed infestations and provide protection to exposed surfaces from raindrop impacts and erosion processes.

Monitoring

To achieve continuous improvement and ensure the activities specified in contracts are being adhered to, regular monitoring should be undertaken with emphasis placed on the continuity between site characteristics and the adjacent landscapes.

Rehabilitation of Affected Areas

Rehabilitation should be done in accordance with the sites Environmental Management Plan (Construction and Maintenance). There are many areas affected by road construction and maintenance activities that require rehabilitation, the major areas being borrow pits, stockpile sites, campsites and sidetracks.

- **Borrow Pits**

Borrow pits are areas either in a road reserve or adjacent land holdings that have been used to extract road building materials such as gravels and soils. They can vary considerably in size, depending on the quantity of material taken and the borrow pits' reserve body of remaining material. The variable size, shape and nature of borrow pits preclude very specific recommendations, however the following general conditions apply. Before extraction commences, licenses and permits should be checked and limits of disturbance and/or clearing must be clearly marked out on the site before any ground disturbing activity takes place. All run-on surface water must be intercepted and diverted around the area to be excavated. As a concurrent operation all available topsoil must be

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removed and stockpiled as low, flat windrows around the top and sides of the area to be developed. These windrows may augment the run-on surface water management system. At the completion of extraction, the former borrow pit must be made stable and safe. This usually requires the sides of the pit to be reshaped with gentle safe grades (e.g. 1:6 grade). All disturbed areas associated with borrow pits must be re top soiled, seeded, fertilized and mulched (if appropriate) as part of the restoration plan. Main Roads has been discouraging the conversion of borrow pits to stock watering points.

- **Stockpile Areas and Construction Camp Sites**

Stockpile areas and construction campsites should be developed in a similar fashion to borrow pits. Limits of disturbance and/or clearing must be clearly marked out on the site using posts or flagging tape before any ground disturbing activity takes place. All run-on surface water must be intercepted and diverted around the proposed site. Windrows or rills of topsoil graded off the site can be formed up to make an effective temporary diversion bank. If required, a rill can be formed below the site using subsoil material, in conjunction with a sump or stacked rock containment structure, to restrict sediment and/or contaminant movement off-site. Vehicle wash-down areas should be constructed and bonded as a separate area to ensure and contaminants are contained and removed at the close of the site. Decommissioning of the site requires all stockpiled material to be removed. Since the area would generally be compacted, the area must then be contour ripped to a minimum depth of 250mm and retopsoiled. All disturbed areas associated with these sites must be seeded, fertilized and mulched (if appropriate) in conjunction with the restoration plan. Livestock should be excluded until the area has become stable. District Environmental Officer may be able to offer advice on seeding and fertilizer application. Remember that standard agricultural and turf type fertilizers are likely to encourage much higher concentrations of trace elements and minerals than were present prior to disturbance. Soil tests on material being stockpiled will assist with these decisions. Follow up maintenance and weed control may also be necessary.

- **Sidetracks**

Sidetracks can create a much greater impact than the actual construction site itself. Justification for sidetracks should be assessed during the planning phase of the project as part of the environmental impact and discussed with designers to minimize potential disturbance. If sidetracks are justified, limits of disturbance must be clearly marked out on the site before any ground disturbing activity takes place. Once again, all run-on surface water must be intercepted and diverted around or through the proposed site.

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Windrows, rills of graded topsoil and stacked rock containment structures can be formed up to make effective temporary diversion banks to restrict sediment and/or contaminant movement off-site. Rehabilitation of sidetracks requires removal of all temporary cross drainage structures from watercourses, together with the removal and disposal of fill materials used for temporary approaches, abutments, crossings or embankments. All remaining areas must be reshaped to blend back in with preexisting landforms. These areas must be free draining, with drainage paths created so that water can move over and/or through the area without scouring. All disturbed or denuded areas must be contour ripped to a minimum depth of 250mm, retopsoiled, seeded, fertilized and mulched (if appropriate) in conjunction with the restoration plan.

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AMBIENT PARTICULATE MATTER MONITORING REPORT

CONSTRUCTION OF INTERCHANGE ON LAHORE – KARACHI MOTORWAY (M-3) AT BUCHEKI – NANKANA ROAD

MONITORING DATE: 09-02-2023
SOURCE: AMBIENT AIR
REPORTING DATE: 16-02-2023
MONITORING INSTRUMENT: AQMS 66 SERIAL # 1310

SR. NO.	PARAMETERS	TIME DURATION	RESULTS UNITS		RESULT (AVERAGE 24 HRS)	
			PM 10 (µg/m³)	PM 2.5 µg/m³	PM 10 µg/m³	PM 2.5 µg/m³
1	PARTICULATE MATTER	09.00 AM	96.46	24.39	87.14 (µG/M³)	27.21 (µG/M³)
2		10.00 AM	98.83	24.95		
3		11.00 AM	95.67	24.95		
4		12.00 PM	99.24	29.95		
5		01.00 PM	100.86	29.05		
6		02.00 PM	101.46	25.08		
7		03.00 PM	101.12	30.25		
8		04.00 PM	103.61	26.45		
9		05.00 PM	100.25	29.15		
10		06.00 PM	96.82	28.75		
11		07.00 PM	100.04	28.35		
12		08.00 PM	101.25	24.95		
13		09.00 PM	98.36	29.35		
14		10.00 PM	90.37	25.45		
15		11.00 PM	67.25	27.55		
16		12.00 AM	86.25	29.35		
17		01.00 AM	58.71	30.15		
18		02.00 AM	46.25	24.95		
19		03.00 AM	39.84	25.95		
20		04.00 AM	59.72	25.45		
21		05.00 AM	80.03	25.05		
22		06.00 AM	81.61	26.55		
23		07.00 AM	99.39	27.75		
24		08.00 AM	88.79	29.95		
PEQS					150 µg/m³	35 µg/m³

PEQSAA: Punjab Environmental Quality Standards for Ambient Air
µg/m³= Micrograms per Cubic Meter

Note:

- Selected measurement units were µg/m³ otherwise stated
- Quality was assured through self calibration of the instrument
- The values were representing of monitoring conditions prevailing during the monitoring hours
- The measurements were carried out on client request
- The client is responsible lawful usage of reported data in future
- The report is not valid for court

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Incharge Environmental Monitoring

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AMBIENT PARTICULATE MATTER MONITORING REPORT

CONSTRUCTION OF INTERCHANGE ON LAHORE – KARACHI MOTORWAY (M-3) AT BUCHEKI – NANKANA ROAD

MONITORING DATE: 09-02-2023
SOURCE: AMBIENT AIR
REPORTING DATE: 18-02-2023
MONITORING INSTRUMENT: AQMS 65 SERIAL # 1310

SR. NO.	PARAMETERS	TIME DURATION	RESULTS UNITS		RESULT (AVERAGE 24 HRS)	
			PM (10) (µg/m³)	PM (2.5) (µg/m³)	PM (10) (µg/m³)	PM (2.5) (µg/m³)
1	PARTICULATE MATTER	09:00 AM	96.28	24.2	86.96 (µg/m³)	27.03 (µg/m³)
2		10:00 AM	98.45	24.7		
3		11:00 AM	95.49	24.1		
4		12:00 PM	99.06	29.7		
5		01:00 PM	100.68	28.8		
6		02:00 PM	101.3	24.9		
7		03:00 PM	100.94	30.0		
8		04:00 PM	102.83	25.2		
9		05:00 PM	100.07	29.9		
10		06:00 PM	96.74	28.5		
11		07:00 PM	99.86	28.1		
12		08:00 PM	101.07	24.7		
13		09:00 PM	98.18	29.1		
14		10:00 PM	90.19	25.2		
15		11:00 PM	67.08	27.3		
16		12:00 AM	86.07	29.1		
17		01:00 AM	58.53	29.9		
18		02:00 AM	46.07	24.0		
19		03:00 AM	39.66	25.4		
20		04:00 AM	59.54	25.2		
21		05:00 AM	79.85	24.8		
22		06:00 AM	81.43	25.3		
23		07:00 AM	99.21	27.5		
24		08:00 AM	86.61	29.7		
PEQS					150 (µg/m³)	35 (µg/m³)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air
µg/m³= Micrograms per Cubic Meter

Note:

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- The report is not valid for court.

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AMBIENT GASEOUS MONITORING REPORT

CONSTRUCTION OF INTERCHANGE ON LAHORE – KARACHI MOTORWAY (M-3) AT BUCHEKI – NANKANA ROAD

MONITORING DATE: 06-02-2023
SOURCE: AMBIENT AIR GASES
REPORTING DATE: 16-02-2023
MONITORING INSTRUMENT: AQMS 65 SERIAL # 1310

SR NO	TIME	PARAMETERS			
		CO	NO	NO_2	SO_2
	HOURS	UNITS			
		(mg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
1	09:00 AM	0.84	12.14	12.01	14.64
2	10:00 AM	0.89	12.16	12.66	15.01
3	11:00 AM	0.98	12.01	11.77	15.27
4	12:00 PM	0.97	12.1	12.2	15.57
5	01:00 PM	1.05	12.08	12.01	14.81
6	02:00 PM	1.03	12.81	12.58	15.43
7	03:00 PM	1.05	11.92	12.13	15.87
8	04:00 PM	1.03	12.05	11.87	15.99
9	05:00 PM	1.04	11.57	11.34	14.67
10	06:00 PM	1.04	11.78	11.9	14.98
11	07:00 PM	1.06	11.9	11.6	14.93
12	08:00 PM	0.98	12	11.74	14.76
13	09:00 PM	0.95	12.66	11.87	15.8
14	10:00 PM	0.88	12	12.9	15.3
15	11:00 PM	0.86	12.8	12.8	15.8
16	12:00 AM	0.75	12.3	12.4	15.9
17	01:00 AM	0.45	12.1	12.5	15.34
18	02:00 AM	0.34	11.4	13.86	15.1
19	03:00 AM	0.44	10.9	12.45	15.6
20	04:00 AM	0.56	11.5	12.54	11.95
21	05:00 AM	0.78	11.5	12.3	14.9
22	06:00 AM	0.77	11.9	11.4	14.1
23	07:00 AM	0.74	11	11.9	14.9
24	08:00 AM	0.9	12.3	11.98	14.11
AVERAGE CONCENTRATION		0.85	11.9	12.21	15.031
PEQSAA		05 (24HR)	40 (24 HR)	80 (24 HR)	120 (24 HR)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligram per Cubic Meter

Note:

- Selected measurement units were µg/m³ & mg/m³ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
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- The report is not valid for court.

Signature
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AMBIENT GASEOUS MONITORING REPORT

CONSTRUCTION OF INTERCHANGE ON LAHORE – KARACHI MOTORWAY (M-3) AT BUCHEKI – NANKANA ROAD

MONITORING DATE: 09-02-2023
REPORTING DATE: 18-02-2023
SOURCE: AMBIENT AIR GASES
MONITORING INSTRUMENT: AQMS 85 SERIAL # 1310

SR. NO	TIME	PARAMETERS			
		CO	NO	NO_2	SO_2
	HOURS	UNITS			
		(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	09:30 AM	0.69	10.07	9.94	12.23
2	10:30 AM	0.61	10.09	10.59	12.8
3	11:30 AM	0.7	9.94	9.7	12.86
4	12:30 PM	0.69	10.03	10.13	13.16
5	01:30 PM	0.77	10.01	9.94	12.4
6	02:30 PM	0.75	10.74	10.81	13.02
7	03:30 PM	0.77	9.85	10.06	13.48
8	04:30 PM	0.75	9.98	9.6	13.58
9	05:30 PM	0.76	9.5	9.27	12.25
10	06:30 PM	0.76	9.71	9.83	12.57
11	07:30 PM	0.78	9.83	9.63	12.52
12	08:30 PM	0.7	9.93	9.67	12.35
13	09:30 PM	0.67	10.91	9.8	13.39
14	10:30 PM	0.6	9.93	10.83	12.89
15	11:30 PM	0.58	10.73	10.73	13.39
16	12:30 AM	0.47	10.23	10.33	13.49
17	01:30 AM	0.17	10.03	10.43	12.93
18	02:30 AM	0.06	9.33	11.79	12.69
19	03:30 AM	0.16	8.83	10.38	13.19
20	04:30 AM	0.28	9.43	10.87	9.57
21	05:30 AM	0.5	9.43	10.23	12.49
22	06:30 AM	0.49	9.83	9.33	11.69
23	07:30 AM	0.46	8.93	9.83	12.49
24	08:30 AM	0.62	10.23	9.91	11.7
AVERAGE CONCENTRATION		0.57	9.89	10.14	12.62
PEQSAA		05 (24HR)	40 (24 HR)	80 (24 HR)	120 (24 HR)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air
$\mu g/m^3$= Micrograms per Cubic Meter
mg/m^3= Miligram per Cubic Meter

Note:

- Selected measurement units were $\mu g/m^3$ & mg/m^3 otherwise stated
- Quality was assured through self calibration of the instrument.
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NOISE LEVEL MONITORING REPORT

CONSTRUCTION OF INTERCHANGE ON LAHORE – KARACHI MOTORWAY (M–3) AT BUCHEKI – NANKANA ROAD

MONITORING DATE: 08-02-2023
REPORTING DATE: 18-02-2023
SOURCE: AMBIENT CONDITIONS
MONITORING INSTRUMENT: NOISE METER-IEC651-TYPE-2

SR. NO	TIME HOURS	UNIT	MINIMUM	MAXIMUM	LEQ
1	09.00 AM	dB(A)	80	85	82.75
2	10.00 AM		75	84	79.75
3	11.00 AM		76	84	80.25
4	12.00 PM		79	86	82.75
5	01.00 PM		77	82	79.75
6	02.00 PM		71	84	77.75
7	03.00 PM		70	84	77.25
8	04.00 PM		71	80	75.75
9	05:00 PM		77	85	81.25
10	06.00 PM		75	81	78.25
11	07.00 PM		69	74	71.75
12	08.00 PM		77	80	78.75
13	09.00 PM		74	82	78.25
14	10:00 PM		78	90	84.25
15	11:00 PM		79	83	81.25
16	12:00 AM		76	85	80.75
17	01:00 AM		70	84	77.25
18	02.00 AM		75	79	77.25
19	03.00 AM		74	80	77.25
20	04:00 AM		78	83	79.75
21	05:00 AM		68	76	72.25
22	06:00 AM		73	79	76.25
23	07:00 AM		72	80	76.25
24	08.00 AM		78	84	81.25

PEQS: Punjab Environmental Quality Standards for Noise

	Day Time	Night Time
a) Residential Area	55	45
b) Commercial Area	65	55
c) Industrial Area	75	65
d) Silence Zone	50	45

Note:

- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature
Incharge Environmental Monitoring

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
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Environmental Protection Agency (EPA-KPK) Certified

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Integrated Environment Laboratory

NOISE LEVEL MONITORING REPORT

CONSTRUCTION OF INTERCHANGE ON LAHORE – KARACHI MOTORWAY (M–3) AT BUCHEKI – NANKANA ROAD

MONITORING DATE: 09-02-2023
REPORTING DATE: 18-02-2023
SOURCE: AMBIENT CONDITIONS
MONITORING INSTRUMENT: NOISE METER-IEC651-TYPE-2

SR. NO	TIME HOURS	UNIT	MINIMUM	MAXIMUM	LEQ
1	09:30 AM	DB(A)	79	84	81.5
2	10:30 AM		74	83	78.5
3	11:30 AM		75	83	79
4	12:30 PM		78	85	81.5
5	01:30 PM		76	81	78.5
6	02:30 PM		70	83	76.5
7	03:30 PM		69	83	76
8	04:30 PM		70	79	74.5
9	05:30 PM		76	84	80
10	06:30 PM		74	80	77
11	07:30 PM		68	73	70.5
12	08:30 PM		76	79	77.5
13	09:30 PM		73	81	77
14	10:30 PM		77	89	83
15	11:30 PM		78	82	80
16	12:30 AM		75	84	79.5
17	01:30 AM		69	83	76
18	02:30 AM		74	78	76
19	03:30 AM		73	79	76
20	04:30 AM		75	82	78.5
21	05:30 AM		67	75	71
22	06:30 AM		72	78	75
23	07:30 AM		71	79	75
24	08:30 AM		77	83	80

PEQS: Punjab Environmental Quality Standards for Noise

		Day Time	Night Time
e)	Residential Area	55	45
f)	Commercial Area	65	55
g)	Industrial Area	75	65
h)	Silence Zone	50	45

Note:

- Selected measurement units were dB (A) otherwise stated
- Quality was assured through self calibration of the instrument
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future
- The report is not valid for court

Signature
Incharge Environmental Monitoring

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ATTENDANCE SHEET FOR PUBLIC CONSULTATION REGARDING PROJECT SITTING IN THE CONTEXT OF ENVIRONMENTAL ASSESSMENT

Construction of Interchange on Lahore – Karachi Motorway (M-3) at Bucheki – Nankana Road in the Name of Rai Mansab Ali Khan Kharal

SR #	NAME	DISTRICT/TOWN	SIGNATURE
1.	Ali Ahmad Raza	Bucheki	
2.	Ghulam Rasool	Bucheki	
3.	Asif Mahi	Bucheki	
4.	Ahmad Shahzad	Bucheki	
5.	Waseem	Bucheki	
6.	Atif Mumtaz	Bucheki	
7.	Abrar Ahmad	Bucheki	
8.	Ghulam Nabi	Bucheki	
9.	Zahid Hussain	Bucheki	
10.	Adeel Rehman	Bucheki	
11.	Abdullah	Bucheki	
12.	Shaikh Irfan	Bucheki	
13.	Zulfiqar Ali	Bucheki	

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14.	Shafeeq Ahmad	Bucheki	
15.	Hussain Akhter	Bucheki	
16.	Murad Khan	Bucheki	
17.	Arif Malik	Bucheki	
18.	Ali Raza	Bucheki	
19.	Hamza Iqbal	Bucheki	
20.	Ali Khawar	Bucheki	
21.	Jawad Bashir	Bucheki	
22.	Abdul Rehman	Bucheki	
23.	Mian Rao	Bucheki	
24.	Arif Ahmad	Bucheki	
25.	Abdul Haq	Bucheki	
26.	Iqbal Ahmad	Bucheki	
27.	Naseer Malik	Nankana Sahib	
28.	Mohammad Iqbal	Nankana Sahib	
29.	Kashif Gujjar	Nankana Sahib	
30.	M. Shahbaz	Nankana Sahib	

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31.	Rohan Malik	Nankana Sahib	
32.	Idrees Ahmad	Nankana Sahib	
33.	Shaukat Malik	Nankana Sahib	
34.	Adnan Rana	Nankana Sahib	
35.	M. Bilal Butt	Nankana Sahib	
36.	Asmat Mahmood	Nankana Sahib	
37.	Ali Hamza	Nankana Sahib	
38.	Aizaz Mahmood	Nankana Sahib	
39.	Waqas Mumtaz	Nankana Sahib	
40.	Shaheer Ahmad	Nankana Sahib	
41.	Waleed Akbar	Nankana Sahib	
42.	M. Asif Rao	Nankana Sahib	
43.	Shahbaz Chohan	Nankana Sahib	
44.	Atif Akbar	Nankana Sahib	
45.	Shah Ahmad	Nankana Sahib	
46.	Murtaza	Nankana Sahib	
47.	Waheed Akbar	Nankana Sahib	

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48.			
49.	Hameed Ahmad	Thatta Essa	
50.	Waseem Arif	Thatta Essa	
51.	Adnan Waqar	Thatta Essa	
52.	Mujtaba Rasool	Thatta Essa	
53.	Asif Ali	Thatta Essa	
54.	Nadeem Akhter	Thatta Essa	
55.	Naveed Ahmad	Thatta Essa	
56.	Aslam	Thatta Essa	
57.	Ahmad Shahzad	Thatta Essa	
58.	Subhan Malik	Thatta Essa	
59.	Shahmeer Hussain	Thatta Essa	
60.	Akhtar Nadeem	Thatta Essa	
61.	Zakir Hussain	Thatta Essa	
62.	Waqar Hameed	Thatta Essa	
63.	Zohaib Rafeeq	Thatta Essa	
64.			

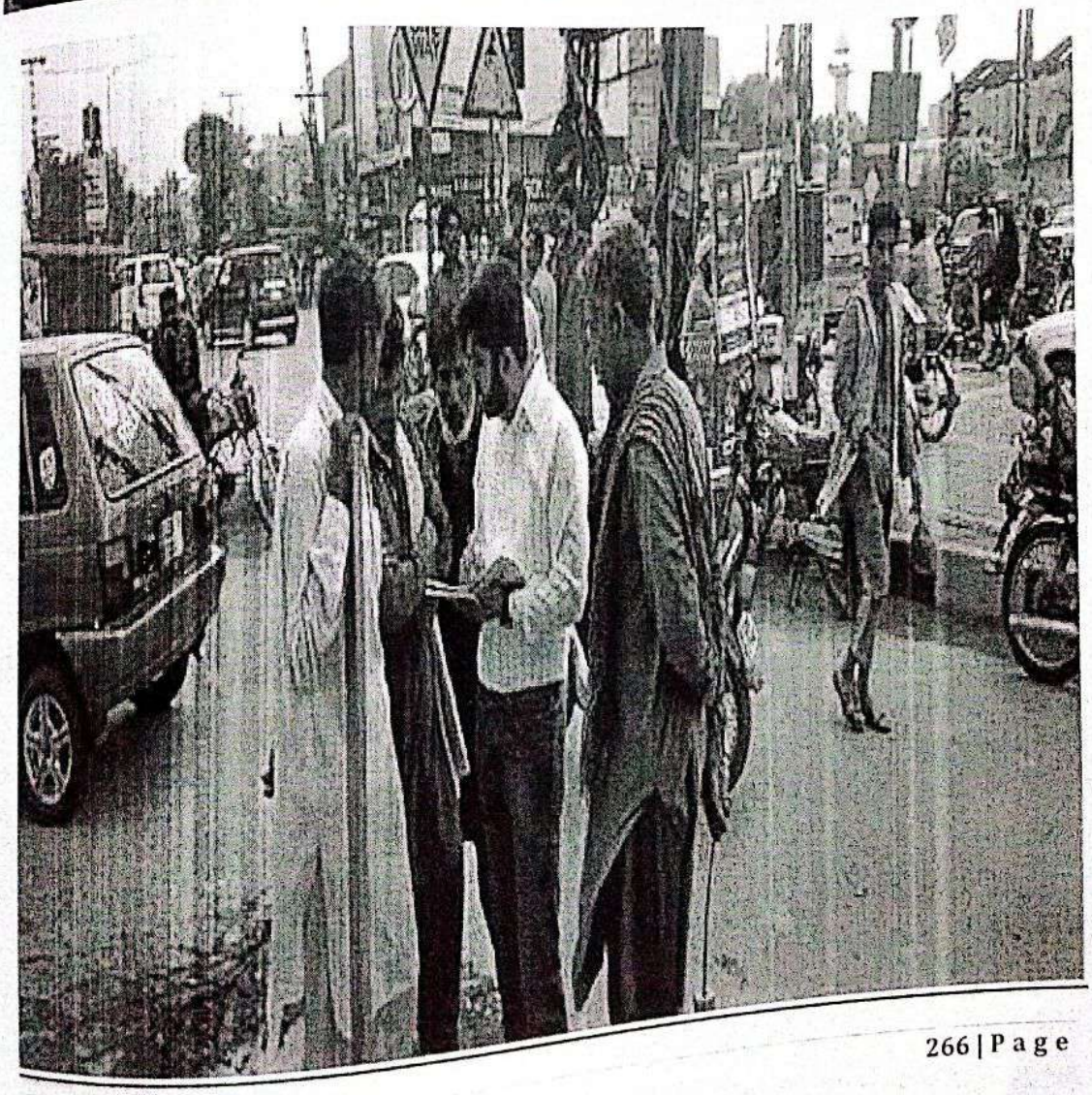
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