Environmental Impact Assessment

Project Number: 48402
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PAK: National Motorway M-4 Gojra–Shorkot Section Project

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ENVIRONMENTAL IMPACT ASSESSMENT

OF FAISALABAD-KHANEWAL MOTORWAY (M-4)

National Trade Corridor Highway Investment Program

(NTCHIP)
National Motorway M-4 Gojra-Shorkot Section Project

Submitted to
ASIAN DEVELOPMENT BANK

by
NATIONAL HIGHWAY AUTHORITY (NHA)

Originally Submitted in March 2007

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&
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List of Abbreviations

Abbreviation	Description
˚C	Degree Centigrade
AD	Assistant Director
ADB	Asian Development Bank
AADT	Average Annual Daily Traffic
APs	Affected Persons
BDL	Below Detectable Level
CC	Construction Contractor
CBO	Community Based Organization
CO	Carbon Mono Oxide
COI	Corridor of Impact
dB(A)	Decibel
DCR	District Census Report
DC	Design Consultant
DD	Deputy Director
DDO	Deputy District Officer
DFO	Divisional Forest Officer
EDO	Executive District Officer
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
Ft.	Feet
GM	General Manager
GoP	Government of Pakistan
IEE	Initial Environmental Evaluation
IP's	Indigenous People
IUCN	International Union for Conservation of Nature
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
Km	Kilometers
LAA	Land Acquisition Act, 1894

Abbreviation	Description
LAR	Land Acquisition and Resettlement
M-4	Motorway (Faisalabad-Khanewal)
Mm	Millimetre
MC	Monitoring Consultant
M&E	Monitoring and Evaluation
NEQS	National Environmental Quality Standards
NESPAK	National Engineering Services Pakistan, (Pvt) Ltd.
NGO	Non Governmental Organization
NHA	National Highway Authority
NH&MP	National Highway and Motorway Police
NOx	Nitrogen Oxides
NWFP	North West Frontier Province
OM	Operation Manual
O&M	Operation and Maintenance
PAPs	Project Affected Persons
PEPA	Pakistan Environmental Protection Act
PHV	Peak Hourly Volume
PM_{10}	Particulate Matter (10 Micron)
PTCL	Pakistan Telecommunication Company Limited
RoW	Right of Way
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
Rft.	Running Feet
Sft.	Square Feet
SPM	Suspended Particulate Matter
SC	Supervision Consultant
SNGPL	Sui Northern Gas Pipe Line
SOx	Sulphur Oxides
TA	Technical Assistance
USEPA	United States Environmental Protection Agency
WHO	World Health Organization

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EXECUTIVE SUMMARY

- **Background of the Project**

1. The Government of Pakistan (GOP) gives major emphasis to improving the existing roads and building new motorways and expressways to improve and expand the country's road network. The National Highway Authority (NHA) under the Federal Ministry of Communications is responsible for the 12,500 kms long National Highway Network and Motorway systems, which carries 75% to 80% of the total commercial traffic. The road network in Pakistan is expanding rapidly and the pace of this development is gradually accelerating which is continuing till now. In spite of overall resource constraints in the country, Government of Pakistan (GOP) has been making substantial investments to develop National Trade Corridor by linking major urban centers.

2. National Highway Authority (NHA) intends to construct Faisalabad-Khanewal Motorway (M-4) as part of National Trade Corridor (NTC) Projects. The proposed Motorway Project with other NTC Projects will provide a reliable, safe and throughway for transportation of goods between central Asian parts and China to Karachi and Gawadar ports. This Project will uplift in the trade activities and in turn increase the economic growth rate of the country. This Motorway will also provide easy access to residents of Faisalabad, Toba Tek Singh, Khanewal and Multan districts and will make easy transportation towards Islamabad, Rawalpindi and Lahore, and will provide a safe, congestion free and high speed facility to commuters of the project area as well.

3. After initial screening criteria based on the ADB's Safeguard Policy Statement, 2009 and Environmental Assessment Guidelines, the Project is categorized as "Category A" for which EIA is required as Project may affect an area larger than the sites or facilities subject to the physical works involved; likely to permanently convert large productive area into non productive and large number of people to be displaced.

4. The Most of the land of the right of way (RoW) of the Project is agricultural; however a small quantity of residential and commercial land will also be acquired. The major towns and cities near RoW are Faisalabad, Gojra, Painsara, Shorkot, Toba Tek Singh and Khanewal.

- **Objectives and Schedule**

5. The prime objective of the proposed Project is to improve trade flows and lower transit costs and time by providing a high speed, safe and reliable access controlled Motorway system.

6. The construction of M4 (section I) tranche 1 of the MFF completed in December 2014. The expected date for the start of civil works for section-II is in December 2015 and is expected to be completed in December 2018.

- **Project Components**

7. The proposed Motorway Project comprises the construction of four lane dual carriageway from Faisalabad to Khanewal and construction of ten Interchanges

at different road crossings. Two Bridges will be constructed one at Sadhnai Spill channel and other on Ravi River. Nine meter wide section of land will be raised with plantation in between two carriageways; this will be utilized in future to construct one lane of 3.65 meters on both carriageways. The carriageway will include paved shoulders at inner and outer sides. The proposed Motorway will be divided in the three construction Packages

- Package-I: Faisalabad-Gojra Section (58 Km);
- Package-II: Gojra - Shorkot Section (62 Km); and
- Package-III: Shorkot -Khanewal Section (64 Km);

- **Relevant Legislation and Guidelines**

8. To carry out the present EIA Study, the environmental legislation and Guidelines enforced by the Pakistan Environmental Protection Agency and Asian Development Bank's (ADB) Safeguard Policy Statement (SPS) 2009 have been followed.

- **Components of the EIA Report**

9. The Report contains the identified environmental impacts and their mitigation measures. Besides, the Report also includes the preparation of Environmental Management and Monitoring Plan to cover the mitigation measures, monitoring requirements and institutional responsibilities (during design, construction and operation phases of the proposed Project).

- **Description of the Project**

10. The proposed second portion of M-4 is the construction of 62 km long road, which will start at end point of M-4 section-I (Faisalabad-Gojra) and ends at shorkot. It will be four lane dual carriageway with each lane 3.65m wide. The proposed second section of M-4 consists of three interchanges at different road crossings. The underpasses will be constructed at suitable locations. The RoW of the proposed project is100m wide; where as it will be 40 m extra at the locations where interchange is constructed. Construction of first section of M-4 i.e. from Faisalabad-Gojra was completed in December 2014 and the construction of the second portion i.e. Gojra-Shorkot which is 62 km will be started soon after fulfilling all codal formalities, Asian Development Bank is providing financial assistance for the construction of this project. On the second section of M-4 for taking care of Environmental and Social aspects ADB's Safeguard Policy Statement (2009) will be followed. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in SPS. A Grievance Redress Mechanism to receive application and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance will also establish.

- **Description of the Environment**

11. Baseline conditions were studied for the physical, ecological resources and for socioeconomic environment. This alignment of this Motorway passes through Faisalabad, Toba Tek Singh, Jhang and Khanewal Districts. The terrain is quite flat and levelled. All the four districts have mostly agricultural fields with flat and levelled terrain throughout the alignment strip. The climate of the Project Area touches two extremes, characterised by hot summers and mild winters. From April onwards, the summer season continuous usually up to the middle of

October after which it becomes cool and the day temperature also begins to recede. May, June and July are the hottest months. The winter season on the other hand starts from November and continues till March. December, January and February are the coldest months.

12. In Kharif, crops such as sugarcane, fodder, maize and rice are cultivated in Faisalabad and Toba Tek Singh districts. In Jhang district beside agricultural land barren land is also present. Sugarcane, Maize, and rice are the main Kharif crops of this district. Flooded areas were also seen nearby the alignment but none of these areas falls into the Project RoW. In Khanewal district kharif season crops are Cotton, Rice and Sugarcane. Wheat is predominantly Rabi season crop of all areas.

13. Faisalabad is for its textile industries but no textile unit is presently situated along the route. In districts of Toba Tek Singh and Jhang, very little commercial units i.e. only a few sugar mills and spinning units but none of them is along the RoW of the proposed Project. In Khanewal district Roshe Power Plant, a hatchery and pesticide factory are situated at a distance of 5 km from the Project RoW.

14. In order to get true picture of the environmental condition of the Project Area, consultants carried out water, air and noise monitoring by taking services of SGS Pakistan (Pvt) Limited in 2007 and Solution Environmental & Analytical Laboratory done analysis of ambient air, water, and noise in July 2014.

15. Socio-economic environment of the Project Area was studied in detail for developing the baseline information about the affected people of the Project. Section 3 of this report describes the findings of this exercise in detail.

- **Project Alternatives**

16. Options were considered for this Project that included “No project” and Alternate transport modes. These have been discussed in Section 4 of this Report. Finally this option was selected because it fulfils the future Project requirements in the best way.

- **Environmental Impacts and Mitigation Measures**

17. Various probable impacts on the existing resources due to the proposed Project and vice versa were studied under the parameters of resettlement/ land acquisition, change of land use, dismantling of structures, relocation of existing utilities, soil erosion, water bodies, air pollution, noise, flora and fauna etc.

18. The most significant impact of the project is resettlement of residents and taking about 4715 acres of agricultural land out of production. The loss in production can be met with by increasing the yield from fields in the agricultural sector. Orchards lost to the project will also have to be raised by the private owners of land. However, the owners of land whose land is to be acquired and the neighbouring farmers can be helped to gain access to modern technology to increase production from their land. Similarly the deficiency in livestock feed/fodder will have to be met from the adjoining areas.

19. Construction activities will result in relocation/rearrangement of various utilities within the RoW, including culverts, PTCL cable, electrical poles, transmission, telephone lines and wells.

20. Mitigation measures to eliminate/minimize those negative impacts have been proposed to bring them to an acceptable level through implementation of the Environmental Management and Monitoring Plans. Proper compensation will be given to the Project affectees in a judicious manner. Mitigation measures have been suggested for the pre-construction, construction and operational stages of the Project, taking into consideration the environmental impacts of the proposed Project.

- **Economic Assessment**

21. The Economic Assessment describes economic benefits of the proposed Project. Economic Internal Rate of Return (EIRR) is also provided. EIRR comes out as 13.2%, which is above 12% the assumed opportunity cost of capital in Pakistan.

- **Environmental Management Plan (EMP)**

22. The EMP provides an approach for managing and monitoring environment related issues and describes the institutional framework and resource allocation. An Environmental management and monitoring plan has accordingly been devised to monitor various activities during the construction and operational phases of the Project, considering all the sensitive issues during the execution. The EMP will be implemented by NHA with the assistance of consultants. NHA will depute Deputy Director Environment to deal with the environmental related issues. Total estimated environmental mitigation cost will be around Rs. 4,058 Million for the whole 184 Km. While for section-II of M-4 the The total environmental cost has been worked out in year 2014 will be Pak Rs. 26,951,900.

23. Site Specific Environmental Management Plan (SSEMP) would be prepared by Environmental Engineer (EE) of contractor in coordination with Environmental Engineer of Supervision Consultant (SC) and that would be approved by EALS and ADB. The SSEMP will focus on site specific features and will adopt a risk based approach to selecting specific mitigation measures.

24. The implementation of the proposed SSEMP involves inputs from various functionaries as EEs of contractor and SC. The contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. It is suggested that provision of the environmental mitigation cost will be made in the total cost of project, for which contractor will be paid on the basis of compliance reports. However, if the contractor fails to comply with the implementation of EMP and submission of the compliance reports, deductions will be made from the payments to the contractor claimed under the heads of environmental components.

- **Public Consultation and Information Disclosure**

25. Consultant's EIA team identified the stakeholders of the proposed Project and discussed the Project with them during the detailed field visits. Their views and concerns were noted and have been incorporated in section 8 of this Report. After reviewing their concerns, mitigation measures have been suggested for giving them the due compensation.

26. Stakeholders of section-II of M-4 were also contacted in June and October 2014 during the detail project visits, their views and concerns were noted and have been incorporated in section 9 of this report. After reviewing their concerns, mitigation measures have been suggested for giving them the due compensation.

- **Grievance Redress Mechanism**

27. In order to receive and facilitate the resolution of affected people's (AP) concerns, complaints and grievances about the Project's environmental performance, a Grievance Redress Mechanism (GRM) will be established at the Project. The GRM will address the APs' concerns and complaints proactively and promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the APs at no costs and without retribution.

- **Conclusion**

28. The proposed Motorway will enhance the trade activities of the country and provide smooth and safe travelling corridor. The proposed Motorway will involve some negative environmental impacts, which are mostly related to pre-construction and construction stages of the Project and are however manageable by properly implementing the EMP. No long-term and significant adverse environmental impacts are however envisaged for the operation stage of the Project. Hence, the Project is environmentally feasible provided that the mitigation measures are properly implemented during the Project execution.

SECTION 1

INTRODUCTION

1.0 General

29. National Highway Authority (NHA) plans to construct (M-4) Motorway from Faisalabad to Khanewal. To comply with Pakistan's environmental regulations as conceived in the Pakistan Environmental Protection Act (PEPA) 1997, NHA entrusted NESPAK with the assignment of carrying out an Environmental Impact Assessment Study of the complete Motorway (M-4) alignment proposed.

30. Later the EIA report for addressing the impacts on Section-II of M-4 was updated in June 2014 with aim to address all the details of Asian Development Bank's Safeguard Policy Statement 2009 and Punjab Environment Protection (Amendment) Act 2012. The NTCHIP Program is financed by ADB through a Multi-tranche Financing Facility (MFF-0016) which was approved in 2007. The MFF consists of several tranches; each covering several subprojects. However, Section-II of M-4 will now be implemented as a separate standalone loan.

31. The first section of the project from Faisalabad-Gojra was completed in December 2014 while the construction of the second section is expected to start in December 2015, the second section will starts from Gojra and ends at Shorkot, the total length of this section is 62 km, ROW of the section-II of M-4 will be 100m, it will be four lane carriageway with each lane 3.65m. As per design the total pavement width of the road will be 14.6m.

32. The National Highway Authority (NHA) will be the Executing Agency (EA) for the project. The Project will provide a dependable road transport network to promote interprovincial connectivity, reduce transportation time to economize the costs, provide all weather roads to the community, and improve the developmental pace in the area. Safeguard Policy Statement 2009 of ADB's will be implemented on section-II of M-4 for taking care of all Environmental and social issues.

33. The construction of the proposed Motorway (M-4) will facilitate and enhance the trade activities in the country and will provide time saving and safe and speedy access to various parts of the country. M-4 is the extension of M-3 and will start from the end point of the existing Faisalabad – Pindi Bhattian Motorway (M-4) near Sargodha Road, Faisalabad. Figures 1.1 and 1.2 indicate the National Highway Network and location plan of the Project Area.

34. The proposed Motorway (M-4) is a part of the National Trade Corridor. The road will provide easy access to the traders and farmers for transportation of goods to other parts of the country by reducing the time required for transportation.

1.1 Proponent of the Project

35. National Highway Authority (NHA) is the proponent of the proposed Project with the following address:

National Highway Authority
27 Mauve Area, G-9/1,

Islamabad
Ph: 051-9032506

1.2 Overview of the Project

36. The length of this Motorway Project is about 184 Km starting from the end point of Faisalabad-Pindi Bhattian Motorway (M-3) near Faisalabad and ending at National Highway Multan- Khanewal Road (N-5). This Project section consists of the following major components:

- Construction of a 4 lane dual carriageway;
- Construction of Interchanges at various road crossings; and
- Construction of bridges at the Ravi River and Sadhnai Canal.

1.3 Scope of Study

37. The scope of the EIA Study aimed at the identification of the possible impacts of the proposed Project on its immediate surroundings on both short and long term basis. Then based on the nature and levels of those impacts, proper mitigation measures were delineated and cost for inclusion into this EIA Report. . Upon approval of this report, the Project Proponent and the Contractor will be bound to follow the recommendations of the Report during the execution of engineering activities on site. In order to investigate the environmental, geological and social features of the Project Area, the Consultants carried out two detailed site visits for collecting primary and secondary data to identify and establish the Corridor of Impact (CoI) and various mitigations required to minimise the adverse impacts.

38. In addition to assessing the direct impacts of the operation, a cumulative environmental impact assessment (CEIA) was also conducted independently, this study is appended as Annexure V. Literature research and consultations were conducted with the community and institutional stakeholders within the corridor of impact of the project to identify Valued Environmental and Social Components (VECs) considered as significant in assessing risk associated with the cumulative impacts. The CEIA covered the proposed project for which an EIA was conducted earlier by NHA, as well as other reasonably foreseeable developments in and around the project area that could affect the VECs. The overall perception of stakeholders in the long term perspective was highly positive and they considered it as an important development for the local economy. Modeling studies were conducted to predict the cumulative long term impacts of operation of the project on noise and air quality in the corridor of impact extending to 500 m form the center of the carriageway on each side. While the project will meet the National Environmental Quality Standards (NEQS) for air quality, mitigation of noise will be required to meet the night-time NEQS for noise in the corridor of impact. Feasible mitigation measures may be required in future are evaluated and discussed in the report. An environmental management and a monitoring plan was included to provide guidelines to NHA for management of the impacts, including a framework for adaptive management to respond to concerns of the community during project operation. The plan included measures for initiating a program to test emission from motor vehicles entering the motorway. Vehicles with excessive emission will be warned and, in association with the Punjab EPD, a system of fine could be initiated. It also planned that thick avenues of trees will be planted in areas where there is dust problem. The proposed mitigation measure for noise included initiating a risk-based monitoring program for all receptors falling within 500 m of M-4 and, as a result construction of noise walls at appropriate places. In addition, NHA will initiate a research program in collaboration with the EPAs to determine a risk based standards for traffic noise.

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1.4 Project Categorisation

39. Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000, Schedule II, lists down the projects requiring an EIA study as under:

40. "The Projects in schedule-II are generally major Projects and have the potential to affect a large number of people. They also include Projects in environmentally sensitive areas. The impact of such Projects may be irreversible and could lead to significant changes in landuse and the social, physical and biological environment."

41. Schedule-II describes the requirements of EIA for transportation Projects as follows: "Federal or Provincial Highways or major roads greater than 50 Million Rupees in value. Maintenance (rebuilding or reconstruction of existing roads) is exempted from the requirement of an EIA".

42. As per EPA Guidelines, the present Project is classified as "Schedule II" that requires an EIA study and approval from the concerned authority, prior to construction (Attached as Annexure -I).

43. Asian Development Bank's Safeguard Policy Statement (SPS) 2009 classify the projects requiring an EIA in Category A as follows: "A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse or unprecedented. These impacts may affect an area lager than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required".

44. The present Project requires an EIA as it involves significant environmental impacts, i.e. resettlement of people and structures, cutting of trees, change in land use etc.

1.5 Standards and Guidelines

45. Environmental issues and control in Pakistan are governed by the Pakistan Environmental Protection Act, 1997. The necessary Guidelines and Procedures for preparing EIA Reports have been published by EPA in the form of "Pakistan Environmental Assessment Package".

46. The applicable requirements of the Government of Pakistan and Asian Development Bank (ADB) that are to be met before commencement of the Project are as follows:

- Pakistan Environmental Protection Act (1997);
- Pakistan Environmental Assessment Procedures (1997);
- Policy and Procedures for Filing, Review and Approval of Environmental Reports
- Guidelines for the Preparation and Review of Environmental Reports Attached as Annexure-I
- Sectoral Guidelines: Roads
- Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations (2000);
- National Environmental Quality Standards (2000) for discharges of municipal and industrial wastewater and gaseous emissions;
- The need for an EIA as part of the Government of Pakistan PC-1 planning approval process for this Project; and

- ADB Guidelines for Environmental Assessment.

1.6 Components of the Report

47. This EIA Report has been prepared following the Pakistan Environmental Protection Agency (EPA) Guidelines for environmental assessment and Asian Development Bank (ADB) Environmental Assessment Guidelines. The format of the Report consists of the following components:

Section 1: Introduction

48. This section represents an introduction of the entire EIA Report. It provides information about the Project location and its benefits to the public. It contains the scope of study and overview of the Project. The section also includes the Project categorisation as per EPA criteria. Besides, it provides information about the standards and guidelines that have to be followed.

Section 2: Policy and Legal Frame Work

49. This section provides an overview of the policy framework and national legislation that applies to the proposed project. The project is expected to comply with all national legislation relating to environment in Pakistan, and to obtain all the regulatory clearances required.

Section 3: Description of the Project

50. In this section salient features of the Project are presented. It provides information about the following:

a) Overview of the proposed Project;
b) Location of the Project;
c) Project components including geometric design standards;
d) Project Right of Way (RoW);
e) Construction material;
f) Schedule of construction;
g) Construction camps; and
h) Workforce and machinery requirements.

Section 4: Description of the Environment

51. It provides an overview of the present environment of the Project area/site. It discusses the following:

a) Methodology of the study;
b) Physical environment;
c) Ecological resources; and
d) Socio-economic environment.

Section 5: Alternatives

52. This section discusses the Alternatives of the proposed Project.

Section 6: Environmental Impacts and Mitigation Measures

53. This section identifies the overall impacts of construction/operation works on the physical, biological and socio-economic environment of the Project Area. This assessment also includes the impact of traffic volume due to improved

road conditions. In addition, it also narrates the measures that will mitigate the Project's adverse environmental effects.

Section 7: Economic Assessment

54. This section describes both tangible and intangible benefits of the proposed Project. It consists of detailed economic analysis of the Project.

Section 8: Environmental Management Plan

55. This section provides an approach for managing and monitoring environment related issues and describes the institutional framework for environmental management and resource allocations to be carried out by the National Highway Authority (NHA) for mitigating negative impacts of the proposed Faisalabad-Khanewal Motorway (M-4) Project.

56. This section describes the measures suggested for executing the Environmental Management Plan (EMP) at the Project site. It elaborates the following in detail:

- Objectives of EMP;
- Key Environmental and social components;
- Role of functionaries;
- Specific implementation responsibilities;
- Environmental monitoring;
- Environmental management plan;
- Environmental mitigation cost;
- Environmental technical assistance and training plan; and
- Environmental monitoring, mitigation and training costs.

Section 9: Public Consultation and Information Disclosure

57. This section consists of the information based on public consultation and information disclosure to them about the Project. It comprises of the following:

- Identification of the main stakeholders;
- Details of scoping sessions;
- Stakeholders' concerns;
- Proposed measures for incorporating the stakeholders' concerns;
- Village meetings; and
- Future information disclosure plan.

Section 10: Public Consultation and Information Disclosure (Section-II) M-4

58. This section deals with the information disclosure to the public and consultation sessions held with the different stakeholder groups that are likely to be affected by the implementation/construction of section-II of M-4 Project. The consultation process was carried out as per the guidelines of ADB and EPA.

Section 11: Grievance Redress Mechanism

59. This section describes the Grievance Redress Mechanism that is to be established at the Project to address and resolve the complaints of the affected people (APs)

Section 12: Conclusions

60. This section presents the conclusion of the whole study. It explains the following in detail:

- Identification of the main issues and concerns;
- Proposed mitigation measures;
- Benefits of the Project; and
- Surveillance and Monitoring of the Motorway after Construction.

SECTION 2

POLICY AND LEGAL FRAMEWORK

2.1 General

61. This section provides an overview of the policy framework and national legislation that applies to the proposed project. The project is expected to comply with all national legislation relating to environment in Pakistan, and to obtain all the regulatory clearances required.

2.2 National Policy and Legal Framework

62. The Climate Change Division is the responsible authority for environmental protection policy making in Pakistan.

63. The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed project are pollution prevention and abatement, restoration of rangelands, increasing energy efficiency, conserving biodiversity, supporting forestry and plantations, and the preservation of cultural heritage.

64. Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA) 1997 was the governing law for environmental conservation in the country. Under PEPA 1997 the Pakistan Environmental Protection Council (PEPC) and Pak EPA were primarily responsible for administering PEPA 1997. Post the adoption of the 18^{h} Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation. Subsequently, the Punjab government amended PEPA 1997 as Punjab Environmental Protection (Amendment) Act 2012, and the Punjab Environment Protection Department (EPD) is responsible for ensuring the implementation of provisions of the Act in Punjab's territorial jurisdiction. Punjab EPD is also required to ensure compliance with the NEQS and establish monitoring and evaluation systems.

2.3 Regulations for Environmental Assessment, Pakistan EPA

65. Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (I0/2000), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.4 Regulatory Clearances, Punjab EPA

66. In accordance with provincial regulatory requirements, an IEE/EIA satisfying

the requirements of the Punjab Environmental Protection (Amendment) Act 2012 which was earlier submitted to Punjab EPA in 2007 for review and approval, and received NOC well before the commencement of construction of M-4.

2.5 Guidelines for Environmental Assessment, Pakistan EPA

67. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed project are listed below:

Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA 1997;
Guidelines for Public Consultations; Pakistan EPA May 1997;

2.6 National Environmental Quality Standards (NEQS) 2000

68. The National Environmental Quality Standards (NEQS), 2000, specify the following standards:

- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers);
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources;
- Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles;
- Maximum allowable noise levels from vehicles;

69. These standards apply to the gaseous emissions and liquid effluents discharged by batching plants, campsites and construction machinery. The standards for vehicles will apply during the construction as well as operation phase of the project. Standards for ambient air quality and noise have also been prescribed.

2.7 ADB's Safeguard Policy Statement (SPS), 2009

70. The Asian Development Bank's Safeguard Policy Statement (SPS) 2009 requires that environmental considerations be incorporated into ADB's funded project to ensure that the project will have minimal environmental impact and be environmentally sound. The occupational health and safety of the local population should also be addressed as well as that of the project workers. A Grievance Redress Mechanism to receive application and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance is also established and provided in Chapter 10.

71. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is to be undertaken using Rapid Environmental Assessment (REA) checklists, consisting of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the potential for the project to cause significant adverse environmental impacts. Projects are classified into one of the following environmental categories:

- Category A: A proposed project is classified as category A if it is likely to have

significant adverse environmental impacts that are irreversible, diverse or unprecedented. These impacts may affect an area lager than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.

- Category B: A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.

- Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

- Category FI: A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary (FI).

2.8 Interaction with other Agencies

72. NHA is responsible for ensuring that the project complies with the laws and regulations controlling the environmental concerns of highway construction and operation, and that all preconstruction requisites, such as permits and clearances are met.

2.9 Provincial EPAs

73. NHA will be responsible for providing the complete environmental documentation required by the Punjab EPA and remain committed to the approved project design. No deviation is permitted during project implementation without prior and explicit permission of the Punjab EPA.

2.10 Provincial Departments of Forests and Wildlife

74. The clearing and grubbing for the Project road will involve clearing and uprooting of trees falling under construction limits within the right of way (ROW). However, any removed trees or vegetation under private ownership will be compensated. If there is some disruption to vegetation or trees the project contractor will be responsible for acquiring a 'No-Objection Certificate' (NOC) from the concerned federal or provincial forest department. The application for an NOC will need to be endorsed by the NHA.

2.11 Provincial Governments

75. The NHA and its contractors must ensure that the project meets the criteria of provincial/district governments as related to the establishment of construction camps and plants, and the safe disposal of wastewater, solid waste, and toxic materials. NHA will coordinate and monitor environment-related issues.

2.12 Other Environment Related Legislations

76. Table 2.1 gives a summary of all legislations, guidelines, conventions and corporate requirements:

Table 2.1: Environmental Guidelines and Legislations

Sr. No.	Legislation/guideline	Description
1	Punjab Environmental Protection (Amendment) Act, 2012	Post the adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation. Subsequently, the Punjab government amended PEPA 1997 as Punjab Environmental Protection (Amendment) Act 2012, and Punjab EPD is responsible for ensuring the implementation of provisions of the Act in Punjab's territorial jurisdiction. Punjab EPD is also required to ensure compliance with the NEQS and establish monitoring and evaluation systems.
2	Pakistan Environmental Protection Act (PEPA) 1997	Basic legislative tool empowering the Government of Pakistan to frame and enforce regulations for the protection of environment. The PEPA 1997 is broadly applicable to air, water, soil, marine and noise pollution, and handling of hazardous wastes. Penalties have been prescribed for those contravening provisions of the Act. Under section 12 of the PEPA 1997, no project involving construction activities or any change in the physical environment can be undertaken unless an IEE or EIA is conducted and a report submitted to the federal or provincial EPA.
3	Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, (2000)	The Regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. Schedule I lists projects that may not have significant environmental impacts and therefore require an IEE. Schedule II lists projects of potentially significant environmental impacts requiring preparation of an EIA. The Regulations also require that all projects located in environmentally sensitive areas require preparation of an EIA. It also lists Projects not requiring either an EIA or an IEE.
4	National Environmental Quality Standards (1993 and 2000)	The NEQS specify standards for industrial and municipal effluents, gaseous emissions, ambient air requirements and emission levels for Sulfur dioxide and Nitrogen oxide, vehicular emissions and noise levels. The PEPA specifies the imposition of a pollution charge in case of non-compliance with the NEQS. The standards were last revised in 2000.
5	National Environmental Policy (2005) (NEP)	NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, "to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country.
6	Land Acquisition Act, 1894 Including Later Amendments	The Land Acquisition Act, 1894, is a "law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition". The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. The land needed for the construction of road will be acquired under normal conditions based on prevailing market prices or negotiated prices between NHA and the owners of land. Section 17(4) of the LAA will not be

		used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached.
7	The Forest Act (1927)	The Act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. No protected forest is situated in the Project Area.
8	Canal and Drainage Act (1873)	This Act prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage.
9	Pakistan Penal Code (1860)	It authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.
10	Protection of Trees and Brushwood Act, 1949	This Act prohibits cutting or lopping of trees and brushwood without permission of the Forest Department. The Forest Department will be approached for permission to cut trees along the road alignment.
NATIONAL ENVIRONMENTAL AND CONSERVATION STRATEGIES		
11	National Conservation Strategy	Before the approval of NEP the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas.
12	Biodiversity Action Plan	The plan recognizes EIA as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity

INSTITUTIONAL FRAMEWORK

13	Environment and Conservation	There is a well-established framework for environmental management in Pakistan. The Ministry of Environment deals with environment and biological resources. Within the ministry, the NCS unit established in 1992 is responsible for overseeing the implementation of the strategy. Two organizations, The Pakistan Environmental Protection Council (PEPC) and the Pak EPA are primarily responsible for administering the provisions of the PEPA, 1997. The PEPC oversees the functioning of the Pak EPA. Its members include representatives of the government, industry, non-governmental organizations, and the private sector. The Pak EPA is required to ensure compliance with the NEQS, establish monitoring and evaluation systems, and both identify the need to and institution of legislations whenever necessary. It is thus the primary implementing agency in the hierarchy. The Provincial Environmental Protection Agencies are formed by the respective provinces.

INTERNATIONAL CONVENTIONS		
14	The Convention on Conservation of Migratory Species of Wild Animals, (1981.21)	The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the Project.
15	Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	The convention requires Pakistan to impose strict regulation (including penalization, confiscation of the specimen) regarding trade of all species threatened with extinction or that may become so, in order not to endanger their survival further.
16	International Union for Conservation of Nature and Natural Resources Red List (2000)	Lists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Larkana
INTERNATIONAL ENVIRONMENTAL GUIDELINES		
17	ADB's Safeguard Policy Statement (SPS), 2009	ADB's Safeguard Policy Statement (SPS), 2009 provides guidelines for environmental assessments of development projects. These guidelines help prospective projects identify impacts they will have on various environmental receptors. The guidelines call for carrying out EIAs or IEEs of projects based on severity of their impacts.

SECTION 3

DESCRIPTION OF THE PROJECT

3.0 General

77. The Faisalabad-Khanewal Motorway (M-4) Project will be a crucial Motorway link as it will enable trade and transportation linkage among major cities of the country. The proposed Project will also facilitate residents of Faisalabad, Toba Tek Singh, Khanewal and Multan and will provide easy access towards Multan, Lahore and onward to Islamabad.

78. Prime objectives of the proposed Project are as follows:

- Enhance trade activities in the country;
- To provide in future the Trade linkage of Central Asian Republics with Pakistan.
- Provide safe, high speed and time saving corridor to the travellers;
- Enhance the efficiency of road network; and
- Reduce the number of accidents.

79. The traffic increase in speed with/without proposed Motorway is enlisted in Table 3.1.

Table-3.1
Vehicle Operating Speeds (Km/h)

Description	Car	Mini Buses/ Coasters	Buses	Truck-Tractors
Without Project	55	50	45	40
With Project	120	110	110	110

Source: NESPAK

80. Number of vehicles will increase annually and it will reach up to 26,000 passenger car unit by the year 2035. The increase in traffic volume will result in more travel time fuel consumption due to reduced traffic speed, traffic jams and accidents.

81. The design of the proposed Motorway will be carried out on the basis of latest traffic counts. Therefore it is imperative to construct the proposed Motorway Project so that the future traffic and travel safety problems can be encountered.

3.1 Location of the Proposed Project

82. The proposed Project falls under the administrative jurisdiction of Faisalabad, Toba Tek Singh, Jhang and Khanewal Districts. The proposed Project will start at the end point of (M-3) near Faisalabad and will end at N-5 near Khanewal.

83. The cities and towns falling en-route the proposed Project are Faisalabad, Painsara, Gojra, Toba Tek Singh, Shorkot, Makhdoompur, Abdul Hakim, Kabirwala and Khanewal. Presently the RoW of the proposed Project contains mostly agricultural land.

3.2 Project Components

84. The proposed Motorway Project components include construction of four lanes dual carriageway from Faisalabad to Khanewal and construction of ten Interchanges at different local road crossings. Two main Bridges will be constructed one at Sadhnai Spill Channel and the other on Ravi River. However twenty small bridges will be constructed on drain and canal crossings. The total width of both carriage ways including land reserved for plantation will be 31.8 meters. Nine meter wide section of land will be raised with plantation in between two carriageways and this section will be utilized in future to construct one lane of 3.65 meters on both carriageways.

85. The proposed project will be divided into three construction Packages

- Package-I: Faisalabad-Gojra Section(58 Km);
- Package-II: Gojra - Shorkot Section (62 Km); Implemented under a standalone project.
- Package-III: Shorkot -Khanewal Section (64 Km); Implemented under a standalone project.

3.2.1 Interchanges

86. The proposed Project will contain ten interchanges; these will be constructed at Faisaabad-Chiniot Road, Painsara-Jhang Road, Gojra-Jhang Road, Toba Tek Singh-Jhang Road, Toba Tek Singh-Warriam Road, Shorkot Cantt-Shorkot City Road, Bagar-Abdul Hakim Road, Makhdoompur-Kabirwala Road, Kabirwala-Khanewal Road and Khanewal-Multan Road. The interchange will be provided with two lanes each lane of 3.5 meters wide with one meter shoulder at outer sides.

3.2.2 Bridges

87. The proposed Motorway will cross two main surface water bodies i.e., Ravi River (chainage145+250) and Sadhnai Canal (chainage145+850). Two separate bridges will be constructed to run across these two water bodies. These bridges will be located near Abdul Hakim-Baghar interchange. In addition to the above, other small bridges will be constructed on the following canal and drain crossings:

- Khai Distributary, 8 m wide (at1+500);
- Drain, 15 m wide (at 6+650);
- Nasrana Distributary, 20 m wide (at 9+900);
- Paharang Drain, 30 m wide (at 10+500);
- Sem Nullah, 30 m wide (at 28+300);
- Jhang Branch Canal, 40 m (32+600);
- Dijkot Branch Drain, 40 m (43+700);
- Dhaular Distributary, 30 m (44+600)
- Nawabwala Distributary, 10 m (48+500);
- Titranwala Distributary, 20 m (54+250);
- Bhango Distributary, 20 m (73+500);
- Small Distributary, 3 m (80+000);
- Khewra Distributary, 3m (82+200);
- Distributary, 20 m (95+500);
- Trimo Link Canal, 150 m (111+000);
- Haweli Canal, 80 m (112+200);
- Darkhana Distributary, 3 m (131+350)
- Sadhnai Drain, Nakasu 250 m (140+00);
- Goraga Distributary, 20 m (144+900); and
- Canal, 8 m (169+600).

3.2.3 Flyovers

88. The Flyovers will be constructed at various road crossings. The link roads across the RoW of the proposed Project will pass through these flyovers. For these flyovers the width of the land strip shall follow the toe of embankment with a maximum width of 60 meters near flyover embankments and a minimum width of 30 meters near lower ends of the flyover ramps where it meets with the existing carriageway.

3.2.4 Rest Areas

89. Rest Areas will be provided after a certain distance on the proposed Motorway to facilitate travellers. For these rest area locations, a strip of 150 meters width and 200 meters length will be reserved on either side of the Motorway.

3.2.5 Service Area

90. These locations will be provided to facilitate travellers. The restaurants and Petrol pumps will be located there to provide comfort to people using the proposed Motorway. A strip of 250 meters width and 700 meters length will be reserved for the Service Area. The toilets in the service areas will be equipped with septic tanks of sufficient capacities. Sewage of the septic tanks will be disposed of at the designated waste disposal sites.

3.3 Project Right of Way

91. The Right of Way (RoW) of the proposed Motorway Project is 100 meters wide, while it will be 300 meters at the locations where interchanges will be constructed. Major construction work will generally remain confined within the RoW. About 4800 acres of land will be acquired for the proposed Project.

3.4 Construction Materials

92. The materials used in construction and up-gradation of the Motorway would include coarse aggregates (crush), fine aggregates (sand), soil, water, asphalt, reinforcement, cement etc. Almost all these raw materials are locally available in the country. The construction material quarries are already available in the area, which have been approved by the Mines and Mineral Department, Punjab. The construction material for M-4 will be procured from these approved quarries and no new quarry will be dug by the contractor.

(i) Crushed Aggregate

93. A well developed source of crushed aggregate is available at Chiniot and Sargodha. Several medium size crushers are exploiting these quarries. The quantities available are quite large; however, mining leases have already been obtained by various parties.

(ii) Fine Aggregate (sand)

94. This is also available in abundant quantity in the nearby areas of the proposed Project. Good quality sand is available in the River bed of Ravi and Chenab and it is the main source of superior sand for construction needs. The Chenab River sand has some superiority over the River Ravi sand.

(iii) Sub-grade Material

95. Large quantity of sub-grade (soil) is abundantly available at various locations near the Project Site. Borrow pits of suitable material at a reasonable reach will be selected.

(iv) Embankment Material

96. The embankment material will be borrowed in huge quantities in the vicinity of the Project Area. In most cases, the contractors will lease private land in the vicinity on short term basis for the purpose of acquiring earth material, after the approval of NHA designated engineer.

(v) Water

97. Groundwater is available throughout the proposed Motorway alignment. Intensive pumping is done on large scale in the vicinity of the Project Area. The surface water present in the vicinity is generally of good quality. The surface water bodies such as Ravi River and canal water is available in Project Area. The quality of the ground and surface water has been analysed in the Project Area. The laboratory results (Annexure II) show that water from both the sources is suitable for all construction requirements.

(vi) Asphalt, Reinforcement and Cement

98. Asphalt, reinforcement and cement will be transported from Khoshab, D.G. Khan, Rawalpindi, Islamabad and Karachi etc.

3.5 Engineer's Cost Estimate

99. The Engineer's Cost Estimate for the proposed Project is presented in Tables 3.2 and 3.3.

Table-3.2 Engineer's Cost Estimate

ENGINEER'S COST ESTIMATE
(Package I-IV)

BILLS	D E S C R I P T I O N	Amount Based on CSR 2006 (Rs.) Package-I	Amount Based on CSR 2006 (Rs.) Package-II	Amount Based on CSR 2006 (Rs.) Package-III (i)	Amount Based on CSR 2006 (Rs.) Package-III (ii)	Total Amount (Rs.) Packages I – III
1	EARTH WORK	2,316,586,885.26	2,177,131,685.55	1,680,190,876.71	201,847,304.08	6,375,756,751.60
2	SUB BASE & BASE	1,572,995,596.92	1,728,153,189.46	1,735,350,876.60	44,975,977.71	5,081,475,640.69
3	SURFACE COURSE & PAVEMENT	489,554,466.50	522,942,977.70	508,203,874.20	16,820,572.99	1,537,521,891.39
4	STRUCTURES	-	-	-	-	-
4A	SUBWAYS & BOX CULVERTS	262,703,161.45	213,681,069.48	238,302,275.68	21,698,947.56	736,385,454.17
4B	PIPE CULVERTS	63,688,409.65	43,309,464.55	58,343,152.76	2,604,028.83	167,943,055.79
4C	BRIDGES	404,121,807.63	283,353,643.91	235,683,688.51	712,734,993.72	1,635,894,133.77
4C-A	SOIL INVESTIGATION FOR BRIDGES	2,062,410.00	1,409,100.00	2,357,040.00	589,260.00	6,417,810.00
4C	FLYOVERS	1,124,305,222.10	332,467,066.54	546,550,371.60	-	2,003,322,660.24
4C-1	SOIL INVESTIGATION FOR FLYOVERS	4,124,820.00	1,178,520.00	2,062,410.00	-	7,365,750.00
4C	INTERCHANGES	824,917,975.18	496,154,011.33	301,488,539.14	-	1,522,566,525.65
4C-1	SOIL INVESTIGATION FOR INTERCHANGES	1,178,520.00	589,260.00	589,260.00	-	2,357,040.00
5	DRAINAGE AND EROSION WORKS	157,285,978.76	173,283,655.77	151,151,731.19	12,495,188.23	494,216,553.96
5A	INSTALLATION AND COMMISSIONING OF A COMPLETE PUMPING STATIONS	15,640,367.08	16,617,890.02	16,617,890.02	977,522.94	49,853,670.06
5B	LAYING OF FEEDER LINE, MAINLINE, AND SUBMAINS OF UPVC PIPES	8,894,048.30	9,342,091.87	9,333,811.87	532,734.41	28,102,684.45
5C	LAYING OF UV RESISTANT LOPE DRIP LINES WITH 4 LTR/HR DRIPPERS	8,951,112.17	9,372,156.44	9,372,156.44	302,208.08	27,997,733.13

ENGINEER'S COST ESTIMATE
(Package I-IV)

BILLS	D E S C R I P T I O N	Amount Based on CSR 2006 (Rs.) Package-I	Amount Based on CSR 2006 (Rs.) Package-II	Amount Based on CSR 2006 (Rs.) Package-III (i)	Amount Based on CSR 2006 (Rs.) Package-III (ii)	Total Amount (Rs.) Packages I – III
5D	**TRENCHING AND BACK FILLING, PUNCTURING OF CULVERTS/UTILITIES, TESTING**	2,264,606.37	2,376,464.63	2,378,464.63	119,243.40	7,140,779.03
5E	**GROUND COVER**	6,440,000.00	6,842,500.00	6,842,500.00	402,500.00	20,527,500.00
5F	**OPERATION & MAINTENANCE**	10,914,460.00	10,874,060.00	10,874,060.00	643,215.29	33,305,795.29
6	**ANCILLARY WORKS**	976,999,941.33	1,019,456,984.38	911,961,044.30	29,024,584.26	2,937,442,554.27
6A	**MISCELLANEOUS WORKS**	153,315,000.00	156,315,000.00	156,315,000.00	3,105,000.00	469,050,000.00
7	**GENERAL ITEMS**	83,860,000.00	83,860,000.00	72,860,000.00	64,240,000.00	304,820,000.00
		8,490,804,788.70	7,288,710,791.63	6,656,829,023.65	1,113,113,281.50	23,449,463,983.49

Table-3.3 Engineer's Cost Estimate for Section-II of M-4

BILLS	D E S C R I P T I O N	Amount Based on CSR 2014 (Rs.)
1	EARTH WORK	6,215,719,718
2	SUB BASE & BASE	4,958,930,717
3	SURFACE COURSE & PAVEMENT	2,487,782,526
4A	STRUCTURES	2,384,649,025
6	ANCILLARY WORKS	2,582,671,223
4B	PIPE CULVERTS	558,507,657

BILLS	D E S C R I P T I O N	Amount Based on CSR 2014 (Rs.)
4C	BRIDGES	647,084,290
6A	MISC ITEMS	2,649,529,636
7	GENERAL ITEMS	249,438,750
	TOTAL	23,253,899,503
	*PROVISIONAL SUM	581,347,488
	GRAND TOTAL	23,835,246,990

The work not contained in the contract and required to be executed on urgent basis may be executed and paid through the Provisional Sum after the approval of Contractor's Quotation by the Employer which quotation by the Employer which quotation shall be complete in all respect including Contractor's overheads and profit

3.6 Construction Schedule

100. The construction work at section-I of M-4 project completed in December 2014. The implementation/construction of the section-II of M-4 is expected to commence in the December 2015 and the estimated completion date will be the end of 2018.

3.7 Construction Camps

101. Camp sites will be selected keeping in view the availability of an adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Final locations will be selected by the contractor after approval from NHA.

102. The area requirement for construction camps will depend upon the deployed workforce and the type and quantity of machinery mobilized. In view of the area required, it will not be possible to locate camp sites within the ROW and the contractors will have to acquire land on lease from private landowners.

3.8 Workforce and Machinery Requirements

103. The workforce and the machinery requirements are presented in Tables 3.4 and 3.5 below:

Table-3.4
Workforce Requirement for Construction (Packages I-III)

No.	Contractors Staff	Workforce Required
A. Managerial Staff		
1	Project Manager	1
2	Deputy Project Managers	4
3	Office Managers	4
4	Accountants	4
5	Purchasers	4
6	Quantity Surveyors	4
7	Computer Operators	4
B. Site Staff		
1	Material Engineers	2
2	Site Engineers	10
3	Surveyors	10
4	Foremen	12
5	Skilled Labourers	80
6	Semi-skilled Labourers	120
7	Labourers	200
Total		459*

***** This figure is valid in case of all the construction packages are initiated at the same time.

Table-3.5
Estimated Machinery Requirements (Packages I-III)

S. No.	Machinery	Nos.
1	Dump trucks	20
2	Graders	8
3	Dozers (D-8)	8
4	Vibratory rollers	8
5	Water boozers	12
6	Loaders	8
7	Asphalt plant	2

S. No.	Machinery	Nos.
8	Asphalt distributor	2
9	Crushing plant	2
10	Air compressors	2
11	Broomers	2
12	Asphalt Paver	4
13	PTR	4
14	Static steel tyred rollers	8
15	Sheep foot rollers	8
15	Generators (10 KV)	4
16	Concrete batching plant	2
17	Vibrators	12
18	Concrete transit mixers	4
19	Rig (and accessories)	4
20	Tri pod	4
21	Welding plants	8
22	Concrete Bucket & Funnel	1 (each)
23	P.C Girder launcher	1
24	Form work	4 sets

*****This figure is valid in case of all the construction packages are initiated at the same time.

SECTION 4

DESCRIPTION OF THE ENVIRONMENT

4.0 General

104. The existing environment in the Project Area has been studied with respect to physical, ecological, cultural and socio-economic aspects. The data presented in this section has been gathered during December 2006 to February 2007 and updated in June to October 2014 in order to address SPS 2009. Furthermore, a cumulative environmental impact was also conducted a sa standlone modelling study in June 2015, the results of which have been appeneded to this EIA study.

105. The direct "Corridor of Impact" (CoI) due to construction of the Motorway is 328 ft. (100 metres), which is within Right of Way (RoW) of the proposed Motorway Project. However effect of loads generating from the moving traffic will be felt beyond the designed RoW. Therefore indirect CoI is beyond the proposed RoW.

106. There is no existing road along the proposed Motorway Project, i.e., the M4 alignment is a new project, of which section-I is now operational.Therefore, at the time of conducting the original EIA the baseline environment of the Project Area was free from environmental pollution such as dust, noise or vehicular emissions, which remains true for the areas falling undtr Section-II. This will allow the determination of baseline conditions against which the incremental impact of the proposed Project will be assessed. Human impacts such as road safety, traffic noise, vehicular emissions and other types of associated pollution are taken into consideration for the operational stage of the proposed Project. These factors are therefore discussed as part of the environmental conditions in the Project Area.

4.1 Methodology

107. The existing information to establish a baseline of the Project Area was collected from different Government Departments/Public Sector agencies. Further, detailed field visits to the site were also carried out in order to have first hand information about the social and environmental conditions/issues of the Project Area.

108. The potential impacts of the proposed Project were ranked on the basis of their magnitude, severity and reversibility.

109. In order to assess the impacts of the proposed Project on the people living in the vicinity of the Project Area, detailed surveys were conducted and existing environmental/socio-economic conditions and salient features of the area were duly observed. In addition, the relevant secondary data was also obtained from the District Census Reports for Faisalabad, Toba Tek Singh, Jhang and Khanewal. During the detailed site visit, relevant government agencies/ departments (Annexure III) were also consulted for the relevant data. To establish baseline ambient air, noise and surface and groundwater conditions of the area; air and water samples for laboratory analysis were collected from locations in all four districts, whereas noise levels were measured at various locations.

110. Locations for air quality, water quality and noise sampling were selected keeping in view their vulnerability to the proposed Project related impacts. These locations were distributed equally in all four districts. In June 2014, in order to update the EIA report for section-II, four different locations along section-II of M-4 were selected as the sensitive receptors during the detailed field visits, these locations were based on their vulnerability to being negatively impacted during construction and operational phases of the project. The analysis of noise, air and water were carried out in order to attain the baseline data/information which in future (during construction and operation phase) will be used as the reference data. Detail analysis reports are attached Annexure-II. For the environmental testing the samples of air, noise and water were collected from following under mentioned locations and villages.

i. RD 59+200 Adjacent to water course in Chak No. 305/JB near RoW
ii. RD 86+700 Adjacent to Govt. Elementary School for girls and community houses in Chak No.396 JB
iii. RD 119+500 At Water course in Mouza Rakh Kotla..
iv. RD 120+200 Near the community houses at the end point of Section-II (Mouza 7-Ghag)

111. The above locations were selected as sensitive receptors based on their distance from the proposed alignment of M-4 Section II. These locations were found within 50 meters of RoW. In future during the construction and operational stage these location were carefully monitored and reported.

i. RD 59+200 Chak 305/JB was selected because few community houses and water course was 35 meters away from proposed alignment.
ii. RD 86+700 Chak 396/JB was selected because Govt. Elementary School for girls, was just 21 meters away from RoW.
iii. There is a densely population area at RD 119+500 Mouza Rakh Kotla .
iv. RD 120+200 Mouza 7 Ghag few community houses and hand pumps found near RoW

The locations of sensitive receptors are shown in Figure-4.1.

4.2 Physical Environment

4.2.1 Meteorology

112. The climate of the Project Area touches two extremes, characterised by hot summers and mild winters. From April onwards, the summer season continues usually up to the middle of October after which it becomes cool and the day time temperature also begins to recede. May, June and July are the hottest months. The winter season on the other hand starts from November and continues till March. December, January and February are coldest months.

113. The mean maximum and minimum temperature in summer are 41 ^{o}C and 27 ^{o}C respectively and in winter 19 ^{o}C and 4 ^{o}C respectively.

114. Table 4.1 shows the temperature, precipitation and relative humidity recorded at Faisalabad for the period of 30 years.

Table 4.1
Month-Wise 30 Year Mean Maximum and Minimum Temperature, Precipitation and Humidity Data (Faisalabad, Toba Tek Singh and Jhang)

Month	Mean Temperature (°C)		Precipitation (Millimetres)	Relative Humidity (%)
	Maximum	Minimum		
January	19.4	4.1	11.5	66.0
February	21.9	7.1	20.1	61.2
March	26.7	12.3	25.7	58.2
April	33.5	18.0	16.9	46.5
May	38.4	22.7	16.1	37.5
June	40.5	26.9	27.9	41.7
July	37.1	27.0	115.0	61.5
August	36.1	26.6	89.8	65.9
September	35.7	23.7	28.6	59.9
October	33.0	17.0	3.8	54.7
November	27.2	10.1	3.0	62.7
December	21.4	5.1	8.6	66.5
Annual (Average)	30.9	16.7	372.3	56.8

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi, 1961 – 90 (District Census Reports – Faisalabad, Toba Tek Singh and Jhang)

115. The above data represent the temperature, precipitation and relative humidity for Faisalabad, Toba Tek Singh and Jhang as they are close to one another therefore data given in District Census report is same. The mean maximum and minimum temperatures in June (the hottest month) are 40.5 °C and 26.9 °C respectively and in January (the coldest month), 19.4 °C and 4.1 °C respectively as per records for the 30 year period (1961-1990).

116. The Project Area experiences very light rainfalls. The summer season continues from July to September and the winter season from December to April. The bulk of the monsoon precipitation occurs in July and August, with monthly averages of 115.0 and 89.8 mm respectively. Minimum rainfall occurs in the month of November, which is 3.0 mm.

Table 4.2
Month-Wise 30 Year Mean Maximum and Minimum Temperature, Precipitation and Humidity Data (Khanewal)

Month	Mean Temperature (°C)		Precipitation (Millimetres)	Relative Humidity (%)
	Maximum	Minimum		
January	21.0	4.5	7.2	62.3
February	23.2	7.6	9.5	56.4
March	28.5	13.4	19.5	51.6
April	35.5	19.5	12.9	40.1
May	40.4	24.4	9.7	33.2
June	42.3	28.6	12.3	39.9
July	39.2	28.6	61.3	56.0
August	38.0	28.0	32.6	59.7
September	37.2	24.9	10.8	56.3
October	34.6	18.2	1.7	51.6
November	28.5	10.9	2.4	61.4
December	22.8	5.5	6.9	66.6
Annual (Average)	33.6	17.8	186.8	52.9

Source: Data Processing Centre, Pakistan (District Census Report Khanewal)

4.2.2 Air Quality

117. The air quality in the Project Area is mostly free from pollutions except dust on the roads where interchanges and flyovers are proposed. A lot of dust occurs due to the dry atmosphere and the situation gets aggravated by the human activity. Large amount of suspended particulate matter (SPM) is

generated due to vehicle movement on unpaved shoulders of these roads. The proposed Project will not cause any dust problem due to smooth road surface and paved shoulders, it will actually improve the situation.

118. For establishing baseline ambient air quality conditions, seven monitoring sites were selected. The air sample collection locations are as under:

1. Faisalabad-Sargodha Road (starting point of M4)
2. Painsera-Jhang Road (Chainage: 34+600)
3. Gojra-Jhang Road near Bhatta Stop (Chainage: 58+100)
4. Toba-Wariam Road (Chainage: 93+700)
5. Cantt. Road Shorkot near Shorkot Rice and General Mill (Chainage: 118+700)
6. Near Bank of Ravi River; (Chainage: 145+200) and
7. Khanewal-Multan Road, N-5 (Chainage: 184+000)

Table 4.3 (a)
Ambient Air Quality Monitoring

#	Parameter	Average Test Results at Sampling Locations							Unit	Duration (hours)	USEPA Standards
		Location 1	Location 2	Location 3	Location 4	Location 5	Location 6	Location 7			
1.	CO	1.20	0.33	0.70	0.40	0.58	0.33	1.04	ppm	24	35 (one hour average)
2.	NO_2	0.02	<0.01	0.02	<0.01	0.01	<0.01	0.02	ppm	24	0.053 (annual arithmetic mean
3.	SO_2	0.02	<0.01	0.01	<0.01	0.01	<0.01	0.01	ppm	24	0.14
4.	PM_{10}	**266.30**	142.66	**228.50**	111.52	135.24	142.66	287.80	$\mu g/m^3$	24	**150**
Location 1: Faisalabad – Sargodha Road						**Location 2:** Painsara – Bhawana Road					
Location 3: Gojra – Jhang Road (near Bhatta stop)						**Location 4:** Toba – Warriam Road					
Location 5: Shorkot City – Shorkot Cantt Road						**Location 6: Mozah Shahadat Kundala**					
Location 7: Khanewal-Multan Road											
Source: SGS Laboratory Test Results 2007											

119. Sampling locations were selected near existing road areas and calm places at agriculture fields, reperesenting both disturbed and relatively pristine environments. Sampling was conducted for 24 hour period. Samples were taken at downwind side and from 5 – 10 metres from the edge of the road. During sampling, average temperatures were 15 and 25^0C respectively. Sampling locations and laboratory reports are provided in Annexure II (a). Results of laboratory analysis of ambient air quality parameters are given in Table 4.3.

120. As ambient air quality standards have not yet been developed in Pakistan, therefore for comparison, USEPA standards are referred.

121. Table 4.3 indicates that the value of PM_{10} exceeds the USEPA Standard on :Faisalabad – Sargodha Road, Gojra – Jhang Road and Mauza Shahadat Kundala. This may be due to the PM_{10} emissions from the vehicular traffic

and dispersion of dust (deposited on these roads) due to running of the vehicles.

122. In year 2014 during the updation of the EIA report for establishing baseline ambient air quality conditions, four monitoring sites were selected. The air samples collection locations are as under:

i. RD 59+200 Chak 305/JB was selected because few community houses and water course was 35 meters away from proposed alignment.
ii. RD 86+700 Chak 396/JB was selected because Govt. Elementary School for girls, was just 21 meters away from RoW.
iii. Thick population lived at RD 119+500 Mouza Rakh Kotla .
iv. RD 120+200 Mouza 7 Ghag few community houses and hand pumps found near RoW

Table 4.3 (b)
Ambient Air Quality Monitoring (2014)

S.No	Locations	Parameters	Unit	Method used	Results	Pak NEQS
1	Chak 305 JB (59+200)	PM_{10}	($\mu g/m^3$)	Integrated method	51	150
2	Chak 396 JB Adjacent to GES(86+700)	PM_{10}	($\mu g/m^3$)	Integrated method	48	150
3	At water course in Mouza Rakh Kotla. (119+500)	PM_{10}	($\mu g/m^3$)	Integrated method	48	150
4	Near end point of Section-II (Mouza 7-Ghag)	PM10	($\mu g/m^3$)	Integrated method	64	150

123. Sampling locations were selected in section-II of M-4 these were collected near from RoW of the proposed motorway i.e. near community houses, schools and agriculture fields. Sampling was conducted once in 24 hour period. Samples were taken at downwind side and from 5 – 10 metres from the edge of the road. During sampling, average temperatures were 35 to 40^0C respectively. Sampling locations and laboratory reports are provided in Annexure II (b).

124. Ambient air quality standards developed in Pakistan is 150µg/m3, therefore for the analyses done in July 2014 were compared with, PAK NEQS standards.

125. Table 4.3 (b) indicates that the value of PM10 remain within the NEQS standards on all four locations This may be due to the reason that the sites at present are away from any road and construction activity.

4.2.3 Noise

126. As the existing status of the Project area is mostly agricultural fields and some road crossings therefore noise is serious issue only at road crossings. The average value of noise along the road crossings close to NEQS and WHO limits and is expected that in the construction and operation phase this will go beyond limits. Roadside noise levels were measured from the edge of

the road (about 7.5 m from the source). Average noise level along the road is between 40 – 67 dB(A), whereas peak noise level is between 61 – 100 dB(A). Table 3.4 and 3.5 presents the maximum, minimum and average noise levels recorded at different locations. Average values for the section are all well within the NEQS i.e. 85 dB(A). However maximum noise levels are in proximity of the WHO Guideline value which is 70 dB(A).

Table 4.4
Noise Levels at Various Locations

Sr. No.	Time	Faisalabad Sargodha Road Noise Level dB(A)			Painsera-Bhawana Road Noise Level dB(A)			Gojra Jhang Road near Bhatta Stop Noise Level dB(A)			Toba-Jhang Road Noise Level dB(A)			NEQS dB(A)	WHO dB(A)
		Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average		
1	12:00	76.6	70.3	56.5	67.6	73.3	56.5	76.3	91.4	52.2	66.3	82.5	55.3	85 (7.5 from the source)	70 (for Industrial, commercial, shopping and traffic areas) 55 (for residential areas, schools and hospitals)
2	13:00	65.5	72.4	58.6	65.5	72.4	58.6	75.8	90.2	49.5	63.2	77.5	51.2		
3	14:00	78.8	92.8	60.8	65.4	77.4	47.8	72.1	88.2	50.0	65.3	79.7	50.2		
4	15:00	79.7	95.4	59.6	60.6	75.5	5.5	78.4	84.4	50.2	61.2	79.5	45.7		
5	16:00	77.6	93.2	58.5	63.3	72.3	53.4	76.2	91.0	50.3	60.1	73.2	44.5		
6	17:00	78.1	96.8	60.1	62.2	71.2	49.3	74.7	91.2	52.2	59.2	71.5	43.2		
7	18:00	70.6	80.4	55.7	65.8	62.1	50.0	76.3	90.5	49.5	59.7	70.5	43.7		
8	19:00	76.3	96.4	61.6	55.9	60.7	51.9	60.2	74.1	43.6	-	-	-		
9	20:00	80.0	98.5	64.7	57.9	63.3	49.1	65.0	79.0	40.0	-	-	-		
10	21:00	79.0	98.0	63.0	58.7	64.2	48.3	70.0	90.0	44.0	-	-	-		
11	22:00	89.0	99.0	59.3	61.6	64.0	47.7	62.1	77.0	48.0	-	-	-		
12	23:00	75.1	100.0	60.2	59.1	60.0	45.5	64.0	78.0	42.6	-	-	-		
13	24:00	77.3	87.1	62.7	55.2	59.0	43.9	70.4	82.0	52.3	-	-	-		
14	01:00	76.5	86.3	61.9	57.9	61.1	48.4	63.3	74.0	47.9	-	-	-		
15	02:00	83.7	85.4	63.0	59.8	62.4	45.2	64.4	84.0	42.1	-	-	-		
16	03:00	80.9	75.6	65.1	58.7	62.5	44.1	60.1	78.0	49.7	-	-	-		
17	04:00	81.8	72.6	67.7	54.0	64.2	45.7	65.0	82.1	50.9	-	-	-		
18	05:00	78.9	70.7	63.9	56.1	65.1	47.8	72.7	90.2	56.3	-	-	-		
19	06:00	79.0	65.5	62.3	63.3	67.0	48.9	72.1	86.6	53.5	-	-	-		
20	07:00	72.1	63.9	59.2	67.7	70.8	53.7	69.8	84.4	52.6	64.1	79.5	53.3		
21	08:00	75.3	77.2	60.4	68.8	69.7	51.1	77.3	92.4	55.1	64.5	80.1	54.2		
22	09:00	77.5	94.1	63.6	66.7	70.9	55.3	76.1	92.4	53.7	62.3	78.9	53.3		
23	10:00	80.7	95.6	65.1	67.6	70.3	56.5	76.3	91.4	52.2	58.3	74.5	50.3		
24	11:00	78.3	90.3	67.9	65.5	72.4	58.6	75.8	90.2	49.5	69.3	82.1	55.1		

Source: SGS Pakistan (Pvt.) Limited

Table 4.5
Noise Levels at Various Locations

Sr. No.	Time	Toba-Warriam Road Noise Level dB(A)			Mozah Shahadat Kundala			NEQS dB(A)	WHO dB(A)
		Min.	Max.	Average	Min.	Max.	Average		
1	12:00	76.6	91.4	64.7	47.8	65.0	52.5	85 (7.5 m from the source)	70 (for Industrial, commercial shopping and traffic areas) 55 (for residential areas, schools and hospitals)
2	13:00	76.3	91.5	59.2	48.1	62.7	55.3		
3	14:00	76.6	90.8	64.7	49.5	60.9	54.2		
4	15:00	76.8	91.0	64.7	47.3	66.3	54.8		
5	16:00	78.3	91.0	66.7	46.7	65.1	53.1		
6	17:00	76.6	91.4	64.3	43.5	62.3	52.7		
7	18:00	75.3	89.2	62.2	42.1	60.3	50.2		
8	19:00	78.3	92.4	63.1	-	-	-		
9	20:00	75.1	89.6	67.4	-	-	-		
10	21:00	71.6	84.8	64.3	-	-	-		
11	22:00	76.1	92.4	61.4	-	-	-		
12	23:00	73.4	85.1	66.0	-	-	-		
13	24:00	73.2	84.4	67.1	-	-	-		
14	01:00	75.8	82.6	64.4	-	-	-		
15	02:00	77.6	90.0	70.2	-	-	-		

16	03:00	76.5	83.4	63.1	-	-	-		
17	04:00	74.0	80.1	60.0	-	-	-		
18	05:00	75.1	84.2	65.5	-	-	-		
19	06:00	73.3	80.1	62.1	-	-	-		
20	07:00	79.9	85.5	64.3	45.1	64.1	57.1		
21	08:00	70.3	83.2	66.7	44.9	63.3	52.4		
22	09:00	71.2	82.5	65.9	47.6	62.2	53.6		
23	10:00	73.7	85.5	67.2	52.7	61.6	54.7		
24	11:00	73.2	86.5	62.4	50.1	70.0	56.9		

127. Noise along the Section II from Gojra to ShorKot of M-4 is not a serious issue as it is a new alignment. Noise levels monitoring were carried out at four different locations where ambient air quality was monitored keeping in view the distance from the community of proposed alignment. These locations have already been shown in figure 4.1. The monitored data for noise is presented in Annexure-II (a). Environment Team of EALA NHA will ensure the implementation of EMP in order to mitigate the negative impacts if arise.

Table 4.6
Noise Levels at Various Locations (2014)

(i) Project Location: Adjacent to community in Chalk No. 305/JB (Pre- Construction Phase)

Sr. No.	Location	Noise Level (dBA) Mint.	Noise Level (dBA) Max.	Average Noise Levels (Leq)
1	Left side of RD	35.6	47.1	41.4
2	Extreme Left side of RD	34.9	47.4	41.2
3	Right side of RD	33.3	39.7	36.5
4	Extreme Right side of RD	35.2	42.2	38.7
5	Left side of road	36.4	44.0	40.2
6	Right side of road	34.8	40.2	37.5
NEQS				**Commercial Area Day Time: 65 dB A**

(ii) Project Location: Adjacent to Govt. Elementary School for girls in Chalk No. 396 JB (Pre-Construction Phase)

Sr. No	Location	Noise Level (dRA) Min.	Noise Level (dBA) Max	Average Noise Levels (Leq)
1.	Left side of RD	36.1	41.9	39.0
2.	Extreme Left Side RD	39.7	51.6	45.6
3.	Right side of RD	40.2	50.9	45.6
4.	Extreme Right Side RD	39.2	42.6	40.9
5.	Left side of RD	37.8	52.6	45.2
6.	Right side of RD	36.2	46.4	41.3

(iii) Project Location: At water Course in Mouza Rakh Kotla (Pre-Construction Phase)

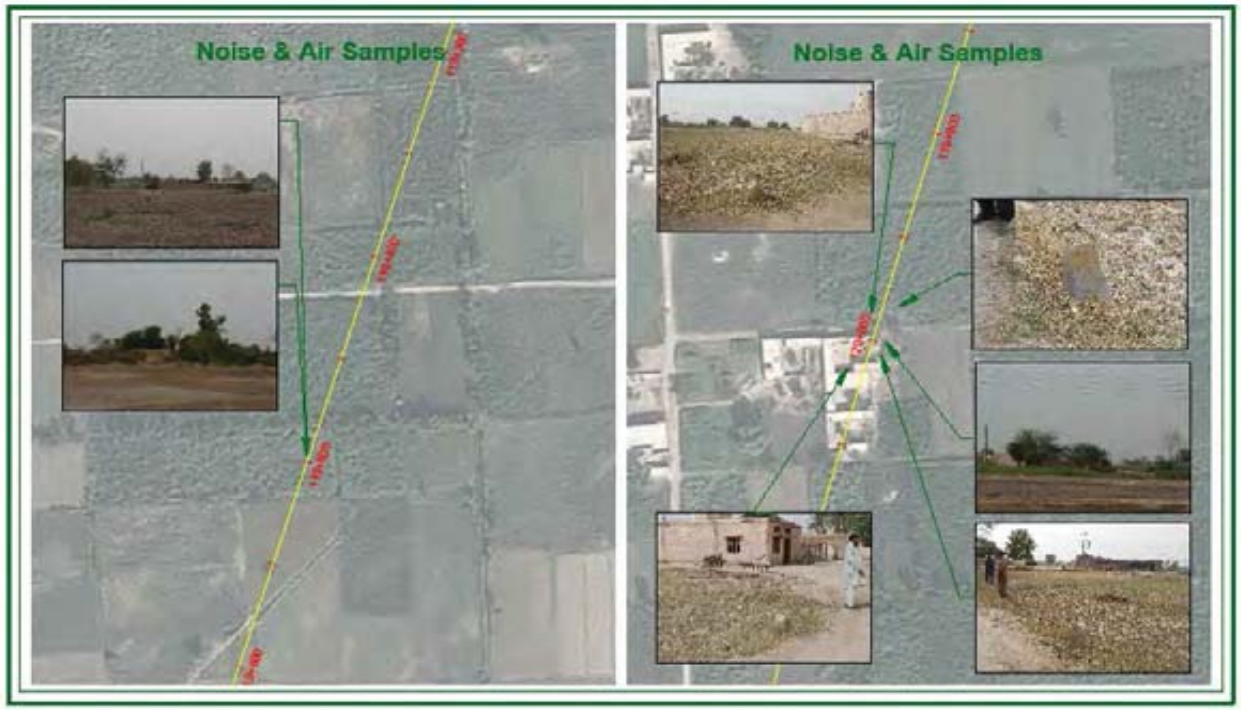
Sr. No	Location	Noise Level (dBA) Min.	Noise Level (dBA) Max	Average Noise Levels (Leq)
1.	Left side of RD	38.7	51.3	45.0
2.	Extreme Left Side RD	42.2	45.2	43.7
3.	Right side of RD	36.8	44.6	40.7
4.	Extreme Right Side RD	39.3	48.9	44.1
5.	Left side of RD	36.4	50.8	43.6
6.	Right side of RD	38.4	49.3	43.8

(iv) Project Location: Near end point of section –II Mouza 7

Sr. No	Location	Noise Level (dRA) Min.	Noise Level (dBA) Max	Average Noise Levels (Leq)
1.	Left side of RD	41.7	55.3	48.5
2.	Extreme Left Side RD	35.2	58.6	46.9
3.	Right side of RD	38.8	53.2	46.0
4.	Extreme Right Side RD	36.2	48.2	42.2
5.	Left side of RD	38.6	59.8	49.2
6.	Right side of RD	39.7	54.3	47.0

Figure 4.1 (i) shows the locations of samples collected for Air and Noise (sensitive receptors)

Figure 4.1 (ii) Shows the locations of samples collected for Air and Noise



4.2.4 Surface Water and Groundwater

128. The main sources of water in the Project Area are Ravi River and Chenab River. The canals and water courses system from these two sources is the main irrigation system in the Project Area. The Jhang Branch, Guggera Branch and Burala Branch are the major irrigation system for the Project area. This system irrigates the land of the Project Area in Faisalabad, Jhang and Toba Tek Singh districts, where as the Project Area in Khanewal district is irrigated through Sadhnai canal and Abdul Hakeem distributary. The Sadhnai canal and Abdul Hakeem Distributary are very important sources of irrigation in Khanewal district. The proposed Motorway will cross Ravi River and Sadhnai Canal at 145+250 Km and 145+900 Km respectively. Two bridges on these locations are also proposed to be constructed.

129. Jhang Branch, Guggera Branch and Burala Branch, Sadhnai Canal system and Abdul Hakeem distributary are the major irrigation source for all four districts. The land is also irrigated by tubewells in the Project Area.

130. Small scale waterlogging and salinity problems were also observed in the Project Area in Khanewal district, but none of these areas comes in the Motorway alignment. These waterlogged and saline areas are more than one kilometre far from the Motorway alignment.

131. Ground and surface water samples from the Project Area were collected and analysed in laboratory. According to the ground water results, most of the water in the area does not meet drinking water quality as prescribed in WHO standards. The concentration of Total Dissolved Solids (TDS), Chloride (Cl) and Sodium (Na) quite high and in Ameenpur, Faecal Coliform (E.Coli) was also found in ground water. The surface water in the Project Area is good for agricultural and all the parameters are within the limits prescribed in NEQS. The people of the Project Area use ground and surface water for their drinking and other needs of life. The surface and ground water present in the area will be used for construction works, however for drinking needs, filtered water will be provided to workers at those locations, where water is not suitable for drinking. The results of ground and surface water analysis are presented in Tables 4.7 and 4.8 respectively. Following are the surface water channels in the Project Area:

1. Jhang Branch Canal (32+600);
2. Dhaular Distributary m (44+600)
3. Nawabwala Distributary (48+500);
4. Titranwala Distributary (54+250);
5. Bhango Distributary (73+500);
6. Khewra Distributary (82+200);
7. Trimo Link Canal (111+000);
8. Haweli Canal (112+200);
9. Darkhana Distributary (131+350);
10. Goraga Distributary (144+900); and
11. Ravi River (145+250).

Table 4.7 – Surface Water Sampling						
Sr.No.	**Parameters**	**Ameen Pur near Check Post**	**Tama Bangla Canal (Gojra Jhang Road)**	**Toba Wariam Road Chak No.400**	**Bank of Ravi River (near Gas Station)**	**NEQS Limits**
A. Chemical Parameters						
1	pH (mg/L)	8.83	8.93	8.86	7.58	06-09
2	Biochemical Oxygen Demand (BOD_5)	7	9	12.5	29	80
3	Chemical Oxygen Demand (COD)	15	16	20	68	150
4	Total suspended solids (TSS)	20.5	31	45	323	200
5	Total dissolved Solids (TDS)	175.5	175	170	410	3500
6	Chloride (Cl)	10.64	10.64	9.75	60.8	1000
7	Fluoride (F)	ND	0.21	0.28	0.07	10
8	Dissolved Oxygen (DO)	4	4.5	5.6	11.2	-
9	Conductivity	309.5	293	288	595	-
10	Nitrates (NO_3)	4.2	4.3	4.3	0.1	-
11	Nitrites (NO_2)	ND	ND	ND	-	-
12	Sodium	7	7	8	1.0	-
13	Taste	Tasteless	Tasteless	Tasteless	-	-
14	Odor	Odorless	Odorless	Odorless	-	-
15	Total Alkalinity	115	110	125	-	-
16	Color	Colorless	Colorless	Colorless	-	-

17	Turbidity	10	15	28	-	-
18	Hardness	130	140	150	-	-
B. Micro-Biological Parameters						
1	Total Colony Count	TNTC/ ml	TNTC/ ml	780/ ml	-	*
2	Total Coli Forms	TNTC / 100 ml	TNTC / 100 ml	TNTC / 100 ml	-	*
3	Faecal Coliforms (E.Coli)	24/ 100 ml	6/ 100 ml	3/ 100 ml	-	*
4	Faecal Streptococci/Enterococci	Absent/ 100 ml	Absent/ 100 ml	Absent/ 100 ml	-	*

Table 4.8 – Ground Water Sampling

Sr.No.	Parameters	Faisalabad Sargodha Road	Painsera Bhawana Road	Gojra Jhang Road	Toba Wariam Road	Cantt Road Shorekot	Bank of Ravi River	Khanewal Multan Road	WHO Limits
A. Chemical Parameters									
1	pH (mg/L)	7.95	7.73	8.51	8.42	7.88	7.69	8.13	6.5 - 8.5
2	Total dissilved Solids (TDS) (mg/L)	2023	369	3915	34.98	1495	243	947	1000
3	Chloride (Cl) (mg/L)	524.7	10.86	825.9	740.91	489.2	37.4	159.1	250
4	Hardness (mg/L)	330	300	137.5	90	465	155.5	366.7	NS
5	Nitrates (NO_3) (mg/L)	6.7	5.5	14	11	5.7	-	-	50
6	Sodium (mg/L)	541	16	1040	1090	286	-	-	200

7	Turbidity (NTU)	ND	ND	ND	ND	ND	4	22	5
8	Fluoride (F) (mg/L)	0.91	0.31	1.04	0.54	0.6	-	-	1.5
9	Nitrites (NO_2) (mg/L)	ND	ND	ND	ND	ND	-	-	3
10	Arsenic (As) (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.01
B. Micro-Biological Parameters									
1	Total Colony Count	TNTC/ ml	3510/ ml	TNTC/ ml	TNTC/ ml	1812/ ml	-	-	*
2	Total Coli Forms	01/100 ml	Absent/100 ml	Absent/100 ml	TNTC/ 100 ml	53/100 ml	-	-	*
3	Faecal Coliforms (E.Coli)	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent / 100 ml	-	-	*
4	Faecal Streptococci/Enterococci	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent/100 ml	Absent / 100 ml	-	-	*

132. In June 2014 samples for the groundwater were collected from Chak 396 JB adjacent to Government Elementary School (86+700) and near end point of Section-II (Mouza 7-Ghag) at RD 120+200 community use hand pumps and tube wells as a source for drinking water and other domestic use in these areas.For the surface water, samples were collected from RD 59+200 Chak 305/JB and RD 119+500 in Mouza Rakh Kotla, the water channels at these locations are being presently used by the community for the irrigation purposes. Sample collection locations are shown in Figure 4.2.

133. Table 4.9 shows the quality of surface water and 4.6 shows the quality of ground water is being used for domestic purpose whereas surface water is used for agriculture requirements. The main source of drinking water in the Project area are wells whereas hand pumps are also used at some locations for domestic purpose. The groundwater and surface water monitoring was carried out in Year 2014.

Table 4.9– Surface Water Sampling (2014)

Sr.No.	Parameters	Adjacent to water course in Chak 305/JB RD (59+200)	At water course in Mouza Rakh Kotla RD (119+500)	WHO Limits
1	pH	8.5	8.5	6.5 - 8.5
2	Total dissolved Solids (TDS) (mg/L)	390	89	1000
3	Chloride (Cl) (mg/L)	34	14	250
4	Ca Hardness (mg/L)	62	10	NS
5	Nitrates (NO_3) (mg/L)	11	8	50
6	Sodium (mg/L)	130	30	200
7	Turbidity (NTU)	0	0	5
8	Fluoride (F) (mg/L)	0.27	0.17	1.5
9	Nitrites (NO_2) (mg/L)	0.08	0.06	3
10	Chromium (mg/L)	BDL	BDL	0.050
11	Temperature (^oC)	24	24	-
12	Total Hardness $CaCo_3$ (mg/L)	82.58	15.33	500
1	Total Coli Forms Number/100 ml	0	0	0/100ml
2	Faecal Coliforms (E.Coli) Number/100 ml	0	0	0/100ml
3	Chemical Oxygen Demand (COD) (mg/L)	118	132	150
4	Biological Oxygen Demand (BOD) (mg/L)	54	58	80

Table 4.10 – Ground Water Sampling (2014)

Sr.No.	Parameters	Adjacent to Govt.Elementary School for girls in Chak No.396 RD (86+700)	Near end point of Section-II (Mouza 7-Ghag) RD (120+200)	WHO Limits

1	pH	9.91	8.25	6.5 - 8.5
2	Total dissolved Solids (TDS) (mg/L)	1201	89	1000
3	Chloride (Cl) (mg/L)	68	14	250
4	Hardness (mg/L)	279.2	10	NS
5	Nitrates (NO_3) (mg/L)	11	8	50
6	Sodium (mg/L)	130	30	200
7	Turbidity (NTU)	0	0	5
8	Fluoride (F) (mg/L)	0.27	0.17	1.5
9	Nitrites (NO_2) (mg/L)	0.08	0.06	3
10	Chromium (mg/L)	BDL	BDL	0.050
11	Temperature (^oC)	26	24	-
1	Total Coli Forms Number/100 ml	0	0	0/100ml
2	Faecal Coliforms (E.Coli) Number/100 ml	0	0	0/100ml

Figure 4.2 (i) Shows the RD's on map for the samples taken for surface and the ground water

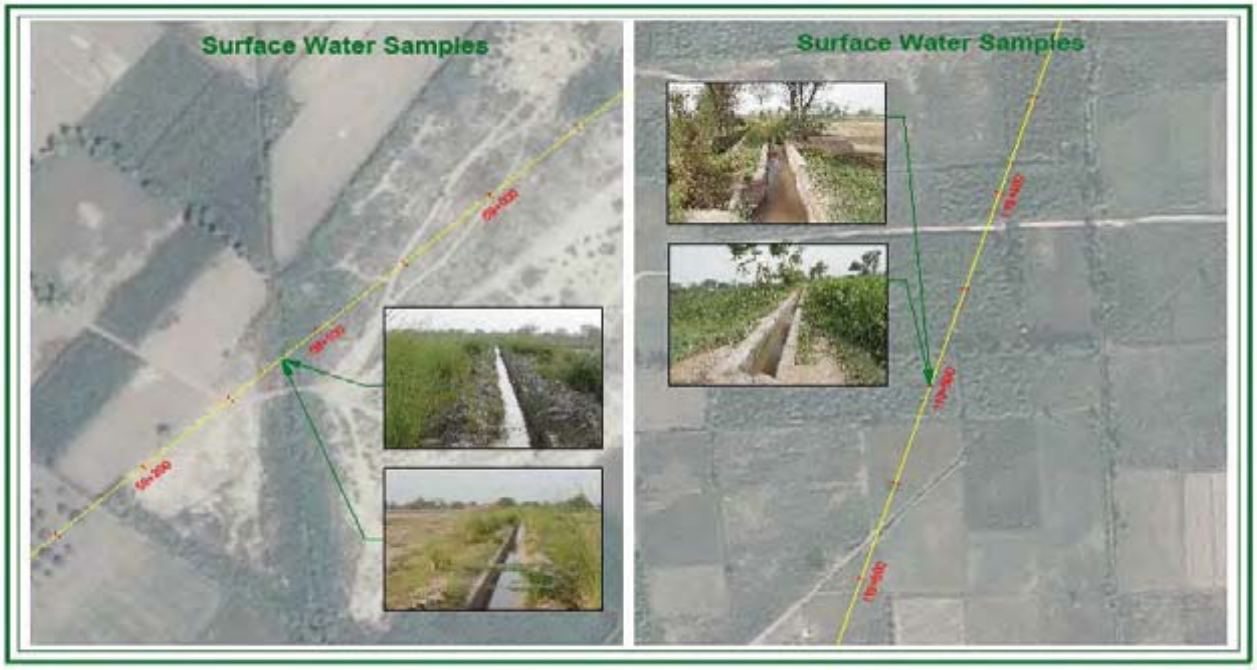
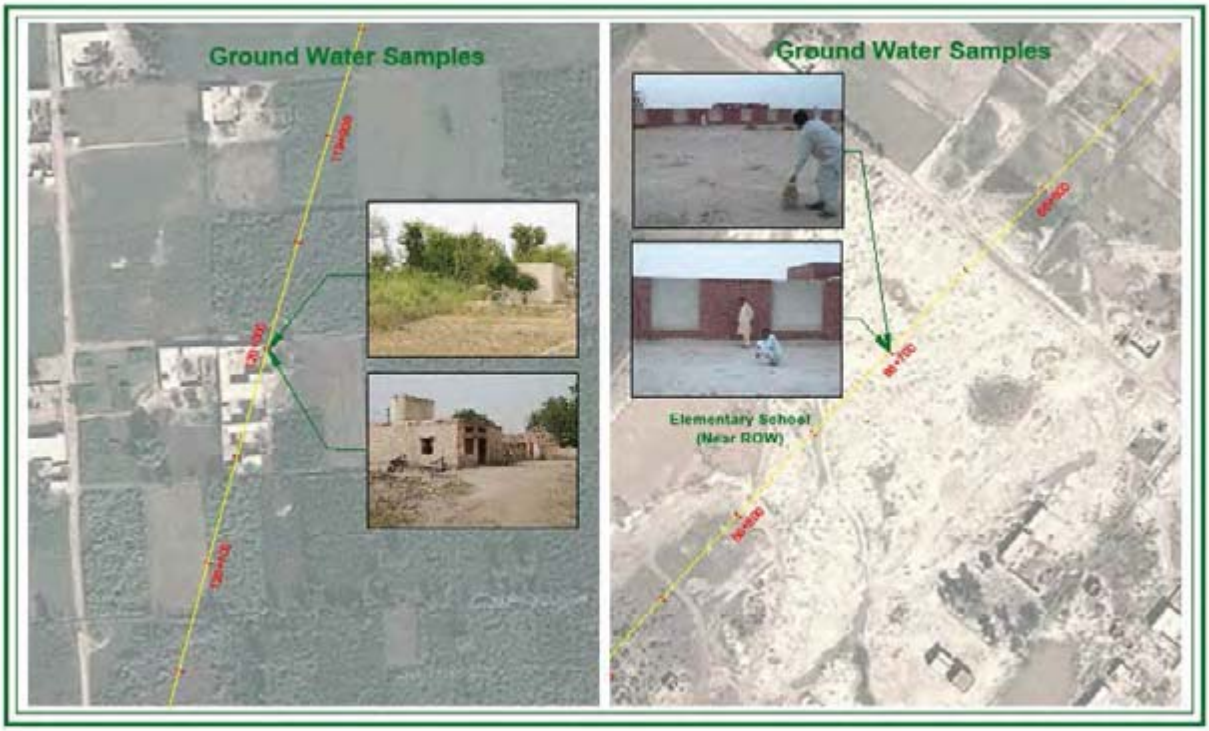


Figure 4.2 (ii) Shows the RD's on map for the samples taken for surface and the ground water



4.2.5 Topography and Geology

134. Topography of the Project Area is totally flat with mild slope from North to South. Project Area is 500 metre above the mean sea level. The soil of all four districts is fertile. The soil in the Project Area is rich alluvial loam. In Jhang district soil is part of Sandal Bar except rock that is not in Project Area. The sand is abundant in Ravi and Chenab river bed and this sand is superior for building material.

4.2.6 Seismicity

135. According to the seismic zoning map of Pakistan, the Project Area lies in Zone 1 of Modified Mercalli (M.M.) intensity scale, i.e. minor damage. Distant earthquakes may cause damage to structures with fundamental period greater than 1.0 second, corresponds to intensity V and VI of the M.M.

4.2.7 Agriculture and Crop Pattern

136. Agriculture along M-4 is predominantly irrigated agriculture. The Project Area depends on perennial canals from Sagir Head Works and Abdul Hakeem Head Works. The shortage of water is generally experienced in winter and in sowing season it greatly hampers Kharif cultivation.

137. The Project Area of M-4 Motorway passes through four districts. Cropping patterns in these districts are different from each other. In Faisalabad Sugarcane and Fodder is Kharif crop. In Toba Tek Singh Sugarcane, Maize, and Rice are Kharif crops. In Khanewal district Kharif season crops are Cotton, Rice and Sugarcane. Wheat is predominantly Rabi season crop of all areas. Table 3.8 represents the major crops and respective Tehsils of the Project Area. Cotton is also grown in some areas of Khanewal and Toba Tek Singh. Vegetables are grown in some areas of Faisalabad and Toba Tek Singh. Citrus orchards are found in district Toba Tek Singh and mango orchards are found in district Khanewal.

Table 4.11
Major Crops/ Cropping Pattern in the Project Areas

S. No.	Tehsil	Cropping Pattern	
		Rabbi	Kharif
1	Faisalabad	Wheat, Fodder	Sugarcane, Fodder, Rice, Potato
2	Gojra(District Toba Tek Singh)	Wheat, Vegetables	Sugarcane, Cotton, Fodder, Potato
3	Toba Tek Singh	Wheat, Fodder	Sugarcane, Cotton, Fodder
3	Shorkot	Wheat, Fodder	Rice, Sugarcane, Cotton
4	Kabir wala (District Khanewal)	Wheat, Gram	Rice, Cotton, Fodder, Vegetable
5	Khanewal	Wheat, Gram	Cotton, Rice, Sugarcane, Maize

Courtesy: Agriculture Extension Departments (Faisalabad, Toba Tek Singh, Jhang and Khanewal)

4.2.8 Industrial and Commercial Activities

138. The route of M-4 has been designed through agriculture fields therefore chances of commercial units along the route are negligible. Faisalabad the starting point of M-4 is famous all over the world for its textile industries but no textile unit is presently situated along the route. In districts of Toba Tek Singh and Jhang, very little commercial units i.e. only a few sugar mills and spinning units but none of them is along the RoW of the proposed Project. In Khanewal district Roshe Power Plant, a

hatchery and pesticide factory in the vicinity of the route where the route crosses Kabirwala-Khanewal road.

4.3 Ecological Resources

4.3.1 Flora

139. The Project Area falls under the Tropical Thorn Forest however, the natural vegetation has been replaced by the agricultural crops. Major crops grown in the area include wheat, oilseeds and fodder during winter, and sugar cane, maize, rice, fodder, and cotton in summer.

(i) Trees: Citrus and guava orchards are common towards the north eastern side, replaced by mango orchards towards south western end. Tree plantation campaigns have motivated the farmers to grow trees along the field borders or along the water channels. A total of 18000 trees were estimated to be growing in the project area. Shisham (Dalbergia sissoo) and Kikar (Acacia nilotica) are the main species. Other species growing in the area are Eucalypts (Eucalyptus camaldulensis), Semul (Bombax ceiba), Bakain / Dharek (Melia Azedarac), Jaman (Syzigium cumini), Sukh chain (Pongamia glabra), Mulberry (Morus alba), Beri (Ziziphus mauritiana) and Khajoor (Phoenix dactylifera). Roadside plantations running parallel or across the project area include Shisham, Kikar, Farash (Tamarix aphylla) and Eucalyptus. Bohr (Ficus bengalensis), Neem (Azadiracta indica), Ber and Bakain are commonly planted at the farm houses.

(ii) Natural Vegetation: Natural vegetation including Karir (Capparis aphylla), Aak (Calotropis procera), Kana (Saccharum bengalensis), Khabbal (Cynodon dactylon), Lamb (Aristida depressa), Gorkha (Lasiurus sindicus) is present only in the graveyards or at open areas along the existing roads and canals. Mesquit (Prosopis glandulosa) has invaded many open areas. Koondar (Typha angustata) grows along water ponds and wet places.

4.3.2 Fauna

i) Mammals

140. Naturally occurring mammals have also been eradicated with the removal of natural Tropical Thorn Forests only the agriculture associated species remain. Jackal (Canis aureus), Mongoose (Herpestes edwardsi and H. javanicus), Jungle cat (Felis chaus), Hedgehog (Hemiechinus collaris) and Five striped Palm squirrel (Funambulus pennantii) commonly occur. Porcupine (Hystrix indica) also occurs in the area. Small mammals including Bandicoot or Indian mole rat (Bandicota bengalensis), Soft furred rat (Millardia meltada), Field mouse (Mus musculus), Indian gerbil (Tatera indica), and House shrew (Suncus murinus) are the common pests of agricultural crops.

141. Domestic livestock include buffalo, cattle, goats and sheep. Donkeys are kept to pull carts in the area. Some farmers are also engaged in horse breeding. Camel may be found occasionally. Livestock are mainly farm fed. Goats and sheep herds may be raised by feeding on wastelands.

ii) Reptiles

142. Cobra (Naja naja), Saw scale viper (Echinus carinatus), Russell's viper (Daboia russelii russelii) Du-muhi (Eryx johnii) and Striped keelback (Amphiesma stolatum) are known to occur in the area. House gecho (Hemidactylus brooki) is common. Common tree lizard (Calotes versicolor versicolor) may also occur in orchards.

Monitor Lizard (Varanus bengalensis) and Fat tailed lizard (Uromastix hardwickii) occur in open areas. Two species of fresh water turtles viz., Indian soft–shell (Aspideretes gangeticus), and Indian flapshell (Lissemys punctata andersoni) have been reported. They are usually present near the ponds, canals and in the fields during the wet season.

iii) Amphibians

143. Bullfrog (Hoplobatrachus tigerinus), Pahari tidda maindak (Fejervarya limnocharis) and Indus valley toad (Bufo stomaticus) are also present in the area.

iv) Birds

144. Because of intensive agriculture pesticide use is a common practice. This has impacted the bird populations adversely. Black and Grey partridges (Francolinus francolinus and F. pondicerianus), are the worst hit as they are also hunted and captured to be kept as pets. Species known to occur in the area are: Cattle egret (Bubulcus ibis), pond heron (Ardeola grayii), Common and Bank myna (Acridotheres tristis and A. ginginianus), Red vented bulbul (Pycnonotus cafer), Jungle babbler (Turdoides striatus), Blyth's reed warbler (Acrocephalus dumetorum), Indian great reed warbler (A. stentoreus), Black kite (Mivus migrans), Black shouldered kite (Elanus caeruleus), Koel (Eudynamys scolopacea), Black drongo or King crow (Dicrurus macrocercus) Common crow (Corvus splendens), and house sparrow (Passer domesticus). Common quails (Coturnix coturnix) visit the area on their spring and winter migration.

4.3.3 Wetlands

145. There are no wetlands of significance in the vicinity of the Project Area. Sidhnai Barrage on the Rive Ravi is located about 4 km from the alignment of the Project Area near Abdul Hakim, but the wetland hardly ever gets the migratory waterfowl. Migratory waterfowl may however visit in small numbers the bed of River Ravi crossing the Project Area near Abdul Hakim during winter.

146. The Proposed road section also crosses canals and distributaries. Such areas do not support any populations of waterfowl; however canalside plantations support the population of song birds, species as already described.

4.3.4 Aquatic Biota

147. Aquatic fauna reported from the rivers and canals of the Project Area is mainly fish, which include the carp fishes viz., mori (*Cirrhinus mrigala*), thaila (*Catla catla*), rohu (*Labeo rohita*), silver carp (*Hypophthalmichthys molitrix*), gulpham (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*) catfishes viz., malli (*Wallago attu*), khagga (*Rita rita*), macchva (*Bugarius bugarius*), sanghara (*Mystus sienghala*) and exotic now naturalized tilapia species (Tilapia mozambica, T. nilotica, T. nilotica).

148. The welfare of fish depends on the availability of food which occurs in the form of invertebrate groups including Rotifers (*Brachionus, Synchaeta, Asplanchna*), Oligochaetes (*Stylaria, Nais*), Crustaceans (*Daphnia magna, D. longispina, Cyclops* sp.) and insects belonging to groups like Ephemeroptera, Plecoptera, Odonata, Megaloptera, Trichoptera, Diptera, Hemiptera and Coleoptera. The fauna is similar to that found in the fish farms established in central Punjab and in standing water.

149. The aquatic flora in the Project Area consists of species usually found in the standing water along the canals and fish ponds including *Typha angustata, Polygonum*

flaccidum, Vallisneria spiralis, Potamogeton graminea, P. crispus, Hydrilla verticillata, Monochoria vaginalis. No rare or endangered species occur in the Project Area.

4.3.5 Sensitive Areas

150. The nearest Protected Areas in the vicinity of the Project Area are Shorkot and Khanewal Irrigated Forest Plantations both located eight and ten kilometers from the alignment of the Project Area.

151. Shisham and Eucalyptus are grown as commercial crops. Both the plantations have been declared as Wildlife Sanctuaries. Black and Grey partridges, song birds, birds of prey, Wild boar, Jackal, Wild cat, Desert hare, Mongoose and Porcupine commonly occur. Cobra, Viper, Krait and Coluberids are the snakes. Hunting is not allowed in the Wildlife Sanctuaries but poaching is not uncommon.

i) Wildlife Sanctuaries: The Wildlife Sanctuaries are too far away from the Project Area to be affected in any significant manner.

ii) Archaeological site: There are no known sites of Archaeological or Cultural importance located within 1 Km of the Project Area.

iii) Wet Lands: There are no major wet lands in the Project Area. Small ponds were however observed to be scattered along the entire route of the Project.

4.3.6 Endangered Species

152. There are no faunal or floral species included in the Red Data Book of IUCN. Population of all bird species including black and grey partridges has however been reduced due to pesticide sprays on agricultural crops. Shisham trees have been dying off mainly because of drought conditions and may be due to some unknown disease which has not as yet been identified hence the number of Shisham trees has greatly been reduced in recent years. Eucalyptus has been blamed for transpiring excess water from the aquifer and as a result Government as a policy matter has forbidden it's planting on good lands especially along irrigated agricultural lands. Its planting in waterlogged and saline areas is advocated. Such areas hardly exist in the Project Area.

4.4 Socio-economic Environment

153. Motorway passes from rural areas of the Punjab and socio cultural conditions of all districts are almost same. Most of the people living in the surrounding villages are farmers, *Punjabi* is their mother tongue. In some areas *Saraiki* is also spoken as mother tongue. In almost all areas dress patron is same, *Shalwar kameez* and *dothi kurta* are the common dresses of males and females. Some modern young males also wear pants and shirts. The history of colonization exercised a profound influence on socio-economic pattern of the areas. People belong to different races but due to frequent inter-marriages, these castes have intermingled and it is now difficult to distinguish their entity and thus tribal system is no more dominated in the culture. In fact a common culture has emerged. Most of the people are engaged in agriculture or agro based businesses. Almost all the land holders have landholding size around 10 Acres therefore they belong to lower middle class. The information given in this section is collected in the socioeconomic survey conducted between January 2007 and February 2007. For the updation of the EIA report for section-II of M-4 new survey was conducted in June and October 2014 the gathered information shows the same scenario as it was in 2007.

4.4.1 Demographic Profile

(a) Faisalabad Tehsil

154. Total population of Faisalabad Sadar Tehsil was 924,110 with a growth rate of 1.94% as recorded in 1998 Census. Population composition was 108 females as compared to 100 males. 97% of the population resided in rural areas and just 3% lived in rural areas. Average household size was 7.4.

(b) Gojra

155. This Tehsil had a population of 495,096 with a growth rate of 1.94%, as recorded in 1998 Census. Population composition was 105 females compared to 100 males. 24% population resided in urban areas and 76% lived in rural areas. Average household size was 7.2.

(c) Toba Tek Singh

156. Total population of the Tehsil was 617,035 with a growth rate of 2.07% as recorded in 1998 Census. Population composition was 107 females compared to 100 males. 90% of population resided in rural areas and just 10% lived in urban areas. Average household size was 5.6.

(d) Shorkot

157. Tehsil had a population of 670,255 with a growth rate of 2.23% as recorded in 1998 Census. Male to female ratio was 108:100. Eighty five (85) % of population resided in rural areas and 15% lived in urban areas. Average household size was 6.9.

(e) Kabirwala

158. Total population of the Tehsil was 659,612 with a growth rate of 2.19% as recorded in 1998 Census. Population composition was 107 females compared to 100 males. 15% population resided in urban areas and 85% lived in rural areas. Average household size was 7.3.

4.4.2 Settlement Patterns

159. M-4 starts from Faisalabad district and ends in Khanewal district. It passes from tehsil areas of Faisalabad, Gojra, Toba Tek Singh, Shorkot, Kabirwala and Khanewal. In tehsils of Faisalabad, Gojra and Toba Tek Singh, people live in villages and a few people live in their farm houses (Bhanis, Deras), therefore very few house and civic structures is coming in the Row. On the other hand in tehsils of Shorkot, Kabirwala and Khanewal, there is no formal pattern of villages establishing and people make their homes in their agriculture lands which is colloquially called Dera or Bhani, in this portion of road many houses and residences are coming in the RoW.

4.4.3 Races and Tribes

160. The population of these all districts is derived from Semitic or from indo-Aryan races. Most of these tribes are predecessors of different tribes who came with different attackers from Afghanistan and Central Asia and remained here. In colonial age British government developed canal command systems in these districts and did first land reforms in 1902. At that time British government allotted agricultural land to different farmer tribes and settled them here by bringing them here from different central districts of the combined Punjab like Sialkot, Amratsar, Gurdaspur,

Gujranwala, Gujrat and other areas. At the time of partition in 1947 (the largest migration of human history) many refugees from Indian Punjab also settled in these areas. These tribes who came here from different regions were also of same clan who used to already live here. By living here side by side from centuries, homogeneity of culture and races has been developed among these people because of blood relations with each other. Generally these tribes can be divided in two classes, farmer tribes and non farmer tribes. Farmer's tribes are those who are mainly involved in farming and non farmer's tribes are those who are engaged in allied agro professions.

4.4.4 Indigenous People

161. Although people living around the project areas belong to different races and tribes and have different cast pattern but there is no community identified who has close culture, close economy and close community (Confined to a limited area). Therefore no any indigenous community exists and there is no danger of elimination or affecting negatively of any community by the proposed project execution.

4.4.5 Caste System

162. Project Area lies in rural areas of the Punjab. Following caste and tribes were identified during the field survey.

Table 4.12
List of Different Castes in Respective Tehsils

S. No.	Tehsils	Castes
1	Faisalabad	Sayyed, Jatt, Arain, Malik, Rajput,Sheikh
2	Gojra	Sayyed, Jatt, Arain, Malik, Rajput, Sheikh
3	Toba Tek Singh	Sayyed, Jatt, Arain, Malik, Rajput, Sheikh
4	Shorkot	Sayyed, Naul, Supra, Sheikh
5	Kabirwala	Sayyed, Haraj, Gill, Mohanas, Wahlas, Noon, Rajput Sanghara, Bandash, Mughal, Sheikh
6	Khanewal	Sayyed, Haraj, Gill, Sanghara, Bandash, Mughal, Sheikh

Source: EIA Field Survey Team (NESPAK)

4.4.6 Religion

163. Religion plays a vital role in people's life. Majority of the Project Area population is Muslim. Cultural festivals are mostly related with religious traditional events. The visit to shrines (termed as Ziarat) is a very common among people. Only minority identified are Christian in the areas which are less than 1 percent.

4.4.7 Socio-economic Survey

164. The information regarding socio-economic conditions is derived from primary and secondary sources. Methodology adopted for survey was based on collection of comprehensive information by utilization of all available resources with time effectiveness. The detailed socioeconomic survey was conducted from 19.01.2007 to 27.01.2007 to analyse the socioeconomic impacts and the concerns of the people of the Project Area. Following methodology was opted for socioeconomic survey, census of all affectees and development of baseline socio-economic conditions.

4.4.8 Methodology

165. To study the socioeconomic condition of the project area all available resources were utilized for this purpose first of all reconnaissance survey was conducted by the

Consultant team. Then a comprehensive field survey was carried out afterward. During this survey, primary data was collected through following data collection tools:

(i) Village Profile
(ii) Household census survey
(iii) Survey of all commercial structures
(iv) Socio-economic survey
(v) Women survey

166. Village profile, which contained comprehensive socio-economic information regarding village was filled for all the villages situated along the route. Household survey forms and commercial forms were filled by all the houses and commercial units which were falling within the RoW. To develop the socio-economic baseline, socio-economic survey and women survey were carried out from 200 males and 100 females randomly from all areas along the Project route.

167. Beside this primary information collected directly from the field. Information from secondary sources was also collected. For this purpose all available documents were studied i.e. (District Population Census Reports 1998 for the concerned districts, Design utility folders, prepared by the design Engineering consultants, IUCN literature and Asian Development Bank Guidelines for socio-economic survey. Meetings were done with the officials of revenue, agricultural and irrigation departments; feed back of all these meetings is also kept in view in study of socio-economic environment.

4.4.9 Analysis of the Respondents

168. Totally 200 questionnaires were filled from males and 100 from females at different locations in the Project Area. In these respondents people from all walks of life was included like residents of surrounding localities, passengers, key influential persons, protagonists of the village communities, women and all possible potential stakeholders. These respondents were representative of all walks of life with different professional back grounds. These people are also consulted regarding problems forecasted by them by the construction of M-4. Beside this focus group sessions were also carried out in the villages adjacent to the RoW to know the view point of general public.

4.4.10 Population Composition

169. Following population composition: male to female population ratio is based on the finding of data collected from the field.

Table 4.13
Population Composition

S. No.	Tehsils (Talukas)	Male(%age)	Female(%age)	Total
1	Faisalabad	52	48	100
2	Gojra	49	51	100
3	Toba Tek Singh	51	49	100
4	Shorkot	52	48	100
5	Kabirwala	52	48	100
6	Khanewal	51	49	100

Source: EIA Field Survey Team (NESPAK)

4.4.11 General Profile

170. Out of the 200 male respondents, 71% were married, 29% were unmarried, 55% were literate, 45% were illiterate, 63% were employed and 37% were unemployed (including students). Table 4.14 presents the general demographic profile of the Project Area.

Table 4.14
General Profile of Male Respondents

S. No.	Respondents	No.	Percentage (%)
1	Married	142	71
2	Unmarried	58	29
3	Literate	111	55
4	Illiterate	89	45
5	Employed	126	63
6	Unemployed	74	37

Source: EIA Field Survey Team (NESPAK)

171. Out of the 100 female respondents, 67% were married, 31% were unmarried, 31% were literate, 69% were illiterate, 26% were employed and 74% were unemployed (including students). Table 4.15 presents the general demographic profile of the Project Area.

Table 4.15
General Profile of Female Respondents

S. No.	Respondents	No.	Percentage (%)
1	Married	67	67
2	Unmarried	33	33
3	Literate	31	31
4	Illiterate	69	69
5	Employed	26	26
6	Unemployed	74	74

Source: EIA Field Survey Team (NESPAK)

4.4.12 Respondents' Age Group

172. Respondents were selected from various age groups. 18% of the respondents were less than 25 years old, 20% belonged to age group between 26 to 35 years, 22% fell in the age group between 36 to 45 years, 20% between 46 to 55 years and 20% of the respondents were more than 56 years old. Table 4.16 presents the distribution of respondents according to age group.

Table 4.16
Respondents' Age Group

S. No.	Age Group	Both Sexes	Percentage	Male	Percentage	Female	Percentage
1	15-25	54	18	40	20	14	14
2	26-35	60	20	34	17	26	26
3	36-45	66	22	38	19	28	28
4	46-55	60	20	36	18	24	24
5	56-65	60	20	52	26	8	8
		300	**100**	**200**	**100**	**100**	**100**

Source: EIA Field Survey Team (NESPAK)

4.4.13 Education Level

173. Literate respondents had different education levels. Out of 142 literate respondents: 30% had primary level of education, 28% had education up to Matriculation and 24% had qualification up to intermediate and 26% were graduate or postgraduate. Educational status of the respondents is shown in the Table 4.17.

Table 4.17
Educational Status

S. No.	Education level				
1	Respondents	Primary	Middle/ Secondary	Intermediate	Graduation/ Post Graduation
2	Male	32	32	27	20
3	Female	10	8	7	6
Total		**42**	**40**	**34**	**26**
Percentage		**30**	**28**	**24**	**18**

Source: EIA Field Survey Team (NESPAK)

4.4.14 Social Amenities

174. During socio-economic survey to develop the social baseline of the Project Area, the respondents were inquired about the utilities in their homes. Almost all the respondents had electricity in their homes whereas 95% had the facility of water supply in their homes. On the other hand 54%, 23% and 15% of the respondents respectively had the facility of sewerage system, landline phone and Sui gas at their homes. Table 4.18 presents the social amenities available in the area.

Table 4.18
Social Amenities

S. No.	Social Facility	Number	Percentage (%)
1	Electricity	190	95
2	Sewerage(open Drains)	109	54
3	Telephone(Land Line)	46	23
4	Water Supply	30	15
5	Sui Gas	17	9

Source: EIA Field Survey Team (NESPAK)

4.4.15 Professional Status

175. Table 4.19 presents the professional status of the respondents. 29 % of the respondents were farmers. Among the respondents “economically active”, 29 % were farmers, 16 % were businessmen and 10 % were labourers. 17% respondents were engaged in allied agriculture professions, like cattle farming, milk selling etc., 17% respondents were unemployed.

Table 4.19
Professional Status

S. No.	Profession	Number of Respondents	Percentage (%)
1	Agriculture	58	29
2	Business	33	16
3	Labor work	19	10
4	Service	14	7
5	Agro based Business	42	21

S. No.	Profession	Number of Respondents	Percentage (%)
6	unemployed	34	17
		200	**100**

Source: EIA Field Survey Team (NESPAK)

4.4.16 Household Income Levels

176. During the socio-economic survey, respondents were inquired about their total monthly income from all sources. Table 4.20 shows the income levels of the respondents. Majority of the respondents i.e. 23% had their income ranging between Rs.10000-15000/month. 19% had income below Rs.5000/month. 22 % respondents belonged to the income group ranging between Rs.5000-10000/month, 19% between Rs.15,000 to 20,000/month and just 17% had an income more than Rs.25,000/month.

Table 4.20
Income Levels

S. No.	Monthly Income Group (Pak Rs.)	Number	Percentage
1	1,000-5,000	39	19
2	5,000-10,000	44	22
3	10,000-15,000	46	23
4	15,000-20,000	38	19
5	25,000+	33	17
		200	100

Source: EIA Field Survey Team (NESPAK)

4.4.17 Land Holding

177. During the survey it was identified that about 29% of the respondents belonged to the agricultural sector and some of those respondents had leased out their lands as a second business/ source of income. Majority of the respondents had very small land holdings; almost 83% of the respondents had landholdings of less than 10 acres. Only 2% had landholdings of more than 20 acres. The land holding status of the respondents is shown in Table 4.21.

Table 4.21
Land Holding

S. No.	Land in Acres	No.	Percentage (%)
1	1-5	30	52
2	5-10	18	31
3	10-15	6	10
4	15-20	3	5
5	20+	1	2
		58	**100**

Source: EIA Field Survey Team (NESPAK)

4.4.18 Borrowing Status

178. During the public consultation it was identified that a reasonable proportion of the respondents, i.e. 37 % had borrowed money from different sources such as Agriculture Bank, feudal lord, or relatives. Table 4.22 shows the barrowing status of the respondents.

Table 4.22
Borrowing Capacity

S. No.	Borrowing Status	Number	Percentage (%)
1	Under debt	81	37
2	Without any debt	119	63
		200	**100**

Source: EIA Field Survey Team (NESPAK)

4.4.19 Housing Characteristics

179. 29% of the respondents live in kacha houses, 45% respondents have semi pacca houses and 26% live in kacha (mud) houses. Table 4.23 shows the characteristics and percentage of houses in the Project Area.

Table 4.23
Types of Construction

S. No.	Construction Type	Number	Percentage
1	Kacha	58	29
2	Semi Pacca	90	45
3	Pacca	52	26
		200	**100**

Source: EIA Field Survey Team (NESPAK)

4.4.20 Gender Component

180. Gender is a critical issue that is connected to any sustainable development process, which is usually perceived as woman specific issues. In order to assess the socio-economic condition of the women of the area, a Gender component survey was conducted by taking a reasonable sample of women. A total of 100 women from the project area were interviewed by the female staff, so that they could feel comfortable. Regarding the level of awareness about the project, mostly the women were aware about the construction of Road project.

181. Table 4.24 shows the condition of women surveyed according to the table 23% women surveyed had access to school 45% had access to college level education and only 32% ladies had access to university level education this shows that they were free in getting education if they like and these educational facilities were in their surrounding. On the other hand 26% women consult leady health visitor, 18% consult government doctor, 32% consult private doctor and 24% consult quacks in case of sickness.

Table 4.24
Social Condition of Women of the project Area

Age	Access to Education Facility			Access to Health Facility			
	School	College	University	Lady Health Visitor	Govt Doctors	Private Doctors	Quacks
16-25	12	11	6	6	4	4	2
26-35	8	6	5	5	2	4	4
36-45	2	11	7	7	6	6	4
46-55	1	9	8	5	2	10	6
56& above	-	8	6	3	4	8	8
	23	**45**	**32**	**26**	**18**	**32**	**24**
	23	**45**	**32**	**26**	**18**	**32**	**24**

Source: EIA Field Survey Team (NESPAK)

4.4.21 Culture and Tradition

182. The food of the inhabitants is very simple. Maize, wheat and rice are eaten in the project area. The use of Desi ghee and lassi is very popular in the rural area. Milk is also available in sufficient quantity. The people of the area are fond of meat especially various forms of beef. The use of ornaments among the females is also common. The females decorate themselves with ear-ring and bangles with rare use of cuba (egg like cups), connected by chains or a flat circle shaped gold hanging on fore-head.

4.4.22 Education Facilities

183. Educational facilities in the Project Area are not inadequate, but quality of education is not up to the merit. Respondents showed their apprehensions about the quality of education. In total 103 villages situated along the road totally 88 government schools for boys and 98 schools for girls beside this there was 92 private schools were also found in these villages during field survey. Table 4.25 below shows the status of educational institution along the CoI.

Table 4.25
Education Facilities in the Project Area

S. No.	Govt. Schools	Male	Female	Private School (Male+Female)
1	Primarry	54	61	58
2	Middle	25	27	26
3	High	9	10	8
Total		88	98	92

Source: EIA Field Survey Team (NESPAK)

4.4.23 Roads and Communication

184. Communication network is a fundamental prerequisite for economic activity to take place. The surrounding villages of the project area are well connected with main road and district headquarters through metalled roads.

4.4.24 Concerns Regarding the Project

185. During the field survey people were inquired about their views regarding the proposed Project. People have positive thinking and hopes about the project but fears and doubts for unforeseen issues are also in their minds. Almost all the people showed their concerns regarding the proposed Project. Respondents had multiple choices and they gave more than one response. The frequency of the responses of the respondents is shown in Table 4.26 below.

Table 4.26
Stakeholders Concerns

S. No.	Concerns	No. of Respondents
1	Livelihood will be disturbed in case loSingh agriculture land and businesses	287
2	People will never given judicious compensation against land acquired	273
2	Residential area will be affected	102
3	No compensation payment is given to affectees, especially tenant	162
4	Jobs will not be provided to local people	130

S. No.	Concerns	No. of Respondents
	during construction	
5	Privacy will be disturbed due to construction work	132

Source: EIA Field Survey Team (NESPAK)

4.4.25 Resettlement Issue

186. During the detailed field visit resettlement issues were critically observed. During the survey it was identified that designer has tried to avoid the settlements. During the detailed field visit it was found no archaeological site or graveyard, no any other structure of religious value or cultural importance is going do be demolished due to the execution of the proposed project. Only one Jamia mosque in Shorkot tehsil adjacent to a farm house needs relocation. Almost 200 house and 20 shops will need relocation for execution of the project. 80% of these houses are pacca (cement and brick masonry) and 20% of these house are made of mud and bricks.

4.4.26 Non-Governmental Organizations (NGO's)

187. In these districts and particularly in rural areas of these districts no international NGO's is working. The only non government organization working in these rural communities is Punjab Rural Support Programme. The main focus of this organization is on agriculture, health and infrastructure.

SECTION 5

PROJECT ALTERNATIVES

5.0 General

188. It is very important to evaluate different alternatives to arrive at the best possible option. Different alternatives were taken into consideration at the design stage of the proposed Project at the time of performing the EIA for the complete alignment and they are briefly described in the following paragraphs:

5.1 Alternative-1: No Project

189. According to the Traffic Projection Survey, it is estimated that in the future years, large number of people will be using the Faisalabad-Khanewal Motorway (M-4). According to the survey, total daily traffic will increase and attain rate of 7.49 per cent per year up to the year 2010 and it will be 7.08 per cent up to the year 2020. At the start of operation of the proposed Project, it is estimated that there will be approximately 13,035 vehicles using the proposed Motorway Project.

5.2 Alternative-2: Pindi Bhattian to D.G. Khan Motorway (NHA Selected Alternative) - Motorway Length 370 kms (approximately)

190. This Corridor was preferred by National Highway Authority. From Pindi Bhattian, it passes well to the north and west of Faisalabad, and then south westwards past Jhang about 15 kms to the north west of that town. It then leads straight to the City of Shorkot and crosses the River Chenab on a new bridge near the existing pontoon bridge. From this bridge, it leads south west across the Thal Desert to the River Indus approximately 25 kms downstream of the Taunsa Barrage. Having crossed the River Indus, it skirts the west and south of D.G. Khan allowing for future connections to Gawadar, Karachi etc.

5.3 Alternative 3: Pindi Bhattian to D.G. Khan Motorway (Punjab Government Selected Alternative) - Motorway Length 375 kms (approximately)

191. The Corridors preferred by NHA and the Government of Punjab are co-incident from Pindi Bhattian to Shergarh in the Thal Desert. From Shergarh, the option selected by the Government of Punjab follows the right bank of the River Chenab passing Muzaffargarh to the north-west and crossing the River Indus 15 kms south of the existing bridge. The suggested alignment then swings to west 20 kms south west of D.G. Khan.

5.4 Alternative 4: Pindi Bhattian to D. G. Khan Motorway (BCEOM and NESPAK Selected Alternative) – Motorway Length 405 kms (approximately)

192. This Corridor was proposed by BCEOM (French Engineering Consultants) and NESPAK (a joint venture). It was divided into the following three Sections and in each section (with the exception of Section 3) four alternatives were taken into consideration.

Section 1: Pindi Bhattian – Shorkot Cantonment

193. Within Section 1, the following four possible alternatives were considered as A, B, C and D:

Alternative A passes west of Faisalabad and then swings west towards Jhang before turning south to Shorkot Cantonment;

Alternative B follows the same route as Alternative A as far as Faisalabad and then takes a shorter direct route to Shorkot Cantonment;

Alternative C from Pindi Bhattian passes Faisalabad to the east and then turns sharply to the west to join Alternative B; and

Alternative D follows the same route as Alternative C to Faisalabad and then takes a shorter direct route to Shorkot Cantonment.

Section 2: Shorkot Cantonment – Muzaffargarh

194. Within Section 2, the following four possible alternatives (A, B, C, D) were considered:

Alternative 'A' strikes west from Shorkot Cantonment to cross the River Chenab downstream of the existing pontoon bridge to the west of the City of Shorkot. It then passes through the thinly populated area referred to as the Thal Desert before turning south to the west of Multan. This alternative avoids a crossing over the River Ravi.

Alternative 'B' strikes south from Shorkot Cantonment crossing the River Ravi near the existing bridge and then swinging south west to pass to the north and west of Multan near the airport.

Alternative 'C' follows the same route as Alternative B but continues south passing to the north of Khanewal and south and east of Multan.

Alternative 'D' takes a south to south easterly direction from Shorkot Cantonment crossing the River Ravi upstream of the existing bridge and continuing south of Khanewal to join Alternative C to the south-east of Multan.

Section 3: Pindi Bhattian – Shorkot Cantonment

195. This section crosses both the River Chenab and River Indus. The constrains imposed by these major physical features are such that it was felt that advantage had to be taken of the existing investment in, for instance, the extensive training works. No alternatives are therefore proposed. The only feasible route is along the existing corridor. All the above Sections and the corresponding alternatives were compared on the basis of these criteria i.e. length, traffic, hydrology and major bridges. The results obtained through the comparative analysis indicated Corridor C as preferred alternative in Sections 1 and 2. In Section 3, only the existing corridor was considered and was retained.

5.5 Alternative 5: Sheikhupura – Multan – D. G. Khan Motorway

196. The Sheikhupura – Multan – D.G. Khan section of Pakistan Motorway would start from Lahore – Islamabad section of Motorway in the vicinity of the city of Sheikhupura and move in the south-westerly direction, crossing Sheikhupura – Pindi Bhattian Road on the eastern side of Farooqabad Town. The existing Lahore – Sheikhupura – Faisalabad Road is crossed by the Project Motorway on the eastern side of the town of Manawala. Traversing through the agricultural areas, the alignment passes almost midway between the city of Faisalabad and Jaranwala Town. Passing south of Faisalabad and after crossing over the Faisalabad – Dijkot Road, the alignment takes west wardly turn to bypass the town of Gojra from north-western side. After crossing Jhang – Toba Tek Singh Road, it passes almost midway between Shorkot City and Shorkot Cantonment avoiding the sensitive defence

related area. The River Ravi is proposed to be crossed between old Sidnahi and New Sidnahi barrage where river bed is well-defined, stable and straight. Passing almost midway between Khanewal and Kabirwala, the alignment crosses over National Highway (N-5) near Khanewal before moving further towards the city of Multan. While passing south of Multan, various radial roads such as Multan – Jahania, Multan – Dunyapur, Multan – Bahawalpur (N-5), and Multan Shujahabad are crossed over by this Motorway. Between Multan and D.G. Khan, the Motorway are east-west, crossing the Rivers Chenab and Indus 8-10 kms downstream of the existing bridge.

197. The total Motorway length has been calculated as 402 kms approximately and divided into four sections as described below:

From M-1 near Sheikhupura to Faisalabad – Dijkot Road, length 103 kms (approximately)

From Faisalabad – Dijkot Road to Shorkot – Shorkot Cantt, length 102 kms (approximately)

From Shorkot – Shorkot Cantt Road to Multan – Bahawalpur Road, length 112 kms (approximately)
From Multan – Bahawalpur Road to D.G. Khan – Karachi Road (N-55), length 85 kms (approximately)

5.6 Alternative 6: Faisalabad – Khanewal Motorway (M-4)

198. This option was selected by considering the factors such as low resettlement cost, less environmental damage and mitigations cost, high speed, safe, shorter distance and the linkage with existing Pindi-Bhatiyan-Faisalabad Motorway. As this Motorway Project consists of complete new alignment therefore there will be no disruption to the existing traffic system during construction. The construction of the proposed Motorway will lessen the burden of the existing Faisalabad-Khanewal road and will also decrease travel time for non-stop travellers from Faisalabad to Kanewal and other cities close to interchanges. It will also minimise resettlement of structures and other utilities. Provision of new Interchanges at various road crossings will facilitate the traffic joining Motorway and leaving it.

5.7 Project Alternatives and Impacts on Environment, Social and Economic Conditions

199 All the above mentioned alternatives were considered with respect to their impacts on environment, social and economic conditions. Table 5.1 presents summary of these alternatives and their respective impacts.

Table 5.1

Comparative Analysis of Different Project Alternatives

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
Alternative 1: No Project	Increased air and noise pollution due to traffic jams on the existing Faisalabad – Khanewal Road – Higher emissions of CO, NO_x, SO_x, PM_{10}, Volatile Organic Compounds (VOC), and Photochemical Oxidants will affect the environment in the following ways: ▪ Damage to plants by choking the leaf pores and restricting photosynthesis; ▪ Impairment of atmospheric visibility affecting transportation safety; ▪ Deterioration of aesthetic quality of atmosphere, land and water; ▪ Soiling of materials, physical properties and infrastructure; ▪ Chlorosis and Plasmolysis in plants; ▪ Damage to materials and property, by acid rains, resulting from oxidation of sulphur oxides to sulphuric acid, after reacting with water vapours; ▪ Formation of photochemical oxidants; ▪ Damage to materials and property, by acid rains, resulting from oxidation of oxides of nitrogen to nitric acid, after reacting with water vapours; ▪ Retardation of growth in plants; ▪ Leaf discoloration and cell collapse in plant; and ▪ Damage to rubber, textiles, paints	▪ Longer travelling times ▪ Traffic accidents ▪ Health impacts due to air and noise pollution caused by increased traffic load on the existing Faisalabad – Khanewal Road	The increased traffic load on the existing Faisalabad – Khanewal Road in future will not only cause traffic jams but also deteriorate its condition thus affecting trade activities in different parts of the country. This will be a major economic impact. Other associated impacts include increased fuel cost and wear and tear of vehicles.

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
	and other materials.		
Alternative 2: Pindi Bhattian – D.G. Khan Motorway (National Highway Authority Alternative) – 370 kms	▪ It will pass through the unproductive Thal Desert for a distance of 75 kms. ▪ Positive impacts on air and noise during the operation phase	▪ Little land acquisition and compensation. ▪ Considerable distance from N5, being at the closest a distance of 45 kms away from Multan. ▪ It will not provide easy or short length access to Multan, Muzaffargarh and Khanewal.	▪ It will open-up new areas for Industrial Development subject to the provision of necessary infrastructure support. ▪ This route would include two of the most expensive and time-consuming bridge river crossings over the Indus and Chenab, which could jeopardize the implementation schedule. ▪ Less attractive to intercity traffic. ▪ Having crossed the River Indus, it skirts the west and south of D.G. Khan allowing for future connections to Karachi, Gawadar etc.
Alternative 3: Pindi Bhattian – D.G. Khan Motorway (Punjab Government Alternative) – 375 kms	▪ It will pass through the Thal Desert area for a distance of 75 kms immediately west of the Chenab River. ▪ Positive impacts on air and noise during the operation phase	▪ It is well away from N5. ▪ No easy or short access to Khanewal.	▪ It will open up new areas for possible development. ▪ This alignment will pass closer to both Multan and Muzaffargarh at 20 kms and 10 kms respectively. ▪ It will demand a new link road to Multan and for this purpose requiring a new bridge over the Chenab River ▪ It will demand three expensive bridges over crossings. ▪ Less attractive for the development of inter-city traffic. ▪ Technical risks on these river crossings could jeopardize the overall implementation schedule.
Alternative 4: Pindi Bhattian - D.G. Khan Motorway (BCEOM-NESPAK alternative) – 405 kms	Positive impacts on air and noise during the operation phase	▪ The proposed will pass closer to the major population centres throughout the province of Punjab and ease their links with the capital Islamabad. ▪ This Motorway Corridor will serve the maximum number of potential Motorway users. ▪ It will provide a by-pass route to the towns	▪ It will promote the most economical bridge over crossings in terms of both capital expenditure and time of construction period. ▪ This Motorway Corridor will best serve the present inter-city traffic and will allow for the development of services once constructed.

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
		of Faisalabad and Multan. ▪ The likely impact on acquisition and compensation for agricultural lands is more than for Alternatives 2 and 3.	▪ By locating the proposed M1 (referred to as Lahore – Islamabad Motorway in 1992) and M3 (referred to as Pindi Bhattian – D.G. Khan Motorway in 1992) Motorway interchange at 15 kms short of Pindi Bhattian and passing south of Faisalabad, it will make this corridor more attractive for Lahore to Faisalabad traffic. ▪ It will not be the shortest route from Islamabad to Karachi.
Alternative 5: Sheikhupura – Multan-D.G. Khan Motorway (BCEOM-NESPAK alternative) – 402 kms	▪ It will traverse through the flat agricultural areas where numerous villages are located. The proposed alignment will help in maintaining sufficient desired distance from the villages all along the alignment and thus results in minimum disturbance to the village life. ▪ The alignment will be aesthetically pleasing and will blend well with topography. ▪ Positive impacts on air and noise during the operation phase	▪ The Motorway alignment has been fixed keeping in view the extent of the existing urban areas and possible future extensions in foreseeable future. ▪ After crossing Jhang – Toba Tek Singh Road, it will pass almost midway between Shorkot city and Shorkot cantonment avoiding the sensitive defense related area. ▪ The city of Sheikhupura itself is on the southern side not very far from M1 (referred to as Lahore – Islamabad Motorway in 1992) alignment, which makes it difficult to create another take off point for the project motorway because otherwise built up area shall have to be acquired. ▪ The motorway end point has been selected on Indus Highway (N-55) about 8 kms south of D.G. Khan well clear of existing urban area and to allow for future expansion of the city.	▪ Combination of the already planned interchange on Sheikhupura – Gujranwala road with the new interchange required for this Project will result in a very complicated and expensive arrangement.
Alternative 6: Faisalabad – Khanewal Motorway (M-4) – 184 kms	▪ Positive impacts on air and noise during the operation phase ▪ Less environmental damage. ▪ Less mitigation cost	▪ It will reduce traffic congestion and travel time by providing safe and good quality route for movement of people and goods. ▪ It will minimise resettlement of structures and other utilities.	▪ The Motorway will enhance economic development by providing high speed safe trade corridor for the movement of goods and passengers to and from other areas of the Province. ▪ Less fuel consumption

Project Alternatives	Impacts		
	Environmental	**Social**	**Economic**
			▪ Less wear and tear ▪ Due to shorter route comparatively less resettlement of structures ▪ Comparatively low resettlement cost.

5.8 Selection of the Preferred Alternative

200. The alternatives (2-5) were studied in the year 1992 for the Motorway (M-3) from Pindi-Bhattian to D. G. Khan (later named as Sheikhupura – Multan - D.G. Khan Motorway). Frequent changes have been made ever since. M-1 (formerly used for Lahore – Islamabad Motorway) was replaced with M-2. M-1 is now meant for Islamabad – Peshawar Motorway, which is now operational. M-3, being approved by NHA, was supposed to start from Sheikhupura and end all the way up to D. G. Khan. But later on, the former M-3 (Pindi Bhattian to D.G. Khan Motorway) was confined to Pindi Bhattian – Faisalabad Motorway with modifications in the design especially in the Section between Pindi Bhattian to Faisalabad. M-4 (the preferred alternative) is a part of the formerly known M-3 Project (Pindi Bhattian to D.G. Khan), and it will start from Faisalabad and end at Khanewal while traversing along a number of cities such as Gojra, Toba Tek Singh, Shorkot Cantt and Kabirwala. Minor modifications have been made especially near Faisalabad and rest of the route follows the same route as approved by NHA under the M-3 Project (Sheikhupura – Multan – D. G. Khan). As already discussed, most of the alternatives are merging at Gojra. Through the construction of M-4, the route from Faisalabad to Gojra will be the shortest. The major reason for changes in the design was to reduce cost by shortening the length and minimizing resettlement as environmental impacts envisaged were nearly the same for all options.

SECTION 6

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.0 General

201. This section identifies the overall impacts of construction/operation works on the physical, biological and socio-economic environment of the Project Area. This assessment also includes the impact of traffic volume due to improved road conditions. In addition, it also narrates the measures that will mitigate the Project's adverse environmental effects.

Following is a description of the perceived environmental impacts (positive/negative) of the proposed Project with their proposed mitigation measures.

6.1 Project Corridor

202. The Project corridor is delineated according to two criteria: right of way (RoW); which the NHA is legally entitled to, and Corridor of Impact (CoI), i.e. the width of the corridor that will be impacted, directly or indirectly, by the proposed Project during the construction and operational phases.

a) Project Right of Way (RoW)

203. The proposed Project corridor will have a well defined RoW that will be 100 meters (328 ft) for the entire length of the Motorway except interchanges where RoW will be 300 meters (984 ft). Major construction works will generally remain confined within the RoW. All the infrastructure and commercial activities within the existing or proposed RoW need to be relocated as they will have direct impact of the Project.

b) Corridor of Impact (CoI)

204. The corridor of the proposed Impact (CoI) was delineated as the extent, which has direct or indirect impact of Project. Direct impacts of the Project are relocation of houses, utilities and air and noise pollution impact on workers during construction. All direct impacts are constrained within the RoW. Indirect impacts, caused by noise, dust emissions, camp sites and borrow sites could be beyond the RoW. The direct CoI of the surface water bodies will be confined within the RoW of the proposed Project and will be temporary only for the construction period. Cumulative impacts have been studies/modelled separately and are annexed in Annexure V.

6.2 Pre-Construction/Design Phase

205. Following is the brief description of impacts envisaged during the Pre-construction/ Design Phase:

6.2.1 Topography

206. The topography in the Project Area will change to some extent because of construction of the proposed Project related structures such as embankments, culverts etc. Visual changes to the topography would be permanent and minor negative in nature. However, the aesthetic elements (such as plantation) will be incorporated in the design to overcome the impacts.

6.2.2 Soil Erosion and Contamination

207. Soil erosion will take place around road cuttings and embankments, which will be mitigated by incorporating the following measures in the design:

- The provision for vegetation with a fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization will be made in the design. Use of stone pitching or riprap will also be provided in the design at appropriate places especially around flyovers, bridges, culverts;
- Provision for rip-rap in discharge zones from drainage structures will be made in the design to reduce erosion;
- Down drains/chutes will be lined with rip-rap/masonry or concrete to prevent erosion;
- Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion; and
- The proposed Project Site, through which the alignment is proposed, will be investigated for the presence of naturally occurring contaminants such as asbestos, arsenic; likelihood of erodibility of soil; contours, terrain stability, slope gradient; physical and chemical properties of soil such as soil depth, particle size distribution, permeability, dispersibility, pH, salinity; and likelihood of seismic activity. If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned authority. The seismic factor shall also be considered at the design stage.

6.2.3 Land Acquisition and Resettlement

208. The major issue in the proposed Project at this stage will be land acquisition and resettlement. This will result in landlessness, homelessness, joblessness, marginalization, loss of access to common property resources, food insecurity, morbidity and mortality, and social disarticulation due to land acquisition and severance (blocking access across it due to be being fenced on both sides). Though, effort has been made to avoid relocation of houses while selecting the alignment of the proposed Motorway. Even then the land acquisition and resettlement will take place for those affected by loss of agricultural land (most of the owners with small landholdings) and associated infrastructures (farm houses, tube wells, poultry farms etc.).

209. The proposed Motorway will be constructed on a new alignment for which about 4794 acres of land will be acquired. The current land acquisition process and procedures are not adequate enough to ensure fair and justifiable compensation to the affectees. Serious negative impacts may result if proper mitigation measures are not adopted.

210. The most significant impact of the Project is the taking of about 4794 acres of agricultural land out of production. The loss in production will be met with by increasing the yield from fields in the agricultural sector. Orchards lost to the Project will also have to be raised by the private owners of land. However the owners of land whose land is to be acquired and the neighbouring farmers will be helped to gain access to modern technology to increase production from their land. Similarly the deficiency in livestock feed/fodder will have to be met from the adjoining areas.

211. This impact would be permanent and major negative in nature and the mitigation measures will involve careful alignment and route selection by the designer to

minimise the impact. Also adequate budget will be provided in the Project cost for the compensation to the affected people as per Land Acquisition Act, 1894 and ADB's Resettlement policy 2009 for the lost assets and restoration of their livelihoods.

212. Entire Motorway Project will be fenced except at the interchanges; therefore, it will not cause substantial increase in the price of land. It is expected that land values will increase near interchanges. This Impact would be a minor positive in nature.

213. During the field visits to the Project Area, resettlement issues were critically observed. During the route survey care was taken to avoid the settlements. About 200 mud/ brick structures will be demolished. During field visits, it was found that no archaeological site or graveyard, nor any other structure of religious value or cultural significance is going to be demolished due to the execution of the proposed Project. Only one Jamia Mosque at Shorkot Tehsil adjacent to a farm house needs to be relocated.

214. The mitigation measures for this have been included in the land acquisition plan (LARP) for the project. :

6.2.4 Flora

215. It has been estimated that a total of 18,000 trees will be felled from the agricultural fields in the entire Project Area. This loss will be compensated by planting strips on both sides of the motorway which, on an average, are estimated to be about 25 meters wide.

216. Compensatory Planting shall be done in rows (avenues). Eight avenues with a row to row distance of 3 meters shall be planted for a length of 50 km near the habitations and four avenues with row to row distance of 6 meters in the rest of the 134 km long strip thus covering the whole length of the Motorway section. A total of 623,984 (311,992 in each strip on both sides of the road) saplings shall be planted. Planting shall go hand in hand with the construction of the road structure. Planting of this nature and extent shall be a huge task and will have to be outsourced. The executing agency is advised to plan in advance for the procurement of planting stock in consultation with the Provincial Forest Department. Permission from the Forest Department will also have to be sought for cutting trees from the roadside or along the water courses if these fall within the ROW. Planting will be done as soon as the construction of the road is completed. Maintenance is the key to the establishment of the plantation. Regular monitoring of plantation will be carried out by the executing agency. Any failures will be immediately beaten up. 25% is the usual percentage provided for beating up of failures.

217. After the Project Area is fenced, the natural vegetation shall establish itself. The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar, Peepal (Ficus reliogosa), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) are helpful in providing shade, ground cover, aquifer recharge, and habitat (including shelter and food) for the wildlife. The compact plantations shall be effective live screens against night glare, dust, noise and pollutant emissions. These vegetated strips shall develop into a complete ecosystem. Flowering and fruiting shrubs will be planted along the road to beautify the landscape. Planting will however be done keeping in view the principles of landscape designing.

- A total of 623,984 (311,992 in each strip on both sides of the road) sapling trees will be planted

- Raised Median will be planted with grasses and shrubs which may not attain height more than two meters. This planting could provide an effective protection against night glare besides beautifying the area;
- The compact plantation will be done on both sides;
- Regular monitoring of plantation will be carried out by the Forest Department and any failures will be immediately beaten upto 25%;
- The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar, Peepal (Ficus reliogosa), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) will be planted;
- If a tree of rare species is growing within the ROW and is required to be removed, it will not be felled but uprooted and transplanted in close consultation with the Forest Department;
- All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort will 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 ensured;
- An awareness campaign targeted on the neighbourhood farmers will be carried to popularize the planting of trees; and
- Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides.

218. In section-II of M-4 it has been estimated that a total of 52610 trees will be felled from the agricultural fields in the Project Area, on both sides of the motorway trees will be planted in rows with a distance of 4m in a 62 km long section. A total of 93000 (46500 number of plants will be raised on one side of RoW) Planting will be done as soon as the construction of the road is completed. 25% is the usual percentage provided for beating up of failures. The indigenous species will be planted

6.2.5 Change in Hydrologic Regime

219. As the proposed Motorway does not pass through any flood prone areas therefore, no change in hydrological regime will occur. The Motorway will cross the Ravi River and Sadhnai Canal, while this crossing will be carried out by bridges therefore no change in water flow pattern will be caused. For the crossing of canals and drains small bridges will be constructed. For the crossing of water courses, culverts and other possible arrangement will be done. The direct CoI of the surface water bodies will be confined within the RoW of the Project, and it will be minor and temporary in nature.

220. Possible impacts are temporary and minor negative, however following mitigation measures will be incorporated:

- Proper design of bridges on Ravi River and Sadhnai canal to accommodate design flows;
- Small bridges will be constructed on canals and drains coming in the RoW;
- Provision of box culverts to control flood damages and provision of safety of embankments; and
- Provision of sufficient sizes of drains to take design flows.

6.2.6 Waterlogging and Salinity

221. Almost 3-5% of the land along the Proposed Project corridor Section was seen affected by waterlogging and salinity. The waterlogged areas are more than 1 km far from the proposed Motorway therefore it is obvious that it will not affect the proposed

Project. However to keep effective drainage system, pipe and box culverts at suitable location will be provided in the design.

6.2.7 Restricted Access Problems

222. As the Proposed Motorway will be fenced therefore the communities along the alignment will face crossing problems. This is a major negative impact due to the proposed Project. To mitigate this impact, underpasses and flyovers will be provided in the design at the shorter distances and at places wherever there are existing crossing paths.

6.2.8 Public Utilities

223. Due to the proposed Project, public utilities will be affected creating disruption of public services and inconvenience to the local residents. This impact is temporary and may be considered as moderately negative in nature. Mitigation measures will include:

- Provision in the design and budget for the relocation of the existing utility infrastructures wherever required; and
- All public utilities (e.g. water pipes, power/ telephone lines likely to be affected by the proposed Motorway will be relocated well ahead of time before the actual commencement of the construction work.

6.2.9 Noise Problems

224. Fast movement of vehicles on the Proposed Motorway will create excessive noise for the communities along the alignment which will be a cause of disturbance for them. This will be a moderate negative impact. To mitigate this impact noise barriers will be constructed wherever there will be populated area within 500 meters along the route by thick plantation or constructing sound barriers wherever possible. Provision of thick plantation of about 25 kms for each side will be provided.

6.3 Construction Phase

225 Following is the brief description of impacts envisaged during the Construction Phase:

6.3.1 Topography

226. As a result of construction, topography of the Project Area will be changed. One of the important activities during construction will be the cutting and dismantling of existing infrastructure and borrow areas that will have impact on the topography of the Project Area.

227. This impact is temporary and minor negative in nature. Mitigation measure for this impact is proper landscaping. All the affected areas will be restored to their original levels.

6.3.2 Borrow/ Open Pits

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

229. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area.

230. This impact is permanent and moderate negative in nature. Mitigation measures will include:

- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4;
- Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands;
- In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
- Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.

6.3.3 Air Quality

231. Air quality may be affected from the following sources:

- Construction machinery;
- Hydrocarbons from asphalt plants and vehicular traffic;
- Dust emissions due to movement of construction machinery on earthen service roads.

232. Impacts of air emissions may be carried over long distances depending upon the wind speed, direction, temperature of the surrounding air and atmospheric stability. Emissions from crushers and quarry sites will cause health impacts, i.e. coughing, flue, difficulty in inhaling, irritation in eyes and reduction in visibility. This impact is temporary and major negative in nature.

233. Mitigation measures will include:

- Dust control by equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions;
- Asphalt hot mix and batching plants will be located 1 Km away from the residential areas, schools and hospitals;
- Surface treating or overlaying diversion tracks with shingle, and sprinkling water across diversion tracks;
- Ensuring that haul trucks carrying aggregate fill materials are kept covered with canvass sheet to help contain construction material being transported between sites;
- Enforcing the NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery;
- Dust mask will be provided to the workers. Proper dust collection system will be ensured at crushers and continuous sprinkling of water; and
- Air Quality Monitoring will be carried out as per schedule given in Environmental Monitoring Plan

6.3.4 Construction Waste Disposal (Wastewater, Oil, Solid Waste etc.)

234. Due to construction activities waste will be generated at construction and contractors camp site. The construction waste will include wastewater, oil spillage from

machinery and solid waste etc. This will result in unhygienic conditions, health risk to work force and general public at the camp site.

235. Following are the types and sources of construction waste:

- Oil, grease etc. from construction machinery;
- Solid waste from waste construction material and food;
- Wastewater from washing and sprinkling; and
- Sanitary waste from staff toilets.

236. This impact is temporary and moderate negative in nature. Mitigation measures will include:

- Wastewater effluent from contractor's workshop and equipment washing yards would be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams;
- Waste will be disposed at designated sites and no waste will be disposed in the productive agricultural field;
- The hazardous waste will be transported to nearby incineration facility;
- Solid Waste generated during construction will be safely disposed in approved and demarcated waste disposal sites and the contractor will not dispose waste into productive agricultural lands and will also provide a proper waste management plan;
- Sanitary wastes generating from staff and labour camps must be disposed of in environment friendly manner, i.e. provision of septic tank etc. for toilet wastes; and
- Aggregate waste material of existing road will be reused in up-gradation of road.

6.3.5 Siting of Construction Camps and Other Facilities

237. The precise locations for construction camps and other facilities such as workshops, equipment washing yards, borrow pits, quarries, crushing plants, asphalt plants, batching plants, construction material storage areas, haul routes and disposal sites for construction waste will be finally decided by NHA in consultation with Contractors. However, the siting of these facilities may cause a number of issues such as loss of plantation and vegetation, permanent physical and visual impact on the area, siltation and pollution risks if construction materials are extracted from the River Chenab bed. The impacts of these facilities would be temporary and moderate negative in nature, which will be mitigated by adopting the following measures:

- The construction camps and workshops shall not be located in sensitive areas and shall not be within 500 meters distance from the existing settlements;
- Efforts will be made to minimize vegetation loss while making site arrangements for construction camps and other facilities;
- Cutting of trees shall be prohibited by contractor(s) and workers near camp sites failing which three new trees will be planted by the Contractor(s) for each tree cut;
- The crushing plants shall not be located in environmentally sensitive areas or existing settlements;
- The sites for borrow pits shall be selected on the basis of type of soil strata, depth of water table, ground topography, prevalent vegetation state etc. and shall not be located within 100 meters from RoW of the proposed Project. They shall be prohibited where they might interfere with the existing or designed drainage pattern. The River locations shall be prohibited where

there is greater likelihood of damaging the River bank or carrying fine material downstream. The Contractor(s) shall also ensure that borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of stagnant water bodies, which are favorable places for mosquito breeding. The depth of construction materials such as gravel removed from the River bank shall be kept one tenth of the total width of the River and this activity shall not interrupt the River flow or undermine the River banks;

- Asphalt hot mix and batching plants shall not be located within 1000 meters of the existing settlements and shall be located sufficiently away from agricultural activities, industrial establishments and sensitive areas including, but not limited to, educational and health facilities;
- Only licensed quarry operations will be used for material sources. If licensed quarries are not available then the contractors may be made responsible for setting up their dedicated crusher plants at approved quarry sites;
- The construction material storage areas shall not be located in sensitive areas and shall be sheltered or sited within hoardings;
- The Contractor(s) shall use the selected routes for transport of construction materials. Any damage caused to these routes by overloading or heavy vehicles shall be borne by the Contractor(s);
- Landowners shall be compensated according to the terms of lease agreements negotiated with them for constructing camps and other facilities; and
- The sites for camps and associated facilities shall be reinstated by the Contractor(s) after decommissioning of the proposed Project.

6.3.6 Soil Erosion and Contamination

238. The proposed Project is planned to be constructed on already fertile soil, which will be lost if not stripped, stored and reused properly. Soil erosion generally takes place where ground cover is removed and inadequately re-established. Due to construction of the proposed Project, soil erosion and contamination may take place around borrow pits, road cuttings, embankments, construction camps, workshop areas, equipment washing yards, asphalt plants, batching plants, fuel and chemical storage areas, etc. Soil erosion and contamination may affect the road stability, increased flood risk (by more rapid and higher levels of runoff), silting up of water bodies, landscape value and in worst cases may reduce the economic productivity of land and biodiversity in the Project Area. The impacts of soil erosion and contamination would be temporary and moderate negative. The following mitigation measures are proposed to alleviate or avoid these impacts:

- Non-productive, barren lands in broken terrain, nullahs and publicly recognized waste lands shall be used for borrowing materials;
- The excavation of earth fill shall be limited to an approximate depth of 50 to 100 cm;

239. In case the use of agricultural land is unavoidable, the top 30 cm of the plough layer shall be stripped off and stockpiled. Where deep ditching is to be carried out, the top 1 meter layer of the ditching area shall be stripped and stockpiled for redressing the land after the required borrow material has been removed;

- Drainage interception ditches shall be built around the borrow pits to prevent surface run off causing erosion during the rainy season;
- The denuded ground cover shall be re-vegetated as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover;
- The road embankments and road cuttings shall be vegetated with a fast growing crop and a native seed mix immediately after fill placement to prevent

scour and to encourage stabilization. Use of stone pitching or riprap shall be made at appropriate places especially around overpasses, bridges, culverts;
- Discharge zones from drainage structures shall be furnished with rip-rap to reduce erosion;
- Down drains/chutes shall be lined with rip-rap/masonry or concrete to prevent erosion;
- Side slopes shall be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion;
- Construction shall be restricted to dry season to avoid soil erosion;
- Soil erosion checking measures such as the formation of sediment basins etc, shall be taken;
- Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain 110 per cent of the total volume of stored fuels and chemicals; and
- The disposal of waste asphalt shall be made in approved locations such as borrow pits or natural depressions and shall not be within the RoW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water percolating through the waste materials and leaching toxic chemicals into the surrounding soils. On completion of disposal at the site, the area shall be capped with a compacted thickness of at least 0.5 meters of impermeable soil covered with at least 200 mm of top soil and shall be finally landscaped.

6.3.7 Noise

240. Noise is one of the most pervasive environmental problems in the urban areas especially on the road side. Noise pollution will be due to increase in mobility and construction activity. However, this impact will be temporary but moderate negative in nature. All mitigation measures mentioned below will be taken in order to minimize the impacts of noise in the Project Area. These measures include, but are not limited to the following:

- Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices;
- Confining excessively noisy work to normal working hours in the day;
- Providing the construction workers with suitable hearing protection like ear cap, ear muffs etc.;
- Avoiding heavy machinery like percussion hammers and pneumatic drills, especially during night time;
- Locating the rock crushing, concrete mixing and material shipment yards away from residential areas, particularly schools, hospitals and nursing homes; and
- Noise quality monitoring will be carried out as per schedule given in Environmental Monitoring Plan.

Table 6.1
Maximum Limits of Noise Levels

Noise Level dB (A)	Situation
194	Lung damage
180	Ear drum rupture
150	Absolute limit with ears protected

150	Maximum of instantaneous noise
135	Absolute maximum with ears unprotected
100	Prolonged noise causing permanent damage
90	Factory work for an 8-hour day, 5 days a week
*85	Ear protection should be worn
80	Noise on building or construction sites
70	Normal road traffic near residential areas

Source: *"Environmental Degradation"* by Engr. Col. Mumtaz Hussain
* Above 85 dB(A) ear protection devices should be worn.

Table 6.2
General Noise Levels of Machinery and Equipment

S. No.	Equipment	Noise-Level in dB (A)
1	Earth Moving Machinery	75-85
2	Material Handling Equipment	75
3	Stationary Equipment	75
4	Tools, Hammers and Drivers	80-95

Source: The General Services Administration, Construction Noise Specification, USEPA 1972

Table 6.3
Construction Equipment Noise Levels

S. No.	Equipment	Observation Point to the Source (meters)	Noise dB(A)
1	Wheeled loading	5	90
2	Grader	5	90
3	Vibration pavement roller	5	86
4	2-wheel vibration pavement roller	5	81
5	3-wheel pavement roller	5	81
6	Tire pavement roller	5	76
7	Bulldozer	5	86
8	Wheeled pneumatic dredger	5	84
9	Sprayer	5	87
10	Power generator	5	98
11	Impact drill	5	87
12	Impact pile driver	5	112
13	Truck	5	92
14	Concrete mixer	5	91
15	Concrete pump	5	85
16	Mobile lift	5	96
17	Pneumatic hammer and rock crusher	5	98
18	Breaker	5	84
19	Pneumatic spanner	5	95

Source: Guangzhou City Center Inner Ring Road Project, Environmental Assessment Report (1997)

6.3.8 Surface and Groundwater

241. Surface water might get contaminated due to the disposal of construction waste generated due to the Project activity; this contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement. The impact on these water bodies will be only for the period of construction and will vanish as the construction work is over. In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.

242. This impact is temporary and minor negative in nature. Following are the mitigation measures:

- The surface and groundwater reserves will be adequately protected from any source of contamination such as the construction and oily waste that will degrade its potable quality;
- The proponent will ensure that the construction work is confined within the RoW and water bodies are prevented from pollution during construction;
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- The contractor will ensure that construction debris do not find their way into the rivers, drainage or irrigation canals which may get clogged;
- Work on irrigation canal areas will be kept to a minimum, protective walls be constructed;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas;
- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond;
- Construction work close to the streams or other water bodies will be avoided, especially during monsoon period; and
- Wastes will be collected, stored and taken to approved disposal site.

6.3.9 Flora and Fauna

243. It has been estimated that a total of 18000 trees will have to be felled from the agricultural fields in the Project Area. This loss will be more than compensated by planting strips on both sides of the motorway which, on an average, is estimated to be about 25 meters wide. After the project area is fenced, the natural vegetation shall establish itself. The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar, Peepal (*Ficus reliogosa*), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) could be planted. These trees shall be helpful in providing shade, ground cover, aquifer recharge, and habitat (including shelter and food) for the wildlife. Following mitigations will be adopted: It has been estimated that a total of 27302 trees will have to be felled both fruit and non-fruit trees from the agricultural fields in the section-II of M-4, all aftees will be compensated details can be found in LARP of section-II (M-4). All the afeectes.

- The compact plantations will be effective live screens against night glare, dust, noise and pollutant emissions. These vegetated strips shall develop into a complete ecosystem. Flowering and fruiting shrubs will be planted along the road to beautify the landscape. Planting will however be done keeping in view the principles of landscape designing;
- A raised median will be planted with grasses (turfing) and shrubs which may not attain height more than two meters. This planting could provide an effective protection against night glare besides beautifying the area;
- All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort will 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 ensured;
- An awareness campaign targeted on the neighbourhood farmers shall be run to popularize the planting of trees; and
- Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides.

244. Black and Grey Partridges are the only huntable species that might occur in the Project Area. Their hunting is allowed as per legislation during the hunting season to a fixed bag limit in open areas on Sundays and holidays. Any hunting outside of this is liable to be checked by the Wildlife Department staff. However such hunting shall hardly impact the wildlife populations in the area.

245. No rare or endangered aquatic faunal or floral species occur in the area. The Provincial Fisheries Department auctions fishing rights in the rivers and canals. The water reservoirs like Sidhnai are stocked with carp fingerlings. The canals are not stocked but the fish stock from the rivers escapes to canals. Fishing is not allowed without a permit and any illegal catch is liable to be punished. Reports about illegal fishing in these areas are almost non-existent. Occasional cases may be reported which may not have any significant impact on the biodiversity of the wetlands.

246. The Project will pose minor negative impact on the fauna present in the area. There is no presence of any game reserve or wild life sanctuary along the proposed alignment, therefore no negative impact will happen. However following mitigation measures will be taken:

- Illegal animal and fish hunting will not be allowed and punishment will be enforced in case of violation;
- Wildlife Department will check and confirm that no hunting is made;
- New and good condition machinery with minimum noise will be used in construction;
- Noisy work will not be carried out in night time so that there will be no disturbance to local birds and animals;
- Contractor will ensure that the no hunting, trapping of animal will be carried out during construction; and
- Borrow pits will be fenced so that no animal will fell into these.

6.3.10 Social and Cultural Problems

247. Due to construction of the proposed Project, exit/entry problems for the residents/ movement of the people to the mosque/shrines may be disturbed. However, the major issue in the proposed Project is land acquisition, which will take place in the project affected areas. This will result in loss of agricultural land, infrastructure (farm houses, tube wells, poultry farms), livelihood, loss of fertile plough layer at camp sites and associated facilities (workshops, asphalt plants etc.).

248. National Environmental Policy of the Government of Pakistan emphasizes on the achievement of environmental sustainability and poverty reduction to enhance the economic growth. Increased economic activity in the Project Area by involvement of local people in the Project related activity. Local labour will be hired, which will provide them an opportunity to develop their skills and capacities. After serving in this Project, the local will utilize their skills in future endeavours.

249. As a result of Motorway Project, prices of lands near interchanges and service areas will increase that will be a positive thing for the local people. After the construction of interchanges and service areas, local people will get a chance to open shops and hotels in its vicinity. This will provide them earning opportunities, which will enhance economic profile of the area. This is a minor positive impact.

250. Change in local lifestyle and culture may occur when the local and migrant workers will come in contact during the construction works. This impact is permanent and minor positive. Those impacts will be mitigated by adding appropriate clauses in the construction contract to avoid any law and order situation.

251. Regarding the resettlement issue It is required that these settlements will be relocated and handled in such a way that those affectees might not be turned into poor or vulnerable groups. These issues are discussed in detail in Resettlement Action Plan.

252. People will face minor exit/entry problems during the construction activities. Only one mosque will fall in the RoW and that is Jamia Masjid (main mosque) situated in Tehsil Shorkot. The impact of construction on entry/exit problem is of minor nature as there is no major shrine located in the immediate vicinity of RoW.

253. This impact is temporary and minor negative in nature. Mitigation measures will include:

- Timely completion of the construction work and provision of alternative routes during the construction;
- Providing alternative ways in order for the local people to perform their routine tasks;
- Timely and adequate compensation package to the Project Affected Persons (PAPs);
- Adding appropriate clauses in the construction contracts to avoid any law and order situation;
- Timely and full public consultation and announcement of mobilizing equipment;
- Establishment of formal links with affected communities;
- Plan for social grievance redress mechanisms;
- Seek assistance from and cooperation with local NGOs;
- Familiarize outside labourers on local etiquettes;
- Local labour shall be employed with an agreed ratio (>75%) for construction works;
- An agreed minimum unskilled labour employment for women with equal remuneration as men agreed at an early stage; and
- The drinking water requirement shall be met preferably by resorting to other sources rather than using the community resources.

6.3.11 Traffic Management

254. Due to construction activities traffic management may be a problem in the Project area. This may result in traffic jams and cause inconvenience to the people passing through the road crossings at proposed interchanges due to movement of vehicles carrying construction materials.

255. This impact is temporary and minor negative in nature and will be mitigated by providing proper alternative traffic management plan during construction of the proposed Motorway. Interchanges will be constructed in a way that traffic flow is not disturbed; alternative routes will be clearly defined. Proper traffic management with marking will be done on the road crossings near proposed interchanges.

6.3.12 Utilities

256. Various utilities such as electrical poles, transmission lines, telephone lines and wells are situated within the RoW of the proposed Motorway. These utilities will be relocated before the start of construction activities. These utilities if not handled properly will cause difficulties to the peoples of Project Area. To handle this problem following mitigation measures will be taken:

- Strengthening of utilities, wherever required; and
- Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area

6.4 Operational Phase

6.4.1 Noise

257. Due to increase in traffic volume, noise is expected to increase. As presently project area is free from noise pollution therefore this impact is permanent and major negative in nature. To cope with this issue, adequate noise barriers such as indigenous tree species will be planted along the fence to reduce the noise pollution. Further improvement will be made with the help of National Highway and Motorway Police (NH&MP) by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a clearance certificate. Noise monitoring will be carried out as per Environmental Monitoring Plan.

6.4.2 Deterioration of vehicles

258. The proposed Motorway, due to smooth road surface will result in less wear and tear of vehicles; it will also result in less fuel consumption. This impact is permanent and major positive in nature.

6.4.3 Soil Erosion and Contamination

259. During the operational phase, soil erosion may take place at different road structures (bridges, embankments, culverts etc.), which may increase the flood risk by rapid flash of storm-water runoff and also undermine these structures. Soil contamination can take place on border areas by road runoff containing heavy metals (e.g. lead). If these areas are used for growing vegetables for human consumption, it can have adverse impacts on human health. The research has shown that the increase in heavy metals is generally limited to a narrow border along the edge of the road and concentrations rapidly fall away with distance from the hard shoulder. The following mitigation measures are proposed to reduce the impacts on soil:

- In case soil erosion takes place, proper remedial measures will be undertaken to stop future impacts of loss of soils and the associated impacts caused by soil erosion; and
- Vegetation for human use will be banned within the proposed RoW.

6.4.4 Road Safety

260. The increased vehicular movement and speed may result in road safety issues like traffic accidents. The accidents may also be due to tiredness. The impacts on road safety would be permanent and moderate negative. They will be mitigated by enforcing speed limits and imposing penalties on the traffic violators. Rest areas will also be provided for those in need for rest during travel. Traffic signs will be provided to facilitate road users about speed limits, rest areas, eating establishments etc. Warning messages such as "*speed thrills but kills*" or "*better late than never*" etc. will also be displayed at appropriate locations to aware drivers about likely accidents due to overspeeding. All the lanes, median, sharp bends will be reflectorized to facilitate travellers in the night time. Proper lighting arrangement on the proposed Motorway will be done at required places.

6.4.5 Landscaping

261. The settlements in the immediate vicinity of the proposed Motorway will be directly affected due to this Project, which would be minor negative impact and will be mitigated by tree plantation along the proposed Corridor. It would also serve as physical barrier between the road and the existing settlements as well as future developments.

6.4.6 Land Use

262. The proposed Project may induce land use changes in the form of development of commercial establishments (restaurants, petrol and gas filling stations), educational institutes etc. The changes in land use may affect the land value, which will vary depending upon the location. The impacts on land use would be permanent and both moderate negative especially for those whose land values have not increased and medium beneficial for businessmen and those having escalated land values (especially near interchanges). However, all the facilities with the exception of restaurants and petrol/gas filling stations likely to pop up in the future will be prohibited within the RoW. The permission will be sought from the concerned authority for the development of any establishment along the proposed Project corridor.

6.4.7 Air Quality

263. The existing status of the project area is that there are agricultural fields due to this no or minor air pollution in the Project Area. Therefore this impact is permanent but minor negative.

264. Mitigation measures will include:

- Setting up of system to monitor air quality along the Project Area in accordance with acceptable International standards;
- Monitoring emissions of vehicles as per NEQS;
- Trees will be planted along the fence of the proposed Motorway, these will work noise barrier. For suitable plantation Forest Department will be consulted.

6.4.8 Time Saving

265. Due to increase in speed and undisturbed flow of traffic, travelling time will be saved to reach destination. Trade will improve due to better transport opportunities. This impact is permanent and major positive in nature.

6.4.9 Socio-economic Conditions

266. The operation of the proposed Motorway would lead to opening up markets to rural economic activities by reducing the production and transportation cost thereby stimulating agricultural production. The proposed Project will promote better business opportunities such as new petrol pumps and hotels. This impact is permanent and major positive in nature.

267. This would be a high beneficial impact but at the same time, it would be major negative for those who cannot access the Motorway except from interchanges. To overcome this problem, interchanges at the existing important routes will be provided in the design.

6.4.10 Water Quality

a) Surface Water

268. The surface water bodies may get flooded and polluted due to uncontrolled release of contaminated storm-water/road runoff from road surfaces. The pollutants associated with the road-runoff include: (a) hydrocarbons such as fuel and polycyclic aromatic hydrocarbons from wear and tear of the road surface, tyres, lubricants leaking from vehicles and from unburnt fuels; (b) heavy metals including cadmium, copper, zinc, iron derived from unburnt fuels, corrosive products from vehicles, wear and tear of tyres and road surfacing. Some heavy metals are largely soluble (copper for example) and insoluble (zinc for example); and (c) suspended solids including insoluble heavy metals as colloidal materials. The worst contamination generally takes place during the first flush of runoff from roads after a spell of dry weather. The level of pollution is directly related to the traffic volume.

269. The pollution risk from accidental spillage may increase moderately. In the long run, the increased traffic volume of traffic and faster traffic speeds would increase the risk of accidental spillage, which could have medium adverse impact on surface water quality. The natural drainage of road runoff across embankments or discharge of runoff into water bodies from large area of carriageway may have medium adverse impacts on ponding and the flood risk to downstream locations. The following mitigation measures are proposed to attenuate surface water quality related impacts:

- In order to discharge rapid removal of storm-water/road runoff, cross slopes and longitudinal drainage will be provided in the design. Well-designed cross drainage structures limit ponding across embankments;
- Retention basins with reedbeds provided in the design will improve the quality of polluted storm-water/road runoff;
- Cleaning of drainage structures will be carried out in case they are blocked by debris etc.; and
- The surface water quality monitoring will also be carried out at defined intervals and for environmental quality monitoring parameters suggested in the Environmental Monitoring Plan. If these parameters are above the prescribed limits, suitable control measures will be taken.

b) Groundwater

270. Groundwater may get polluted due to contaminated road runoff on earthen shoulders and embankments planted with grasses. However, the areas in the immediate vicinity of the proposed Motorway will be avoided for vegetation due to the risk of contamination. Groundwater quality monitoring will be carried out as per schedule suggested in the Environmental Monitoring Plan.

SECTION 7

ECONOMIC ASSESSMENT

7.0 General

271. This section includes the overall economic benefits in relation to environmental costs resulting due to implementation of the proposed project.

7.1 Economic Benefits

272. The economic benefits resulting due to the implementation of the proposed Motorway Project will include:

i) Decreasing the vehicle operating cost and travel time costs due to better/ improved road facility, reduced traffic congestion, uninterrupted and smooth traffic flow;

ii) Improvement in the trade opportunities in country;

iii) Decrease in travelling costs and vehicles maintenance costs

iv) Uplift in the overall economy of the Punjab Province and

v) Improvement in the commercial activity in the Project Area, resulting in economic uplift of the people of the Project Area.

7.2 Environmental Costs

273. The total environmental cost has been worked out to be Rs. 3,969.199 million (US $ 66.187 million). This includes Rs. 3,864.969 million (US $ 64.42 million) as Land Acquisition and Resettlement Cost, Rs. 97.5 million (US $ 1.625 million) as mitigation cost, Rs. 6.53 million (US $ 0.109 million) as Monitoring Cost, and Rs. 0.2 million (US $ 0.033 million) for training cost. The environmental costs have been added to the Project Investment cost of 23,549.46 million (US $ 392.491 million). The total investment costs in financial terms thus come out to be Rs. 27,518.66 million (Us $ 458.644 million). This cost has been converted into economic terms as Rs. 24,766.79 million by applying SCF (Standard Conversion Factor) of 0.90. For the implementation of section-II tranche 4 i.e. section-II of M-4 separate Environmental mitigation and monitoring cost has been calculated in the year 2014, the total cost has been worked out is which Rs. 26,951,900 (US $ 269519). This includes Rs. 5,178,000 (US $ 51780) cost as Monitoring cost, Rs. 700,000 (US $ 7000) cost as the technical training cost, Rs. 21,073,900 (US $ 24234.5) as tree plantation cost.

274. Annual Operation and Maintenance (O&M) cost and overlaying costs have been worked out as Rs. 58.874 million and 2980.014 million respectively. Both expressed in economic terms are as Rs. 52.987 million and 2682.013 million respectively.

275. Economic Internal Rate of Return (EIRR) has been thus worked out as 13.2%, which is well above 12% the assumed opportunity cost of capital in Pakistan, thus rendering this Project economically viable for implementation.

SECTION 8

ENVIRONMENTAL MANAGEMENT PLAN

8.0 General

276. This section provides an approach for managing and monitoring environment related issues and describes the institutional framework for environmental management and resource allocations to be carried out by the National Highway Authority (NHA) for mitigating negative impacts of the proposed Faisalabad-Khanewal Motorway (M-4) Project.

8.1 Objectives of Environmental Management Plan (EMP)

277. The EMP will help the NHA, address the upcoming adverse environmental impacts of the proposed Motorway Project, enhance the Project's overall benefits and introduce standards of good environmental practices. The primary objectives of the EMP are to:

1. Define the responsibilities of the Project proponents in accordance with the three Project phases (design, construction and operation);
2. Facilitate the implementation of the mitigation measures by providing the technical details of each Project impact, and proposing an implementation schedule of the proposed mitigation measures;
3. Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
4. Identify training requirements at various levels and provide a plan for the implementation of training sessions;
5. Identify the resources required to implement the EMP and outline corresponding financing arrangements; and
6. Providing a cost estimate for all proposed EMP actions.

8.2 Key Environmental and Social Components

278. The key environmental and social issues associated with this Project are as follows:

1. Resettling commercial structures owned by squatters presently operating within the proposed construction limit of the project corridor;

2. Appropriately locating temporary construction camps, asphalt plants, and waste disposal sites, and the environmental impact of operating these facilities;

3. Regulating the procurement of borrow material and topsoil erosion during construction;

4. Avoiding the obstruction of Motorway drainage system during construction and operation;

5. Enhancing and maintaining avenue tree plantation along the entire length of the project corridor;

6. Minimizing the impact on cultural sites or structures and community-owned assets during construction and operation; and

7. Ensuring pedestrian and traffic safety during construction and operation.

8.3 Role of Functionaries for Implementation of EMP

8.3.1 General

279. This sub section describes the methodology required for the implementation of EMP in conjunction with the NHA, Design Consultants, EIA Team, Supervision Consultants and Contractors. The executing agency of the Project will be National Highway Authority (NHA). General Manager (NHA/ADB) will be the overall Incharge of the Project. The GM (NHA/ADB) will delegate the supervisory responsibilities of the Project to the Project Director who will have professional staff supported by a team of consultants including Environmental Monitoring Specialists/Consultants.

280. Environmental Protection Agency (EPA) Punjab will act as the overall regulatory body. The specific roles of key functionaries are described hereafter.

281. The Organizational setup of the management plan is shown in Figure. 8.1.

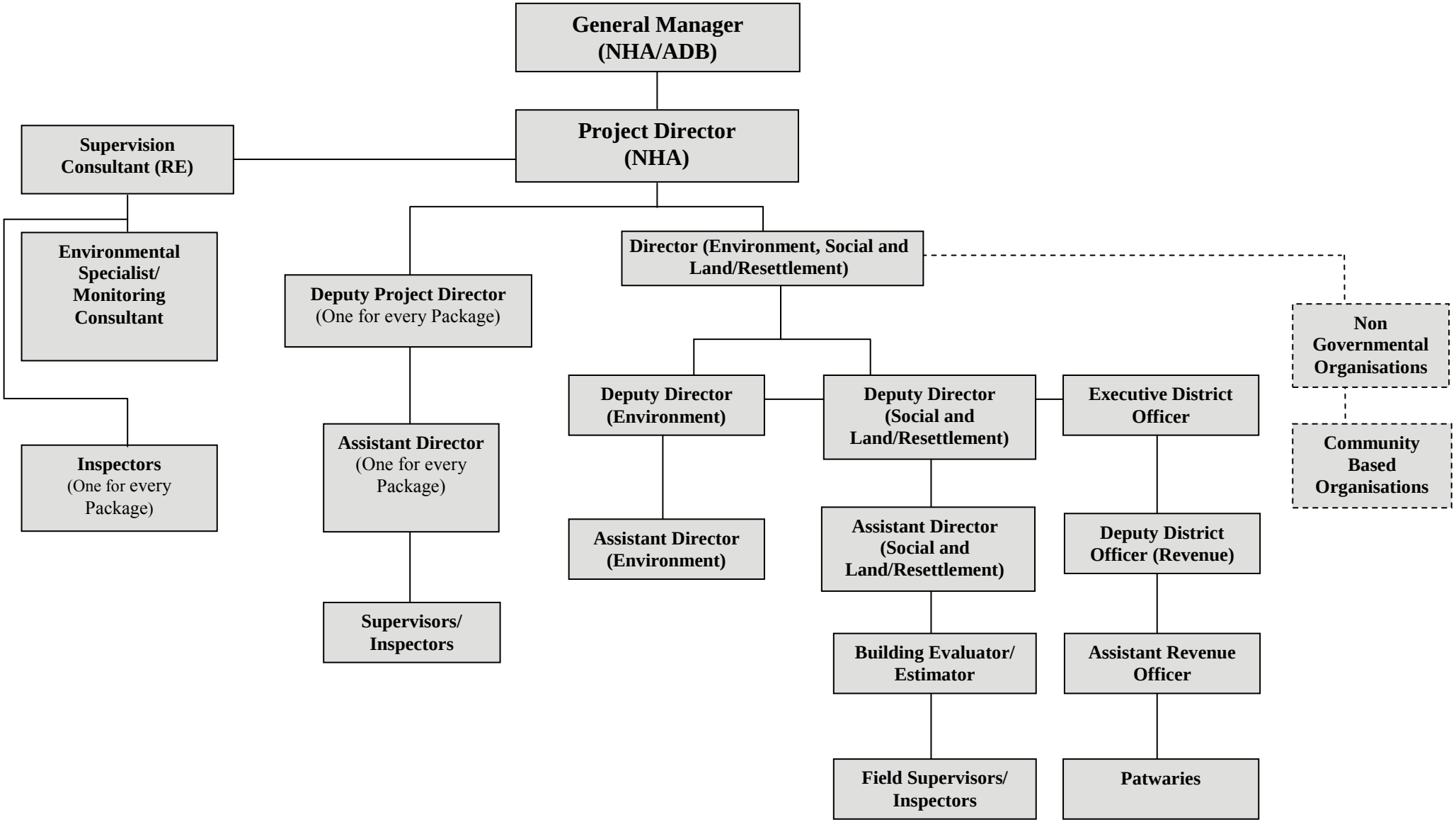


Figure. 8.1: Organisation Chart for Construction, Environmental Management and Resettlement Action Plan

8.3.2 National Highway Authority (NHA)

a) Project Director

282. The Project Director (NHA) will be responsible for the successful implementation of the Project. He will be assisted by the Supervision Consultants. The Project is divided into four Packages. Project Director will have four Deputy Directors; one for every Package.

b) Director (Environment, Social and Land/Resettlement)

283. The Director (Environment) will be the overall incharge for handling NHA's obligations with respect to the EMP. Preparation of bi-annual environmental monitoring report, or any corrective action plans required to be submitted by ADB will be the responsibility of Director Environment. 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 Site Specific Environmental Management Plan (SSEMP) are implemented. In addition, the Deputy Director (Environment) will also coordinate with the EPA Punjab, provincial Agriculture, Forest and Wildlife departments, NGOs/ CBOs and other public/ private sector organisations.

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

285. Executive District Officer (E.D.O Revenue) will be assisted by D.D.O (Revenue), Assistant Revenue Officer and Patwaries in assessing the award price for land acquisition to the affectees.

8.3.3 EIA Consultants

286. EIA consultants will prepare a comprehensive EIA and EMP of the Project in compliance with Pak EPA and ADB Guidelines.

8.3.4 Design Consultants

287. The design consultants will ensure that all the mitigation measures designated for the design phase are incorporated in the design and included in the contract documents.

8.3.5 Supervision Consultants

288. Supervision Consultants appointed by the GM (NHA/ADB) will be headed by a "Project Manager", who will be an Engineer. He along with his team will supervise the Project contractors to ensure quality of work and fulfilment of contractual obligations. The Supervision Consultants (SC) will provide one Environmental Specialist/ Monitoring Consultant (MC) who will:

1. Ensure that all the environmental and social parameters/provisions comply with the applicable standards;
2. Ensure that day-to-day construction activities are carried out in an environmentally sound and sustainable manner;
3. Organise periodic environmental training programmes and workshops for the Contractors' staff and NHA site staff in consultation with the NHA; and

4. Develop “good practices” construction guidelines to assist the Contractors and NHA staff in implementing the EMP;
5. Assist NHA as required in developing the bi-annual environmental monitoring reports;
6. Assit NHA in reviewing the SSEMP developed by the contractor.

8.3.6 Construction Contractor

289. 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.

8.4 Specific Implementation Responsibilities

290. This section describes the implementation and supervision responsibilities for the different phases of the Project.

8.4.1 Design Phase/ Pre-Construction Phase

291. The Director (Environment, Social and Land/Resettlement), NHA and his staff with the assistance of EIA consultant are responsible for ensuring that the Project design and specifications adequately reflect the EMP and the Resettlement Policy Framework (RPF). He will ensure the Project’s compliance with environmental regulations and donor requirements; and ensure stakeholder participation in the Project design.

292. The responsibilities of Director (Environment) may be briefly described as follows:

1. To coordinate with regulatory agencies including EPAs, EIA consultant, local NGOs, that could assist the NHA in independent reviews of environmental and social compliance;
2. To supervise environmental and social assessment reports, and provide substantial inputs and guidance to the EIA consultant;
3. To get the approval of EIA from the EPA Punjab;
4. 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;
5. Submit the bi-annual environmental monitoring report to ADB.

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293. 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:

1. Identifying and verifying Project affected persons (PAPs) on the basis of specified documents;
2. Identifying which public facilities and utilities need to be relocated;
3. Identifying alternative resettlement sites for PAPs outside the RoW;
4. Carrying out a consultation and dissemination campaign with regard to compensation procedures, entitlement packages, and proposed alternative resettlement sites;
5. Preparing individual entitlement files;
6. Preparing and approving compensation budgets;
7. Ensuring that an adequate notice period is given to PAPs before shifting;
8. Providing shifting assistance to displaced squatters and to assist squatter-owners to salvage their facilities as per ADB Guidelines; and

9. Submit bi-annual environmental monitoring reports to ADB; and
10. Approve the SSEMP prepared by the contractor prior to the commencement of civil works.

8.4.2 Construction Phase

294. The NHA will appoint Supervision Consultants, who along with the Deputy Director (Environment) will oversee the working of contractor in accordance with the EMP.

- The Supervision Consultant will liaise with the Project staff to monitor environmental compliance during the construction;
- He will supervise the construction and provide technical support to help ensure compliance with the EMP;
- The Supervision Consultants will assess the environmental impact of Motorway construction;
- He will monitor the progress of work and adherence of the contractor to the EMP and Resettlement Action Plan; and
- He will direct the Contractor to work in such a manner that all Project activities are in compliance with the EMP and NEQS.

8.4.3 Operation Phase

295. The Deputy Director (Environment) and his staff will be responsible for the following:

1. Coordinating with the operational staff working under the Regional General Manager to monitor environmental compliance during Motorway operation;
2. Advising on, and monitoring tree plantations along the Motorway;
3. Reporting on the progress of environmental compliance to the federal and EPA Punjab;
4. Assessing the long-term environmental impacts of Motorway operation;
5. Sustaining a working partnership among the NHA, Punjab EPA, Agriculture, Forest and Wildlife departments of Punjab, NGOs and other related public private sector organizations; and
6. Reporting to Director (Environment) about progress of the work.

8.5 Environmental Management Plan

296. The Environmental Management Plan based on the mitigation measures (indicated in Section 5 of this Report) is presented in Table 8.1 below.

Table 8.1 (a): Environmental Management Plan (Design/ Pre-Construction Phase)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
1	Topography	▪ Change in topography due to construction-related structures such as bridges, embankments etc; and ▪ Visual changes to topography.	Provision for plantation in the design	Design Consultants (DC)	NHA	The cost for plantation will be included in the total Project cost.
2.	Soil Erosion	Road stability, increased flood risk (by more rapid and higher levels of runoff), silting up of water bodies, landscape value and in worst cases may reduce the economic productivity of land and biodiversity in the Project Area	Plantation and stone pitching or rip-rap on embankments and around bridges, flyovers etc.	DC	NHA	The cost for plantation and stone pitching will be included in the total Project cost.
3.	Land Acquisition and Resettlement	▪ Loss of 4,794 acres of agricultural land; and ▪ Resettlement of Affected Persons (APs).	▪ Careful alignment and route selection by the designer to minimise resettlement; ▪ Developing proper judicious compensation package for affectees; and ▪ Giving compensation amount before their shifting.	DC,	NHA	The compensation amount estimated for this Project will be made part of the total Project cost.
4.	Flora	Cutting of 18,000 trees of different species In section-II Cutting of 27,302 trees of different species (fruit and non-fruit trees)	▪ A total of 623,984 (311,992 in each strip on both sides of the road) sapling trees will be planted ▪ Raised Median will be planted with grasses and shrubs which may not attain height more than two meters. This planting could provide an effective protection against night glare besides beautifying the area; ▪ The compact plantation will be done on both sides; ▪ Regular monitoring of plantation will be carried out by the forest department and any failures will be immediately beaten upto 25%; ▪ The indigenous trees most suited to the tract like Shisham, Kikar, Bakain, Dharek, Siris (*Albizzia procera*), Farash, Sukh chain, Jaman, Bohar,	DC, NHA	NHA	The cost for plantation, grassing etc. will be included in the total Project cost.

			Peepal (*Ficus reliogosa*), Gullahr (*Ficus glomerata*), Sohanjana *(Moringa oleifera*), Karir and Wan (*Salvadora oleoides*) will be planted; ▪ If a tree of rare species is growing within the ROW and is required to be removed, it will not be felled but uprooted and transplanted in close consultation with the Forest Department; ▪ All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort will 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; ▪ An awareness campaign targeted on the neighbourhood farmers will be carried to popularize the planting of trees, and saplings will be provided on subsidized costs; and ▪ Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides. ▪ In section-II, a total of 93000 (46500 trees will be planted on one side of (RoW) sapling trees will be planted			
5.	Change in Hydrologic Regime	Minor impacts	▪ Provision of box culverts to control flood damages and provision of safety of embankments; and ▪ Provision of sufficient sizes of drains to take design flows.	DC	NHA	The cost for culverts will be included in the total Project cost.
6.	Water-logging and Salinity	Minor impacts	Drainage culverts at suitable locations will be provided in water logged areas.	DC	NHA	The cost for drainage culverts will be included in the total Project cost.
7.	Restricted Access	Blockade of access across the proposed Motorway because of its being fenced on both sides	Provision of flyovers and underpasses at the existing passages	DC	NHA	The cost for flyovers and underpasses will be included in the total Project cost.

8.	Public Utilities	Inconvenience caused by disruption of public utilities	▪ Provision in the design and budget for the relocation of the existing utility infrastructures wherever required; and ▪ All public utilities (e.g. water pipes, power/ telephone lines likely to be affected by the proposed Motorway will be relocated well ahead of time before the actual commencement of the construction work.	DC	NHA	The cost for relocation of the existing utility infrastructures will be included in the total Project cost.
7.	Noise	Disturbance to neighbouring communities	▪ Provision for excessive tree plantation in the design	DC	NHA	The cost for plantation will be included in the total Project cost.

Table 8.1 (b): Environmental Management Plan (Construction Phase)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
1	Topography	Cutting and dismantling of existing infrastructure	Proper landscaping	Construction Contractors (CC)	Supervision Consultants (SC)	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
2	Borrow/ open pits	▪ Land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments; and ▪ Borrow and open pits are potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife.	▪ Necessary permits will be obtained for any borrow pits from the competent authorities; ▪ No excavations allowed within a distance of 100 metres of the RoW; ▪ In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4; ▪ Soil erosion along the borrow pits will be regularly checked to prevent/ mitigate impacts on adjacent lands; ▪ In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and ▪ Borrow pits will be used for construction material landfill or fish ponds, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.	CC	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
3	Air Quality	Air quality will be affected by fugitive dust emissions from construction machinery, asphalt plants and vehicular traffic. Emission may be carried over long distances depending upon the wind	▪ Dust control by equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions; ▪ Sprinkling of water across diversion	CC	SC, EPD Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
		speed, direction, the temperature of the surrounding air etc.	tracks. Ensuring that haul trucks carrying asphalt concrete mix and/ or aggregate fill materials are kept covered with tarpaulin to help contain construction material being transported between sites; and ▪ Enforcing the NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery.			include their costs in other items of work in the BOQ.
4	Construction waste disposal (Wastewater, oil and solid waste etc.)	Unhygienic conditions, health risk to work force	▪ Wastewater effluent from contractors workshop and equipment washing yards will be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams; ▪ Training of work force in the storage and handling of materials and chemicals that will potentially cause soil contamination; ▪ Solid waste generated during construction and in camp sites will be properly treated and safely disposed of in demarcated waste disposal sites; and ▪ Debris generated by dismantling of existing pavement structures will be recycled subject to the suitability of the material.	CC	SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
5.	Construction Camps and Other Facilities	Loss of plantation and vegetation, permanent physical and visual impact on the area, social disturbance for nearby community	▪ The construction camps and workshops will not be located in sensitive areas and prevented within 500 meters distance from the existing settlements; ▪ Efforts will be made to minimize vegetation loss while making site arrangements for construction camps and other facilities;	CC	NHA & SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			▪ Cutting of trees shall be prohibited by contractor(s) and workers near camp sites failing which three new trees will be planted by the Contractor(s) for each tree cut; ▪ The crushing plants shall not be located in environmentally sensitive areas or existing settlements; ▪ The sites for borrow pits shall be selected on the basis of type of soil strata, depth of water table, ground topography, prevalent vegetation state etc. and shall not be located within 100 meters from RoW of the proposed Project. They shall be prohibited where they might interfere with the existing or designed drainage pattern. The River locations shall be prohibited where there is greater likelihood of damaging the River bank or carrying fine material downstream. The Contractor(s) shall ensure that borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of stagnant water bodies, which are favourable places for mosquito breeding; ▪ The depth of construction materials such as gravel removed from the River bank shall be kept one tenth of the total width of the River and this activity shall not interrupt the River flow or undermine the River banks; ▪ Asphalt hot mix and batching plants will not be located within 1000 meters of the existing settlements and shall be located sufficiently			

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			away from agricultural activities, industrial establishments and sensitive areas including, but not limited to, educational and health facilities; ▪ The construction material for M-4 will be taken from these approved quarries and no any new quarry will be dug by contractor; ▪ The construction material storage areas shall not be located in sensitive areas and shall be sheltered or sited within hoardings; ▪ The Contractor(s) will use the selected routes for transport of construction materials. Any damage caused to these routes by overloading or heavy vehicles will be borne by the Contractor(s); ▪ Landowners shall be compensated according to the terms of lease agreements negotiated with them for constructing camps and other facilities; and ▪ The sites for camps and associated facilities shall be reinstated by the Contractor(s) after decommissioning of the proposed Project.			
6.	Soil Erosion and Contamination	Road stability, increased flood risk (by more rapid and higher levels of runoff), silting up of water bodies, landscape value and in worst cases may reduce the economic productivity of land and biodiversity in the Project Area.	▪ Non-productive, barren lands in broken terrain, nullahs and publicly recognized waste lands shall be used for borrowing materials; ▪ The excavation of earth fill shall be limited to an approximate depth of 50 to 100 cm; ▪ In case the use of agricultural land is unavoidable, the top 30 cm of the plough layer shall be stripped off and stockpiled. Where deep	CC	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			ditching is to be carried out, the top 1 meter layer of the ditching area shall be stripped and stockpiled for redressing the land after the required borrow material has been removed; ▪ Drainage interception ditches shall be built around the borrow pits to prevent surface run off causing erosion during the rainy season; ▪ The denuded ground cover will be re-vegetated as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover; ▪ The road embankments and road cuttings will be vegetated with a fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. Use of stone pitching or riprap will be made at appropriate places especially at overpasses, bridges, culverts; ▪ Discharge zones from drainage structures will be furnished with rip-rap to reduce erosion; ▪ Down drains/chutes shall be lined with rip-rap/masonry or concrete to prevent erosion; ▪ Side slopes shall be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion; ▪ Construction will be restricted to dry season to avoid soil erosion; ▪ Soil erosion checking measures such as the formation of sediment			

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			basins etc, will be taken; ▪ The proposed Project Site, through which the alignment is proposed, will be investigated for the presence of naturally occurring contaminants such as asbestos, arsenic; likelihood of erodibility of soil; contours, terrain stability, slope gradient; physical and chemical properties of soil such as soil depth, particle size distribution, permeability, dispersibility, pH, salinity; and likelihood of seismic activity. If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned authority. The seismic factor shall also be considered at the design stage; ▪ Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain 110 per cent of the total volume of stored fuels and chemicals; and ▪ The disposal of waste asphalt shall be made in approved locations such as borrow pits or natural depressions and shall not be within the RoW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water			

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			percolating through the waste materials and leaching toxic chemicals into the surrounding soils. On completion of disposal at the site, the area shall be capped with a compacted thickness of at least 0.5 meters of impermeable soil covered with at least 200 mm of top soil and shall be finally landscaped.			
7.	Noise	Physiological and psychological impacts	▪ Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices; ▪ Confining excessively noisy work to normal working hours in the day; ▪ Providing the construction workers with suitable hearing protection like ear cap, ear muffs etc.; ▪ Avoiding heavy machinery like percussion hammers and pneumatic drills, especially during night time; ▪ Locating the rock crushing, concrete mixing and material shipment yards away from residential areas, particularly schools, hospitals and nursing homes; and ▪ Noise quality monitoring will be carried out as per schedule given in Environmental Monitoring Plan.	CC	SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
8.	Surface and Groundwater	▪ Surface water might get contaminated due to the disposal of construction waste generated due to the Project activity; this contamination will not only endanger the aquatic life but will also result in	▪ The surface and groundwater reserves will be adequately protected from any source of contamination such as the construction and oily waste that will degrade its potable quality; ▪ The solid waste will be disposed of	CC	SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
		jeopardizing the health of natives that use this water for meeting domestic requirement; and ▪ In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.	in designated landfill sites to sustain the water quality for domestic requirements; ▪ Regular water quality monitoring according to determined sampling schedule; ▪ The contractor will ensure that construction debris do not find their way into the drainage or irrigation canals which may get clogged; ▪ Work on irrigation canal areas will be kept to a minimum, protective walls be (re-constructed; ▪ To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas; ▪ Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond; ▪ Construction work close to the streams or other water bodies will be avoided, especially during monsoon period; ▪ Constructing temporary or permanent devices to prevent water pollution due to increased siltation; and ▪ Wastes will be collected, stored and taken to approved disposal site.			other items of work in the BOQ.
9.	Flora and Fauna	▪ Loss of 4794 acres of agricultural land ▪ Cutting of 18,000 trees due to Project related construction activities. ▪ Hunting and fishing	▪ Flowering and fruiting shrubs will be planted along the road to beautify the landscape. ▪ Raised Median will be planted with grasses (turfing) and shrubs which	NHA	SC, Forest Department and Wildlife Department	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			may not attain height more than two meters. ▪ All old and mature trees falling in the 25 meter wide proposed planting strips will be saved. Effort will 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 ensured; ▪ An awareness campaign targeted on the neighbourhood farmers will be run to popularize the planting of trees, and saplings will be provided on subsidized costs; and ▪ Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides. ▪ Illegal animal and fish hunting will not be allowed and punishment will enforced in case of violation; ▪ Wildlife department will check and confirm that no hunting is made; ▪ New and good condition machinery with minimum noise will be used in construction; ▪ Noisy work will not be carried out in night time so that there will be no disturbance to local birds and animals; ▪ Contractor will ensure that the no hunting, trapping of animal will be carried during construction; and ▪ Borrow pits will be fenced so that no animal can fell into these.			other items of work in the BOQ.
10.	Social and Cultural Problems	▪ Exit/entry problems for the residents/ movement of the people to the mosque/shrines may be disturbed;	▪ Providing alternative ways in order for the local people to perform their routine tasks;	CC, NHA	SC	No additional payment will be made to the contractor for these

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
		and ▪ Serious law and order situation due to interaction of workforce with the local communities. ▪ Livelihood problem due to loss of agricultural land	▪ Adding appropriate clauses in the construction contracts to avoid any law and order situation; ▪ Local labour shall be employed with an agreed ratio (>75%) for construction works; and ▪ An agreed minimum unskilled labour employment for women with equal remuneration as men agreed at an early stage.			mitigation measures. The contractor will include their costs in other items of work in the BOQ.
11.	Traffic Management	Traffic jams causing inconvenience to the people	▪ Proper alternative traffic management plan – control of traffic in cooperation with the local traffic police department	CC, NHA, Local Traffic Police Department	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
12.	Utilities	Construction activities will result in relocation of various utilities within the RoW, including electrical poles, transmission and telephone lines	▪ Strengthening of utilities, wherever required; ▪ Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area	NHA and Local Concerned Departments.	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

Table 8.2 (a): Environmental Management Plan (Construction Phase of Section-II M 4)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
1	Topography	Cutting and dismantling of existing infrastructure	Proper landscaping	Construction Contractors (CC)	Supervision Consultants (SC)	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
						other items of work in the BOQ.
2	Borrow/ open pits	▪ Land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments; and ▪ Borrow and open pits are potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife.	▪ Necessary permits will be obtained for any borrow pits from the competent authorities; ▪ No excavations allowed within a distance of 100 metres of the RoW; ▪ In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4; ▪ Soil erosion along the borrow pits will be regularly checked to prevent/ mitigate impacts on adjacent lands; ▪ In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and ▪ Borrow pits will be used for construction material landfill or fish ponds, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.	CC	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
3	Air Quality	Air quality will be affected by fugitive dust emissions from construction machinery, asphalt plants and vehicular traffic. Emission may be carried over long distances depending upon the wind speed, direction, the temperature of the surrounding air etc.	▪ Dust control by equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions; ▪ Sprinkling of water across diversion tracks. Ensuring that haul trucks carrying asphalt concrete mix and/ or aggregate fill materials are kept covered with tarpaulin to help contain construction material being transported between sites; and ▪ Enforcing the NEQS applicable to gaseous emissions generated by	CC	SC, EPD Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			construction vehicles, equipment and machinery.			
4	Construction waste disposal (Wastewater, oil and solid waste etc.)	Unhygienic conditions, health risk to work force	▪ Wastewater effluent from contractors workshop and equipment washing yards will be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams; ▪ Training of work force in the storage and handling of materials and chemicals that will potentially cause soil contamination; ▪ Solid waste generated during construction and in camp sites will be properly treated and safely disposed of in demarcated waste disposal sites; and ▪ Debris generated by dismantling of existing pavement structures will be recycled subject to the suitability of the material.	CC	SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
5.	Construction Camps and Other Facilities	Loss of plantation and vegetation, permanent physical and visual impact on the area, social disturbance for nearby community	▪ The construction camps and workshops will not be located in sensitive areas and prevented within 500 meters distance from the existing settlements; ▪ Efforts will be made to minimize vegetation loss while making site arrangements for construction camps and other facilities; ▪ Cutting of trees shall be prohibited by contractor(s) and workers near camp sites ▪ The crushing plants shall not be located in environmentally sensitive areas or existing settlements; ▪ The sites for borrow pits shall be selected on the basis of type of soil	CC	NHA & SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			strata, depth of water table, ground topography, prevalent vegetation state etc. and shall not be located within 100 meters from RoW of the proposed Project. They shall be prohibited where they might interfere with the existing or designed drainage pattern. The River locations shall be prohibited where there is greater likelihood of damaging the River bank or carrying fine material downstream. The Contractor(s) shall ensure that borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of stagnant water bodies, which are favourable places for mosquito breeding; ▪ The depth of construction materials such as gravel removed from the River bank shall be kept one tenth of the total width of the River and this activity shall not interrupt the River flow or undermine the River banks; ▪ Asphalt hot mix and batching plants will not be located within 1000 meters of the existing settlements and will be preferred to establish 500 meters away the settlement and sufficiently away from agricultural activities, industrial establishments and sensitive areas including, but not limited to, educational and health facilities; ▪ The construction material for M-4 will be taken from these approved quarries and no any new quarry will be dug by contractor;			

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			▪ The construction material storage areas shall not be located in sensitive areas and shall be sheltered or sited within hoardings; ▪ The Contractor(s) will use the selected routes for transport of construction materials. Any damage caused to these routes by overloading or heavy vehicles will be borne by the Contractor(s); ▪ Landowners shall be compensated according to the terms of lease agreements negotiated with them for constructing camps and other facilities; and ▪ The sites for camps and associated facilities shall be reinstated by the Contractor(s) after decommissioning of the proposed Project.			
6.	Soil Erosion and Contamination	Road stability, increased flood risk (by more rapid and higher levels of runoff), silting up of water bodies, landscape value and in worst cases may reduce the economic productivity of land and biodiversity in the Project Area.	▪ Non-productive, barren lands in broken terrain, nullahs and publicly recognized waste lands shall be used for borrowing materials; ▪ The excavation of earth fill shall be limited to an approximate depth of 50 to 100 cm; ▪ In case the use of agricultural land is unavoidable, the top 30 cm of the plough layer shall be stripped off and stockpiled. Where deep ditching is to be carried out, the top 1 meter layer of the ditching area shall be stripped and stockpiled for redressing the land after the required borrow material has been removed; ▪ Drainage interception ditches shall be built around the borrow pits to prevent surface run off causing	CC	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			erosion during the rainy season; ▪ The denuded ground cover will be re-vegetated as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover; ▪ The road embankments and road cuttings will be vegetated with a fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. Use of stone pitching or riprap will be made at appropriate places especially at overpasses, bridges, culverts; ▪ Discharge zones from drainage structures will be furnished with rip-rap to reduce erosion; ▪ Down drains/chutes shall be lined with rip-rap/masonry or concrete to prevent erosion; ▪ Side slopes shall be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion; ▪ Construction will be restricted to dry season to avoid soil erosion; ▪ Soil erosion checking measures such as the formation of sediment basins etc, will be taken; ▪ The proposed Project Site, through which the alignment is proposed, will be investigated for the presence of naturally occurring contaminants such as asbestos, arsenic; likelihood of erodibility of soil; contours, terrain stability, slope gradient; physical and chemical			

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			properties of soil such as soil depth, particle size distribution, permeability, dispersibility, pH, salinity; and likelihood of seismic activity. If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned authority. The seismic factor shall also be considered at the design stage; ▪ Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain 110 per cent of the total volume of stored fuels and chemicals; and ▪ The disposal of waste asphalt shall be made in approved locations such as borrow pits or natural depressions and shall not be within the RoW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water percolating through the waste materials and leaching toxic chemicals into the surrounding soils. On completion of disposal at the site, the area shall be capped with a compacted thickness of at least 0.5 meters of impermeable soil covered with at least 200 mm of top soil and shall be finally			

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			landscaped.			
7.	Noise	Physiological and psychological impacts	▪ Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices; ▪ Confining excessively noisy work to normal working hours in the day; ▪ No heavy machinery will be used or any disturbance causing work will be done in the late hours i.e. after 9pm in summer and 6pm in winters; ▪ Providing the construction workers with suitable hearing protection like ear cap, ear muffs etc.; ▪ Avoiding heavy machinery like percussion hammers and pneumatic drills, especially during night time; ▪ Locating the rock crushing, concrete mixing and material shipment yards away from residential areas, particularly schools, hospitals and nursing homes; and ▪ Noise quality monitoring will be carried out as per schedule given in Environmental Monitoring Plan. ▪ In section-II of M-4 two locations were found most sensitive during the site survey regarding the effect of noise due to the presence of Govt Elementary school for Girls and few community houses in Mouza 7 Ghag, at the pre construction stages noise analysis has been collected as a base line reference, samples results can be viewed in table 4.4 during the construction phase special	CC	SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			attention will be paid on these locations;			
8.	Surface and Groundwater	▪ Surface water might get contaminated due to the disposal of construction waste generated due to the Project activity; this contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement; and ▪ In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.	▪ The surface and groundwater reserves will be adequately protected from any source of contamination such as the construction and oily waste that will degrade its potable quality; ▪ The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements; ▪ Regular water quality monitoring according to determined sampling schedule; ▪ The contractor will ensure that construction debris do not find their way into the drainage or irrigation canals which may get clogged; ▪ Work on irrigation canal areas will be kept to a minimum, protective walls be (re-constructed; ▪ To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas; ▪ Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond; ▪ Construction work close to the streams or other water bodies will be avoided, especially during monsoon period; ▪ Constructing temporary or permanent devices to prevent water pollution due to increased siltation; and	CC	SC, EPA Punjab	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			▪ Wastes will be collected, stored and taken to approved disposal site.			
9.	Flora and Fauna	▪ 1156 acres private land will be acquired, 47 acres land will be acquired for interchanges and 347 acres is the Government owned land. ▪ Cutting of 27302 trees due to Project related construction activities. ▪ Hunting and fishing	▪ Flowering and fruiting shrubs will be planted along the road to beautify the landscape. ▪ Effort will 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 ensured; ▪ An awareness campaign targeted on the neighbourhood farmers will be run to popularize the planting of trees, and saplings will be provided on subsidized costs; and ▪ Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides. ▪ Illegal animal and fish hunting will not be allowed and punishment will enforced in case of violation; ▪ Wildlife department will check and confirm that no hunting is made; ▪ New and good condition machinery with minimum noise will be used in construction; ▪ Noisy work will not be carried out in night time so that there will be no disturbance to local birds and animals; ▪ Contractor will ensure that the no hunting, trapping of animal will be carried during construction; and ▪ Borrow pits will be fenced so that no animal can fell into these.	CC, NHA	SC, Forest Department and Wildlife Department	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
10.	Social and Cultural	▪ Exit/entry problems for the residents/	▪ Providing alternative ways in order	CC, NHA	SC	No additional payment

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
	Problems	movement of the people to the mosque/shrines may be disturbed; and ▪ Serious law and order situation due to interaction of workforce with the local communities. ▪ Livelihood problem due to loss of agricultural land	for the local people to perform their routine tasks; ▪ Adding appropriate clauses in the construction contracts to avoid any law and order situation; ▪ Local labour shall be employed with an agreed ratio (>75%) for construction works; and ▪ An agreed minimum unskilled labour employment for women with equal remuneration as men agreed at an early stage.			will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
11.	Traffic Management	Traffic jams causing inconvenience to the people	▪ Proper alternative traffic management plan – control of traffic in cooperation with the local traffic police department	CC, NHA, Local Traffic Police Department	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.
12.	Utilities	Construction activities will result in relocation of various utilities within the RoW, including electrical poles, transmission and telephone lines	▪ Strengthening of utilities, wherever required; ▪ Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area	NHA and Local Concerned Departments.	SC	No additional payment will be made to the contractor for these mitigation measures. The contractor will include their costs in other items of work in the BOQ.

Table 8.2 (b) Environmental Management Plan (Operation Phase)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
1.	Noise	Physiological and psychological	▪ Plantation of indigenous tree species ▪ Enforcing laws and testing vehicles regularly for noise pollution	NHA		The cost for plantation will be included in the total Project cost.
2.	Deterioration of Vehicles	Less wear and tear due to improved road condition	-	-		
3.	Soil Erosion and Contamination	▪ Flood risk by rapid flash of storm-water runoff, undermining of the structures such as bridges, flyovers and slope instability causing damage to the Motorway; and ▪ Soil contamination due to Wastewater arising from Service Areas.	▪ In case soil erosion takes place, proper remedial measures will be undertaken to stop future impacts of loss of soils and the associated impacts caused by soil erosion; ▪ Vegetation for human use will be banned within the proposed RoW; and ▪ Toilets at the service areas will be equipped with septic tanks, and the waste will be disposed at designated sites.	NHA	NHA & NH&MP	The cost for these mitigation measures will be included in the total Project cost.
4.	Road Safety	Road safety issues like accidents	▪ Enforcing speed limits and imposing penalties on the traffic violators; ▪ Rest areas will be provided for those in need for rest during travel; ▪ Traffic signs will be provided to facilitate road users about speed limits, rest areas, eating establishments etc.; ▪ Warning messages such as "*speed thrills but kills*" or "*better late than never*" etc. will also be displayed at appropriate locations to aware drivers about likely accidents due to overspeeding; ▪ All the lanes, median, sharp bends will be reflectorized to facilitate travellers in the night time; and ▪ Proper lighting arrangement on the	NH&MP	NHA	The cost for these mitigation measures will be included in the total Project cost.

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility		Cost
				Implementation	Supervision	
			proposed Motorway will be done at required places.			
5.	Landscaping	Solid waste along the Motorway	▪ Provision of solid waste collection bins/containers at appropriate places ▪ Safe disposal of solid waste	NHA		The cost for these mitigation measures will be included in the total Project cost.
6.	Land Use	Development of commercial establishments (restaurants, petrol and gas filling stations), educational institutes etc., which may affect the land value	Seeking permission from the concerned authority for future development	NHA	Development Authority	The cost for these mitigation measures will be included in the total Project cost.
7.	Air Quality	Change in air quality with the passage of time	▪ Setting up of system to monitor air quality along the Project Area in accordance with acceptable International standards; and ▪ Trees will be planted along the fence of the proposed Motorway, these will work noise barrier. For suitable plantation Forest Department will be consulted.	NHA	EPA Punjab	The cost for these mitigation measures will be included in the total Project cost.
8.	Time Saving	Reduced travel time, which will be permanent moderate positive impact	-	-		
9.	Socio-economic Conditions	▪ Opening up markets to rural economic activities by reducing the production and transportation cost thereby stimulating agricultural production ▪ In-accessibility except from interchanges	▪ Providing interchanges at appropriate locations ▪ Keeping underpasses in operation condition by regular maintenance	NHA		The cost for these mitigation measures will be included in the total Project cost.

Note: DC (Design Consultant), CC (Construction Contractor), SC (Supervision Consultant), NHA (National Highway Authority), NHMP (National Highway & Motorway Police)

8.6 Environmental Monitoring

297. This section provides a monitoring plan that identifies the roles and responsibilities of Project staff involved in environmental and social monitoring and lists the parameters that will be used in the monitoring process.

8.6.1 Objectives

298. The main objectives of the pre-construction, construction and operation phase monitoring plans will be to:

- Monitor the actual impact of the works on physical, biological and socio-economic receptors within the Project corridor for indicating the adequacy of the EIA;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the EIA;
- Ensure compliance with legal and community obligations including safety on construction sites;
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMP; and
- Ensure the safe disposal of excess construction materials.

299. The main objectives of monitoring during the operation phase will be to:

- Appraise the adequacy of the EIA with respect to the Project's predicted long-term impacts on the corridor's physical, biological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
- Compile periodic accident data to support analyses that will help minimise future risks; and
- Monitor the survival rate of avenue plantations.

8.6.2 Monitoring Roles, Responsibilities and Schedules

300. The Project staff engaged in social and environmental monitoring is listed below, followed by descriptions of the monitoring responsibilities specific to each post:

- DD (Environment)
- Supervision Consultants

301. Overall monitoring plan is shown in Table 8.3.

a) Deputy Director (Environment)

302. The Deputy Director (Environment) will have overall responsibility for Environmental Monitoring and Evaluation (M&E). This includes the following:

1. Ensuring the availability of human and material resources required for environmental monitoring;
2. Generating periodic monitoring reports and disseminating these among the management and appropriate staff members;
3. Ensuring that the required environmental training is provided to the staff concerned; and

4. Contracting out external monitoring to independent firms and ensuring that periodic environmental audits are carried out.

303. The DD (Environment) and his team will also be responsible for:

1. Carrying out visits to the construction sites to review the environmental performance of the contractors; and
2. The status of the Project's consultation strategy.

b) Supervision Consultant

304. Supervision Consultant will involve the Environmental Expert/ Monitoring Consultant and Resident Engineer. The Resident Engineer will overlook the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP. The Monitoring Consultant (MC) on the other hand will carry out the environmental monitoring and report to DD (Environment) for adequacy of the monitoring program as specified in EMP. The MC will also induct a Technical Training Consultant to educate the Contractor's and NHA's staff.

8.6.3 Monitoring Parameters

a) Environmental Monitoring Parameters

305. The following environmental parameters will be monitored at locations identified during the construction phase (e.g. location of asphalt plants, construction camps. etc.).

- Ambient Air Quality (NO_x, SO_x, CO, PM_{10}, Hydrocarbons, Smoke)
- Water Quality
  Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium)
  Wastewater Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)
- Noise Levels

b) Social Monitoring Parameters

306. Social monitoring will be carried out based on the following indicators:

- Number of PAPs to be resettled/ relocated/ provided livelihood assistance where required;
- Availability and adequacy of alternative resettlement sites for PAPs (by number and type);
- Inventory and valuation of PAPs' affected assets;
- Pre- and post-resettlement incomes of PAPs;
- Notice period given to PAPs before shifting them from their original locations within the RoW;
- Number of vulnerable PAPs compensated under the EMP;
- Verification of shifting assistance provided to displaced squatters and to squatter-owners allowed to salvage their facilities;
- Number and nature of consultations carried out, as well as targeted stakeholders;
- PAPs' perspectives on compensation procedures, entitlement packages, and proposed alternative resettlement sites;

- Record of any problems due to restricted access to the Motorway during construction and whether ramps/ diversions have been provided where required;
- Number of grievances recorded and redressed;
- Number of public facilities and utilities to be relocated;
- Number of mosques/ shrines/ graves to be relocated (if any) and corresponding contribution of affected communities and NHA; and
- Verification of relocation of mosques/ shrines/ graves.

8.6.4 Reporting Structure and Outcomes

307. Progress reporting will be the overall responsibility of the Project Director who will provide inputs to the Supervision Consultants for submission to GM (NHA/ADB). The Supervision Consultants will be responsible for submitting a monthly environmental/ social report for the Project to GM (NHA/ADB). In addition, the DD (Environment) will prepare a quarterly report encompassing environmental concerns, and following review by the Director (Environment, Social and Land/Resettlement) he will submit the report to the EPA Punjab.

Table 8.3 (a) Environmental Monitoring Plan

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
Pre-Construction Stage								
	|Ambient Air Quality (CO, NO_x, SO_x, PM_{10})	7.5 metres from the edge of pavement downwind at seven selected locations	USEPA Standards	7	Once @ Rs.50,000/ location	NHA	Continuous for 24 hours or one full working day	350,000/-
	Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Entercocci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) Surface Water Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)	Community groundwater sources near the edge of the RoW at 7 selected locations along the proposed Motorway	▪ WHO Drinking Water Quality Guidelines (2004) ▪ NEQS (2000)	7 for groundwater and 4 for surface water	Once @ Rs. 10,000 /-per sample	NHA		110,000/-
	Noise Levels on dB(A) Scale	Seven locations: 15 meters from the edge of the pavement, at sensitive locations like basic health unit, school, madrassa and residential/ commercial area.	WHO Noise Guidelines	7	Once @ Rs. 1,500/- per point	NHA	24 hours @ 15 seconds interval over 15 min every hour, then averaged	10,500/-
							TOTAL	**470,500/- (US$ 7,841.667)**
Construction Stage								
	Air Quality (PM_{10}, Hydrocarbons) All relevant stack emissions (CO, NO_x, SO_x, Smoke)	40 metres from hot mix plants	USEPA, WHO, NAAQS	4 (1 in each section)	Bi-annually @ Rs. 70,000/- for four years	Contractor	Continuous for 24 hours or one full working day	2,24,000/-
	PM_{10}	In active construction area	USEPA, WHO, NAAQS	4 (1 in each section)	Monthly @ Rs. 10,000 for four years	Contractor	Continuous for 24 hours or over one full	1,920,000

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
							working day	
	Water Quality Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) Wastewater Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)	Four locations - near edge of the RoW and community groundwater source All project-related wastewater discharge locations including camp sites, asphalt plants and workshops (four locations)	WHO Drinking Water Quality Guidelines (2004) NEQS (2000)	4 for groundwater and 4 for wastewater (1 for groundwater and 1 for surface water in each section)	Bi-annually @ Rs. 10,000	Contractor		640,000/-
	Noise Levels on dB (A) Scale	At equipment yard and construction site and during pile driving 7 meters from noise source	WHO Noise Guidelines	4 (1 in each section)	Monthly @ Rs. 1,500 per point for four years	Contractor	24 hours @ 15 seconds interval over 15 min every hour, then averaged	288,000/-
		Not less than one location 15 meters from the edge of pavement and at locations of all potentially affected sensitive receptors		7				504,000/-
							TOTAL	**5,592,000/-** **US $ 93,200/-**
Operation Stage								
	Ambient Air Quality (CO, NO_x, SO_x, PM_{10})	7.5 metres from the edge of pavement downwind at seven selected locations	USEPA Standards	7	Once @ Rs.50,000/ location	NHA	Continuous for 24 hours	350,000/-
	Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Entercocci, pH, TDS, Total Hardness,	Community groundwater sources near the edge of the RoW at 7 selected locations along the proposed Motorway	▪ WHO Drinking Water Quality Guidelines (2004)	7 for groundwater and 4 for Wastewater	Once @ Rs. 10,000 per sample	NHA		110,000/-

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
	Nitrate, Chloride, Sodium) Surface Water Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)		▪ NEQS (2000)					
	Noise Levels on dB(A) Scale	Seven locations: 15 meters from the edge of the pavement, at sensitive location like basic health unit, school, madrassa and residential/ commercial area.	WHO Noise Guidelines	7	Once @ Rs.1,500/- point	NHA	24 hours @ 15 seconds interval over 15 min every hour, then averaged	10,500
							TOTAL	**470,500/- US $ 7,841.667/-**
							Total Monitoring Cost	**6,533,000/- US $ 108,883.3 /-**

Table 8.3 (b) Environmental Monitoring Plan for Section-II M 4

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
Pre-Construction Stage								
	|Ambient Air Quality (CO, NO_x, SO_x, PM_{10})	7.5 metres from the edge of pavement downwind at four selected locations	PAK NEQS	4	Once @ Rs.50,000/ location	NHA	Once in 24 hours	200,000/-
	Surface water and Ground water Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Entercocci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) Surface Water Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)	Community ground water and surface water sources near the edge of the RoW at 4 selected locations along the proposed section-II of M-4	▪ WHO Drinking Water Quality Guidelines (2004) ▪ NEQS	2 for groundwater and 2 for surface water	Once @ Rs. 15,000 /-per sample	NHA		60,000/-
	Noise Levels on dB(A) Scale	Four locations: In Chak No. 305/JB at RD 59+200, Chak No. 396 JB at RD 86+700 near GGES, at RD 119+500 at Rakh Kotla and at RD 120+200 in Mouza 7 Ghag area locations shown on map no Riaz.	PAK NEQS	4	Once @ Rs. 1,500/- per point	NHA	Once in 24 hours	6,000/-
							TOTAL	**266,000/- (US$ 2660)**
Construction Stage								
	Air Quality (PM_{10}, Hydrocarbons) All relevant stack emissions (CO, NO_x, SO_x, Smoke)	40 metres from hot mix plants	Pak-NEQS	4	Bi-annually @ Rs. 50,000/- for two years	Contractor	Continuous for 24 hours or one full working day	800,000/-
	PM_{10}	In active construction area	Pak-NEQS	4	Monthly @ Rs. 10,000 for two years	Contractor	Continuous for 24 hours or	960,000/-

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
							over one full working day	
	Water Quality Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium) Wastewater Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)	Four locations - near edge of the RoW and community groundwater source All project-related wastewater discharge locations including camp sites, asphalt plants and workshops (four locations)	WHO Drinking Water Quality Guidelines (2004) NEQS	2 for groundwater and 4 for wastewater 2 for surface water	Bi-annually @ Rs. 15,000	Contractor		480,000/-
	Noise Levels on dB (A) Scale	At equipment yard and construction site and during pile driving 7 meters from noise source	PAK NEQS	4	Monthly @ Rs. 1,500 per point for two years	Contractor	24 hours @ 15 seconds interval over 15 min every hour, then averaged	6,000/-
		Not less than one location 15 meters from the edge of pavement and at locations of all potentially affected sensitive receptors		4				6,000/-
							TOTAL	**2,252,000/-** **US $ 22,520/-**
Operation Stage								
	Ambient Air Quality (CO, NO_x, SO_x, PM_{10})	7.5 metres from the edge of pavement downwind at four selected locations	PAK-NEQS	4	Once @ Rs.50,000/ location	NHA	Once in 24 hours	200,000/-
	Groundwater Quality (Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Entercocci, pH, TDS, Total Hardness,	Community ground water and surface water sources near RoW at four selected locations along the proposed	▪ WHO Drinking Water Quality Guidelines ▪ NEQS	2 for groundwater and 2 for surface water	Once @ Rs. 15,000 per sample	NHA		60,000/-

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
	Nitrate, Chloride, Sodium) Surface Water Quality (pH, DO, TSS, Alkalinity, BOD_5, COD, Turbidity)	section-II of M-4 Motorway						
	Noise Levels on dB(A) Scale	Four locations: In Chak No. 305/JB at RD 59+200, Chak No. 396 JB at RD 86+700 near GGES, at RD 119+500 at Rakh Kotla and at RD 120+200 in Mouza 7 Ghag area locations shown on map no Riaz	PAK NEQS	4	Once @ Rs.1,500/- point	NHA	Once in 24 hours	6000
							TOTAL	**266,000/- US $ 2660/-**
							Total Monitoring Cost	**5,178,000/- US $ 51,780 /-**

8.7 Environmental Mitigation Cost

308. To minimise the negative impacts arising due to increased vehicular activity on the road, excessive trees will be planted along the entire Project.

309. Table 8.4 gives the mitigation cost for Planting and Maintenance. Two strips of 25m width have been planned to be reserved for planting on both sides of the motorway (Faisalabad – Khanewal section = 184 km long). Planting shall be done in rows (avenues). Eight avenues (row to row distance = 3m) shall be planted for a length of 50 km near the habitations and four avenues (row to row distance = 6m) in the rest of the 134 km long strip.

Number of plants in eight avenue/ rows of 50 km = (50,000m/3m x 8)

= 133,328

Number of plants in four avenue/ rows of 134 km = (134,000m/3m x4)

= 178,664

Number of plants in one strip (133,328 +178,664) = 311,992

Number of plants in one strip (311,992 x2) = 623,984

Number of Avenue miles
(500 plants in on avenue mile) to be planted = 1,250

Beating up of failures
(25% of the plants planted) Avenue miles = 312

Table 8.4
Mitigation Cost on Planting and Maintenance

#	Year	Planting cost (Rs. Per Av. Mile)	Avenue Miles	Amount	
				Pak Rs.	US $
1	1	25,000 ($ 416.6)	1,250	31,250,000	520,833.3
2	1	(for beating up failures) 25,000 ($ 416.6)	312	7,800,000	130,000
3	2	10,000 ($166.6)	1,250	12,500,000	208,333.3
4	3	7,500 ($ 125)	1,250	9,375,000	156,250
5	4	4,000 ($ 66.7)	1,250	5,000,000	83,333.3
6	5	3,000 ($ 60)	1,250	3,750,000	62,500
		TOTAL		**69,675,000**	**1,161,250**

291. Table 8.5 gives the mitigation cost for grass turfing and planting with shrubs and climbers. Raised Median shall be planted with grasses (turfing) and shrubs which may not attain height more than two meters. A large variety of shrubs and stout climbers is available and choice can be made out of these. Kener (Nerium oleander) and Bouganvillea are two examples. This planting could provide an effective protection against night glare besides beautifying the area.

The width of the median = 7 m

Length of the motorway section = 184 km

Area of the median = 130 ha

Table 8.5
Cost on Grass Turfing and Planting with Shrubs and Climbers

#	Year	Planting cost (Rs. Per Hectare)	Area (Ha)	Amount	
				Pak Rs	US $
1	1	75,000 ($ 1250)	130	9,750,000	162500
2	1	75,000 ($ 1250), beating up failures, turfing (25%)	32.5	2,475,000	41250
3	2	30,000 ($ 500)	130	3,900,000	65000
4	3	30,000 ($ 500)	130	3,900,000	65000
5	4	30,000 ($ 500)	130	3,900,000	65000
6	5	30,000 ($ 500)	130	3,900,000	65000
7		**Total**		**27,825,000**	**463750**

8.8 Environmental Technical Assistance and Training Plan

310. An environmental and social training and Technical Assistance (TA) programme will be carried out to build the NHA's capacity to effectively implement this EMP, as well as to facilitate the improved environmental management of future Motorway Projects by increasing the environmental and social awareness of NHA staff in general. The NHA with the collaboration of Monitoring Consultants (MC) will arrange the environmental training sessions for their staff. The objective of these sessions will be to help establish appropriate systems, and to train senior NHA staff responsible for managing environment, operations, and planning, who can then impart training at a broader level within and outside the NHA (i.e., the training of trainers). The Consultants will organize training courses for NHA staff, in specialized areas such as air and noise pollution monitoring; develop environment operation manuals in consultation with the NHA's Environmental wing. The details of this training program are presented in Table 8.6

Table 8.6
Personnel Training Programme/ TA Services

Provided by	Contents	Trainees/ Events	Duration
Monitoring consultants/ organizations specializing in environmental management and monitoring	Short seminars and courses on: Environmental laws and regulations daily monitoring and supervision	Three seminars for NHA Project staff	2 days
Monitoring consultants/ organizations specializing in social management and monitoring	Short seminars and courses on: Social awareness	Three seminars for Project staff dealing in Social/lands matters	2 days
Monitoring consultants/ organizations specializing in Occupational, health and safety issues	Short lectures relating to Occupational Safety and Health	Two seminars for contractor's staff	2 days

8.9 Environmental Monitoring, Mitigation and Training Costs

311. For an effective implementation of environmental mitigation measures, it is very important to provide sufficient funds for the implementation of environmental mitigation measures, monitoring, training and land acquisition and resettlement (including damages). National Highways Authority (NHA) is committed to implement all mitigation measures given in this report and will provide required funds in this regard. The summary of total environmental costs is given in Table 8.7, which amounts out to be Rs. 3,969.199 million (US $ 66.187).

Table 8.7 Summary of Environmental Costs

#	Description	Cost (Millions)	
		Pak Rs.	US $
1.	Environmental Mitigation Cost	97.50	1.625
2.	Environmental Monitoring Cost	6.53	0.109
3.	Environmental Training Cost	0.2	0.033
4.	Land Acquisition and Resettlement Cost	3,864.969	64.42
	TOTAL	**3,969.199**	**66.187**

8.10 Environmental Mitigation Cost (Replantation)

312. Three rows of plants will be raised along the M-4 Section-II road on one side of the road. Distance between two plants will be kept as 4 meters, thus on one side 46500 numbers of plants are to be raised (93000 on both sides of the road).

Plantation Cost

313. The cost of plantation includes the cost of equipment and initial planting and maintenance for two years and given in detail in table 8.8 and 8.9.

Table 8.8: Estimated Cost of Raising of Plantation Over 1 km (250 plants in one row, 750 plants for three rows in 1 km)

Sr. No	Particulars of Work	Quantity (No.)	Rate (Rs.)	Amount (Rs.)
1	Clearance of Site	750 plants (8 MD, 5 labour)	400/MD	16,000
2	Layout	750 plants (2 MD, 4 labour)	400/MD	3,200
3	Digging of Pits 2.65 x 250 = 662.50cft. (232.537m^3)	750 pits (10 MD, 8 labour)	400/MD	32,000
4	Average cost of plants	750 plants	30/plant	22,500
5	Carriage of plants 750 Nos. from Nursery to Site including loading/unloading	750 plants	5/plant	3,750
6	Planting of plants with ball of earth	750 plant (5 MD, 8 labour)	400/MD	16,000

7	Miscellaneous (weeding for 4 times a year, pesticides and maintenance, replacement of dead plants)			200,000
Sub-Total				**293,450/-**

**MD: Man Days*

Note: For the remaining period of contractor's contract with NHA, maintenance of plants (Weeding for 4 times a year, pesticides, replacement of dead plants and watering 40 times a year) will be the responsibility of contractor

293,450 Pak Rs. is a cost of plantation in 1 km while the cost for plantation in 62 km of length is 18,193,900 Pak Rs.

Cost of Equipment

314. The tentative cost of equipment is given in Table 8.9 given below:

Table 8.9: Tentative Cost of Equipment for 2 years

Sr. No	Name of Equipment	No.	Price (Rs.)
1.	Tractor	2	600,000
2.	Water Tanker/Bowzer	2	500,000`
3.	Kassies (Local Earth Digging Tool)	200	40,000
4.	Vaholas (Local Earth Digging Tool)	200	40,000
5.	Lift Pump for filling Water Tanker/Bowzers	2	200,000
6.	Cost of Diesel for 2 years		1500,000
Sub-Total			**2,880,000 Pak Rs.**
			28800 US$

Total Cost of Plantation

i. Cost of Plantation in 62 km is 18,193,900/-
ii. Cost of equipment is 2,880,000/-
iii. Total cost in Pak Rs. 21,073,900/-
iv. Total cost in US $ 210739

8.11 Environmental Technical Assistance and Training Plan

315. An environmental and social training and Technical Assistance (TA) programme will be carried out to build the NHA's capacity to effectively implement this EMP, as well as to facilitate the improved environmental management of future Motorway Projects by increasing the environmental and social awareness of NHA staff in general. The NHA with the collaboration of Monitoring Consultants (MC) will arrange the environmental training sessions for their staff.

316. The objective of these sessions will be to help/establish appropriate systems, and to train senior NHA staff responsible for managing environment, operations, and planning, who can then impart training at a broader level within and outside the NHA (i.e., the training of trainers). The Consultants will organize training courses for NHA staff, in specialized areas such as air and noise pollution monitoring; develop environment operation manuals in

consultation with the NHA's Environment section. The details of this training program are presented in Table 8.10

Table 8.10 Personnel Training Programme/ TA Services

Provided by	Contents	Trainees/ Events	Duration
Monitoring consultants/ organizations specializing in environmental management and monitoring	Short seminars and courses on: Environmental laws and regulations daily monitoring and supervision	Three seminars for NHA Project staff	2 days
Monitoring3 consultants/ organizations specializing in social management and monitoring	Short seminars and courses on: Social awareness	Three seminars for Project staff dealing in Social/lands matters	2 days
Monitoring consultants/ organizations specializing in Occupational, health and safety issues	Short lectures relating to Occupational Safety and Health	Two seminars for contractor's staff	2 days

a) Cost of Environmental Technical Training

317. The cost provision of Rs. 700,000 (US$ 7000) is estimated on lump sum basis for providing technical training to the staff.

8.12 Environmental Monitoring, Mitigation and Training Costs

318. For an effective implementation of environmental mitigation measures, it is very important to provide sufficient funds for the implementation of environmental mitigation measures, monitoring, and training. National Highways Authority (NHA) is committed to implement all mitigation measures given in this report and will provide required funds in this regard. The summary of total environmental costs is given in Table 8.11, which amounts out to be Rs. 26,951,900 million (US $ 269519).

Table 8.11 Summary of Environmental Costs

#	Description	Cost (Millions)	
		Pak Rs.	**US $ *100Pak Rs**
1.	Environmental Mitigation Cost (Plantation)	21,073,900	24234.5
2.	Environmental Monitoring Cost	5178000	51780
3.	Environmental Training Cost	700,000	7000
	TOTAL	**26951900**	**269519**

SECTION 9

PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

9.0 General

319. This section deals with the information disclosure to the public and consultation sessions held with the different stakeholder groups that are likely to be affected by the implementation of the proposed Project. The consultation process was carried out as per the guidelines of ADB and EPA.

320. This consultation process had the following objectives:

1. Share information with stakeholders on proposed improvement works and expected impacts on the physical, biological and socio-economic environment of the Project corridor;
2. Understand stakeholders' concerns regarding various aspects of the Project, including the existing condition of the Motorway, upgrading requirements, and the likely impact of construction related activities and operation of the improved Motorway;
3. Provide an opportunity to the public to influence Project design in a positive manner;
4. Obtain local and traditional knowledge, before decision making;
5. Increase public confidence about the proponent, reviewers and decision makers;
6. Reduce conflict through the early identification of controversial issues, and work through them to find acceptable solutions;
7. Create a sense of ownership of the proposal in the mind of the stakeholders; and
8. Develop the proposal which is truly sustainable.

9.1 Identification of main Stakeholder

321. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. During the field survey different stakeholders identified were the villagers, local residents, government officials, shop owners, public representative, NGO's and general public. All those stakeholders had different types of stakes according to their professions.

9.2 Scoping Sessions

322. A series of scoping sessions and focus group discussions were also carried out with local communities and local government representatives. The meetings were held at various locations.

323. Generally, people were found to be aware of the need of the Motorway, and indicated their support for the present NHA Project. Local communities demanded that they will be part of a continuous consultation process with other stakeholders at different stages of the Project including the design, construction, and operational periods. The scoping sessions were carried out according to the schedule indicated in Table 9.1.

Table 9.1

Schedule of Scoping Sessions

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Topic
1	19th January 2007 20th January 2007	Faisalabad Tehsil (District Faisalabad)	10:00 am	Kamal Pur Shahbaz Pur Chanan Key Gardana Dandawal	6 12 8 11	Project introduction & Suggestions of Stakeholders Compensation package for affected persons Land acquisition related matters Under passes and Fly overs designs
2	21th January 2007 22th January 2007	Gojra Tehsil (District T.T.Singh)	05:00 pm	Chak No 334 J.B. Chak No 337 J.B. Chak No 343 J.B. Chak No 353 J.B. Chak No 438 J.B.	9 12 7 12 7	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed Compensation in cash and in time Special care for vulnerable groups
3	23th January 2007 24th January 2007	Tehsil Toba Tek Singh (District T.T.Singh)	10:30 am 10:30 am	Chak No 317 J.B. Chak No 384 J.B. Chak No 383 J.B. Chak No 397 J.B. Chak No 400 J.B.	10 7 8 6 5	Project introduction & Suggestions regarding Road Safety Resettlement issues were discussed Compensation package with the Affectees Compensation in cash and in time
4	23th January 2007 24th January 2007	Tehsil Shorkot (District Jhang)	1:30 pm 16:30 pm	Chak No 487 J.B. Chak No 489 J.B. Chak No 404 J.B. Chak No 406 J.B. Chak No 505 J.B.	11 9 8 9 6	Project introduction & Discussion on Compensation Package with the Affectees Compensation in cash and in time Resettlement issues were discussed Under passes and Fly overs designs
5	25th January 2007 26th January 2007	Tehsil Kabirwala (District Khanewal)	10:30 am 15:30 pm	Mouza Jalal Pur Mouza Allah Hoo Mouza Nahaley Wala Mouza Ali Pur Mouza Kot Bhader Mouza Sham Kot	9 6 4 6 5 5 4	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed Compensation Package with the Affectees Compensation in cash and in time Resettlement issues were discussed Under passes and Fly overs designs
6	27th January 2007	Tehsil Khanewal	13:30 pm	Mouza 8 Vanohe	6	Project introduction & Discussion on

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Topic
		(District Khanewal)		Mouza 15 Vanohe Mouza Dunaya wala Mouza 9 Vanohe	4 6 4	Compensation Package with the Affectees Resettlement issues were discussed Compensation in cash and in time

Stakeholders' Concerns

324. The most commonly raised concerns raised during the meetings are listed herewith:

(a) Motorway Design

- Provide underpasses at shorter distances;
- Provide interchanges at appropriate places so that residents of the Project Area can avail the Motorway travel;
- Overhead bridges at existing Link road crossings;
- Improve general standards of construction;
- Abate dust emissions by providing paved road shoulders;
- Construct median in the centre of road for the safety of moving traffic.
- Provide drain outlets to help drain away run-off from the Motorway, particularly in areas where road level is higher than that of surrounding settlements; and
- Plant trees along the Motorway that could reduce air and noise pollution.

(b) Motorway Construction

- Avoid dumping construction material along the Motorway;
- Adopt measures to minimise dust, smoke, and noise pollution, and to control spillages from construction machinery;
- Implement a proper solid waste management plan;
- Induct local labour into the construction workforce as far as possible to avoid social conflict between the migrant labour and local communities; and
- Provide proper diversion for the traffic during construction to avoid traffic congestion, related hazards, and dust emissions.

(c) Motorway Operation

- Erect cautionary and informatory signs;
- Control use of loud horns near schools, traffic disorders and violations of traffic regulations;
- Specify speed limits where required;
- Ensure that cross-drainage pipes and culverts are regularly cleaned; and
- Regularly remove accumulated piles of rubbish from the RoW.

9.3 Proposed Measures for incorporating the Stakeholders' Concerns

(a) Motorway Design

325. The contractors and design consultants will include the following environmental and safety provisions in the project design under the Project:

- Under passes, bridges and interchanges will be located at appropriate and possibly shorter distance;
- A tree plantation programme to compensate for the anticipated loss of vegetation during the construction activities, and to help abate pollution caused by emissions, dust, and noise during Motorway operation; and
- Drainage system will be provided to control surface runoff.

(b) Motorway Construction

326. The following measures will be carried out in order to protect surrounding communities from the expected impact of construction:

- Project facilities will be located at a minimum distance of 500 metres from existing settlements and built-up areas. In order to avoid restricting the mobility of local people, construction vehicles will remain confined within their designated areas of movement.
- Sensitivity towards local customs and traditions will be encouraged to minimise social friction. Good relations with local communities will be promoted by encouraging contractors to provide opportunities for skilled and unskilled employment to locals, as well as on job training in construction for young people.
- NHA is bound to comply with the prevailing national/provincial regulations concerning pollution and waste disposal.
- Solid waste generated during construction and at camp sites will be properly treated and safely disposed off only in demarcated waste disposal sites approved by the supervision consultant; and
- 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/NH&MP (National Highway and Motorway Police). All such barricades will be set up as per local regulations.

(c) Motorway Operation

- Cautionary and informatory signs will be erected;
- Use of loud horns near schools, traffic disorders and violations of traffic regulations will be monitored and controlled by NH&MP;
- Speed limits will be specified and NH&MP will control it; and
- Cross-drainage pipes and culverts cleaning will be ensured on regular basis.

9.4 Village Meetings

327. Village meetings have many uses in participatory development, including information sharing and group consultation, consensus building, prioritising and sequencing of interventions and collaborative monitoring and evaluations. Concerns raised during village meetings have been discussed in Table 9.2.

9.5 Future Information Disclosure Plan

328. After suggesting the possible solutions of the stakeholders' concerns, the solutions (final EIA report) will be disclosed once again before the stake holders and general public. EIA report will be accessible to interested parties on request and the version of final report will be available in the nearest library and its summary will be available in stakeholders' mother tongue.

Table 9.2
Village Meetings and the Concerns

S. No	Village Name/ Venue	Total House hold	Population	Date	No of Participant	Main Concerns	Expectations
1	Chak No. 5 Kamalpur	1000	8000	19.01.07	12	Judicious compensation at market price will be given to affected persons. Agriculture land will be divided in to two portions. Title less affected persons will not given compensation	Economics opportunities for the people of area. Employment opportunity for the people of area. Transport Facility will be improved.
2	Village Shahbazpur	500	4000	19.01.07	9	Under passes will be given. Land will be acquired at market price. Land price will be given before land acquisition.	Transport Facility will be improved.
3	Chak No.337 J.B.	400	3500	21.01.07	10	Agriculture land will be divided in to two portions. Tenants will be compensated for their crops. Under pass will be constructed. Interchange will be given here.	Better transport facilities. Chance of labour work during construction. Less time consumption during Journey
4	Chak No.317 J.B.	300	3000	23.01.07	10	Judicious compensation at market price will be given to affected persons. Accidents Chances will be increase. .	Better transport facilities. Chance of labour work during construction. Less time consumption during Journey
5	Chak No.487J.B.	50	750	23.01.07	11	Accidents Chances will be increase. Judicious compensation at market price will be given to affected persons. Fly over will be constructed. Agriculture land will be divided in to two portions.	Unemployment will be decrease. Patients would easily go to big cities
6	Chak No.406J.B.	300	6000	24.01.07	9	Accidents Chances will be increase. Land will be acquired at current market price. Fly over will be constructed. Agriculture land will be divided in to two portions.	We will enjoy better trans port facilities. Business facilities will be generated. Better transport facilities will be available.
7	Mouza Jalalpur	250	1800	25.01.07	9	Service road will be provided. Sign board will be provided along the settlement. Proper arrangements will be done to avoid construction hazards.	We will enjoy better trans port facilities. Business opportunities will be generated. Better transport facilities will be available.
8	Mouza Allah hoo	200	2100	26.01.07	6	Agriculture land will be divided in to two portions. Cash compensation will be given through one window operation.	People will be able to reach big cities easily. Village people will never migrated to big cities
9	Village Mouza Vanohe	100	1000	27.01.07	6	Agriculture land will be divided in to two portions. Houses and shops will not be dislocated Compensation will be given before demolition. Business will be disturbed Village will be ruin.	People will be able to reach big cities easily. This road will link the people of different cities. Economy of the area will be boasted village at people will never

S. No	Village Name/ Venue	Total House hold	Population	Date	No of Participant	Main Concerns	Expectations
							migrated to big cities
10	Mouza 9 Chak Vanohe	150	1800	27.01.07	21	Fair and proper compensation will be given. Compensation will be given well in time. Agriculture land will be divided in to two portions.	Different kind of conveyances will be available. Different kind of industries will be installed. We will enjoy better trans port facilities. Business facilities will be generated. Better transport facilities will be available.

The Public Meetings were also held in the affected villages for sharing social and environmental issues and their mitigation measures. The details of these meetings are attached as Annexure-IV.

9.6 Proponent Commitments

329. The LAA and its implementation Rules require that following impacts assessment / valuation effort, land and crops are compensation in cash at market rate to titled landowners and registered land tenants /users respectively. The LAA mandates that land valuation is to be based on the latest 5-3 years average reinstated land sale rates, through, in several recent cases the median rate over the past 1 year, or even the current rates, have been applied. Due to vide spread and under – valuation by the revenue department current market rates are now frequently applied with an added 15% compulsory Acquisition surcharge as provided in LAA.

330. Based on the LAA, only legal owners and tenants' registered with the Land Revenue department or processing formal agreements are eligible for compensation or livelihood support. The right of the title less are however addressed under the 1986. Jinnah Abadees for non proprietors in Rural Areas Act which recognise to squatters the right to receive rehabilitation in from of a replacement plot. It is to be noted that this right has been sometime extended in practice to include some from of rehabilitation in cash or in the forms of different from land. Projects such as Chotiari Dam, Ghazi Brotha Hydropower and National Highways Improvement, have awarded compensation and assistance to unregistered tenants and other forms of AP (sharecropper/squatters).

331. As noted above, exceptions to the rule are intrinsic to the fact that the law is elastic and are broadly interpreted at provincial level depending on operational requirements, local needs, and socio-economic circumstances. Recourse is often taken to ad hock arrangements, and understandings for resettlement in difficult situations. The above is also influenced by the fact that an amendment of the LAA has been considered necessary by the Ministry of Environment. Accordingly, a National Resettlement Policy (NRP) and a Resettlement Ordinance have been drafted to broaden LAA provisions and current practices so as to widen the scope of eligibility and tightening up loopholes (i.e. regarding definitions of malpractices, cut-off dates, political influence on routing, etc.). But both these documents are still awaiting government's approval for implementation.

9.7 ADB's Involuntary Resettlement Policy

332. The ADB Policy on Involuntary Resettlement is based on the following principles which will be adopted at time of land acquisition problem:

- Involuntary resettlement will be avoided or at least minimized.
- Compensation will be given to ensure the maintenance of the APs' pre-project living standards.
- APs will be fully informed and consulted on LAR compensation options.
- APs' socio-cultural institutions will be supported/ used as much as possible.
- Compensation will be carried out with equal consideration of women and men.
- Lack of formal legal land title will not be a hindrance to rehabilitation.

- Particular attention will be paid to households headed by women and other vulnerable groups, such as IPs and ethnic minorities, and appropriate assistance will be provided to help them improve their status.
- LAR will be conceived and executed as a part of the project, and the full costs of compensation will be included in project costs and benefits.
- Compensation/rehabilitation assistance will be paid prior to ground levelling, demolition, and in any case, before an impact occurs.

SECTION 10

PUBLIC CONSULTATION AND INFORMATION DISCLOSURE IN THE YEAR 2014 FOR SECTION-II M-4

10.0 General

333. This section deals with the information disclosure to the public and consultation sessions held with the different stakeholder groups that are likely to be affected by the implementation/construction of section-II of M-4 Project. The consultation process was carried out as per the guidelines of ADB and EPA.

334. This consultation process had the following objectives:

9. Share information with stakeholders on proposed improvement works and expected impacts on the physical, biological and socio-economic environment of the Project corridor;
10. Understand stakeholders' concerns regarding various aspects of the Project, including the existing condition of the Motorway, upgrading requirements, and the likely impact of construction related activities and operation of the improved Motorway;
11. Provide an opportunity to the public to influence Project design in a positive manner;
12. Obtain local and traditional knowledge, before decision making;
13. Increase public confidence about the proponent, reviewers and decision makers;
14. Reduce conflict through the early identification of controversial issues, and work through them to find acceptable solutions;
15. Create a sense of ownership of the proposal in the mind of the stakeholders; and
16. Develop the proposal which is truly sustainable.

10.1 Identification of Main Stakeholder

335. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. During the field survey different stakeholders identified were the villagers, local residents, government officials, shop owners, public representative, NGO's and general public. All those stakeholders had different types of stakes according to their interests and professions.

336. General public, elected representatives, local councillors and informal community leaders including members of non-government organizations (NGOs) were asked to state their current perceptions of priorities for improvements to the urban environmental infrastructure in their areas and about the likely impacts of the Project during construction and operation phases. women groups were also contacted. The main objectives of the public information campaign and public

consultation were as follows:

- To share the information about the proposed project, its components and activities with affected people;
- To obtain cooperation and participation of the general public in Project planning and implementation processes;
- To establish accessible and effective grievance redress procedures; and
- Create a sense of ownership among the stake holders regarding the Project.

10.2 Approach for Public Consultation

337. The approach adopted towards public participation was to disseminate information, solicited inputs and getting consensus on issues and propose mitigation measures. This approach was put into practice through consultation in public meetings, meetings with influential people of the districts, workshops and roadside consultations with pedestrians, vehicle drivers, roadside vendors etc were held. The first consultation process was held in 2006-2007 during the preparation of environmental assessment report. Subsequently, further consultations were held in June 2014 and October 2014 during the updation of the Environmental Impact Assessment Report for section-II of M-4. A fresh public consultation was conducted on 24-25 June 2014 and 13-15 October 2014 by the team of Environment Cell and the Land Staff (NHA). The main focus of the consultation was to get a view/idea of the public about the construction of proposed section-II of M-4 and their grievances if any. As the construction of the first section i.e. Faisalabad-Gojra section-I of M-4 is near the completion stage therefore public was well aware of the benefit of the construction which they will obtain during the construction and at the operational stage of the second section of the project. Village meetings were conducted both with the male and female residents of the communities, and public was aware for the provision of jobs during the construction period. On the whole residents appreciate the proposed project and were happy for the development of the area.

10.3 Meetings with Stakeholders

338. During the first round of consultations meetings were held with the local communities NGO's Government officials and all possible stakeholders in 2007. During discussions with residents and site visits, it has been revealed that local people were generally aware of the Project and were in favor of its construction

339. In the second round of consultation for the updation of EIA report for Section-II Director Environment and Monitoring from Environmental Protection Agency (EPA) Punjab was contacted for validation of NOC which was earlier issued in 2007. In June and October 2014 Public Consultations were also arranged with community members of different villages along the road alignment, the Project is generally accepted and people want this Project to be taken up. The consultation sessions were carried out according to the schedule indicated in Table 10.1.

Table 10.1 Schedule of Scoping Sessions (2014)

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Name of Participants	Topic
1	24 June 2014	Tehsil & District Toba Taksingh	10:00 am	Chak 383 JB	11	M. Akram S/O Shah Muhammad M. Adeel S/O Abdul Rasheed M. Ajmal Hussain S/O M. Hussain Qamar Ajaz S/O Khushi Muhammad M. Naeem Babar S/O liaquat Ali Ghulam Rasoul S/O M. Ismail Muraba Falak Sher S/O M. Shafi Imran Ali S/O Ashiq Auraim t Adil Husain S/O M. Hassan Abdul Ghafar S/O Ismail Javaid Ahmar S/O Abdul Hameed Manzoor Hussain S/O Ismail	Compensation package for affected persons Land acquisition related matters Under passes and culverts Designs Formation of a village level committee Briefing about the Environmental Issues arise during the construction activities
2	24 June 2014	Tehsil & District Toba Taksingh	10:45 am	RD 80+100	3	Kareem Bibi W/O Khadim Hasan Sughra Iqbal-Anwer Ali Kinza Fatima D/O Farman Ali	Discussion on Compensation Package with the Affectees Resettlement issues were discussed Jobs to the local residents Briefing about the Environmental Issues arise during the construction activities
3	24 June 2014	District T.T.Singh)	11:30 am	Chak 397 JB RD 84+700	4	Mohammad Adil S/o M.Anyat Ummar Hayat S/O M.Adil Samena bibi W/O Ummar Hayat Rasheed S/O M.Adil	Suggestions regarding Road Safety Resettlement issues were discussed Compensation package with the Affectees Briefing about the Environmental Issues arise during the construction activities

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Name of Participants	Topic
4	25th June 2014	Tehsil Shorkot (District Jhang)	12:15 pm	RD 86+637	13	Mahmood S/O Ramzan Abdulstar S/O Abdul Latif Umair Hayat S/O Ahmed Bux Nazeer Ahmed S/O Wariam Haq Nawaz S/O Deen Mohammad Mohammad Asif S/O Mohammad Zulfiqar Mohammad Muzafar S/O Alladita Shaukat S/O Mohammad Ramzan Alamgheer S/O Saad Ali Mohammad Asghar S/O Nazeer Ahmad Nazar Bibi W/O Muhammad Bux Sakina Bibi W/O Tahir Abbas Janta Bibi W/O Mohammad Nawaz Shahnaz Bibi W/O Zafar Iqbal	Discussion on Compensation Package with the Affectees Under passes and culverts designs Briefing about the Environmental Issues arise during the construction activities
5	25th June 2014	Tehsil Shorkot (District Jhang)	2:00 pm	RD 87+100	3	Ghazala Bibi W/O Mazhar Mounda Bibi W/O Sultan Suneera W/O Saleem	Land Compensation issues were discussed Under passes and culverts designs Briefing about the Environmental Issues arise during the construction activities
6	25 June 2014	Tehsil Shorkot District Jhung	13:30 pm	Mouza Sat Ghag RD 120 End Point of Section-II M-4	11	Mohammad Sadiq S/O Badhur Khan Mohammad Yasheen S/O Ghulam Baqir Ghulam Murtaza S/O Abdul Kareem Abdul Rasheed S/O Jafar Hussain Amir Nadeem S/O Mohammad	Discussion on Compensation Package with the Affectees Under passes and culverts designs Briefing about the Environmental Issues arise during the construction activities

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Name of Participants	Topic
						Ayub Mohammad Ramzan S/O Mohammad Nadir Ejaz Hussain S/O Tariq Hussain Sajjad Hussain S/O Talib Hussain Umar Daraz S/O Talib Hussain Sarfaraz S/O Talib Hussain Sadabahar S/O Talib Hussain	
7	14 October 2014		11:00 am	Chak 487	25	Maqsood Ahmed S/o Haji Nabi Bhaksh, M. Nawaz S/o Haji Nabi Bhaksh, Abdul Rasheed S/o Kamal Din, Mukhtar Ali S/o Barkat Ali, M. Ashraf S/o Talib Din, Asghar Ali S/o Mukhtair Ali, Asghar Ali S/o Nabi Baksh, Abdul Sattar S/o Kamal Din, Sardar S/o Kamal Din, Ghulam Bari S/o Barkat Ali, Faqeer Muhammad S/o Moula Bhaksh (other names of participants are attached in Annexure-IV for reference	Compensation package for affected persons Land acquisition related matters Under passes and culverts Designs Formation of a village level committee Briefing about the Environmental Issues arise during the construction activities
8	14October 2014			Chak 396 JB	17	Mazhar Abbas S/o M. Nawaz, M Ameen S/o Ghulam Naveed, Rub Nawaz S/o Bhadur Khan, M. Sadiq S/o Chiragh Din, Nazir Ahmed S/o M. Daraya, M. Iqbal S/o Lal Khan, Raja Ali Shan S/o Malik Dad, M. Riaz S/o Rahim Dad, Raja Liaquat Ali S/o Aslam Khan, Haq	Compensation package for affected persons Land acquisition related matters Under passes and culverts Designs Formation of a village level committee Briefing about the Environmental Issues arise during

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Name of Participants	Topic
						Nawaz S/o Murad, M. Tariq S/o Tariq Aslam, M. Imran S/o Taj Muhammad, Faqeer Muhammad Nambar Dar, M. Riaz S/o Khan,	the construction activities
9	15 October 2014			Chak 310	27	Farzand Ali S/o M. Sadiq, Akbar Ali S/o Maqbool Ahmed, M. Akram S/o Allah Ditta, Ali Raza S/o M. Hanif, Saif Ullah S/o Anayat Ullah, Zafar Iqbal S/o M. Iqbal, Mateen Ullah S/o Anayat ullah, M. Ijaz S/o M. Sarwar, Arshed Ali S/o Rehmat Ali, Munir Ahmed S/o Ghulam Ali, Nazir Ahmed S/o M. Din (other names of participants are attached in Annexure-IV for reference	Land Compensation issues were discussed Under passes and culverts designs Briefing about the Environmental Issues arise during the construction activities
10	16 October 2014			Chak 383 JB	23	Shahida Parveen W/o Farman Ali, Nasreen W/o Dilbar Hussain, Shameem Wo Muhammd Ramzan, Dilbar Hussain S/o M. Tufail, Farooq-e-Azam S/o M. Irshad, Shahzad Ahmed S/o Munawar Hussain, M. Shahid Shaheen S/o M. Yaqoob, (other names of participants are attached in Annexure-IV for reference	Land Compensation issues were discussed Under passes and culverts designs Briefing about the Environmental Issues arise during the construction activities
11	15 October 2014			Chak 396	16		Discussion on Compensation Package with the Affectees Under passes and culverts designs

S. No.	Date	District /Tehsil	Time	Village	No. of Participants	Name of Participants	Topic
							Briefing about the Environmental Issues arise during the construction activities Formation of a village level committee
12	15 October 2014			Chak 7 Gagh	24	M. Ikram Shah S/o Mian Shab, Aman Ullah S/o M. Ramzan, Zia Ullah S/o M. Sharif, Sarfraz S/o Mian Fazil, Jumma Din S/o M. Khan, Allah Ditta S/o Khuda Baksh, M. Ramzan S/o M. Fazil, Adil S/o Bhadur Khan (other names of participants are attached in Annexure-IV for reference	Compensation package for affected persons Land acquisition related matters Under passes and culverts Designs Formation of a village level committee Briefing about the Environmental Issues arise during the construction activities

The details of these meetings (scanned copies of attendance sheets and the pictorial profile) are attached as Annexure-IV.

10.4 Stake Holders Concern

340. The most common concerns noticed during the fresh public meeting are listed as under:

Motorway Design

- The design of road should be least disturbing the local agriculture and economic activity.
- Sufficient cross drainage structures should be provided to avoid flooding of the area.
- The Motorway alignment should minimum effect the local settings and to avoid the severance of the area while passing through the populated area.
- The respectful local customs should be taken in account in a design and should be maintained during construction.

Motorway Construction

- Avoid undue delays in construction to limit the inconvenience to the public cause by the road construction.
- Adopt measures to minimize dust, smoke and noise pollution during construction.

- Avoid dumping of the construction materials during the construction and to carry out proper site clearance after completion of the construction activities.
- Provision of properly formed and maintained diversions during construction.
- Inclusion of local labour and workforce up to the maximum possible extent in project construction activities.

Motorway Operations

- Erection of informatory regulatory and cautionary signs to eliminate operational hazards
- Control over speeding and the use of loud pressure horns near populated area.
- Specify speed limits where required.
- Proper maintenance of cross drainage structure to avoid flooding of road and adjacent area.

341. These concerns will be addressed through the proper implementation of the EMP. The list of consulted persons during consultations held in June and October 2014 and the pictorial profile of public consultation is attached as Annexure-IV. Public consultation was held in accordance with the guidelines of ADB and Pakistan Environmental Protection Act 1997. On different locations at different Chaks public meetings were organized and the team travelled along the project alignment and gathered all data about the sensitive receptors as well.

10.5 Future Information Disclosure Plan

342. After suggesting the possible solutions of the stakeholders' concerns, the solutions (final EIA report) will be accessible to interested parties on request and the version of final report will be available in the project offices and its summary will be available to stakeholders in national language.

SECTION 11

GRIEVANCE REDRESS MECHANISM

11.0 General

343. In order to receive and facilitate the resolution of affected people's (AP) concerns, complaints and grievances about the Project's environmental performance, a Grievance Redress Mechanism (GRM) will be established at the Project. The GRM will address the APs' concerns and complaints proactively and promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the APs at no costs and without retribution. The mechanism will not impede access to the country's judicial or administrative remedies.

344. The APs will be fully informed of their rights and of the procedures for addressing complaints verbally and in writing during consultations. A mechanism will be established to address/resolve the project related issues including the APs concerns or grievances including those related to the environment.

345. A Grievance Redress Committee (GRC) at the project level will be notified. Although the GRC will be the focal unit for grievance redress at the sub-project (local) level, an informal mechanism will also be instituted to facilitate the APs to resolve their issues at the local level.

11.1 Grievance Redress Committee, Focal Points, Complaints Reporting, Recording and Monitoring

346. NHA will assist the project affected communities/villages to identify local representatives to act as Grievance Focal Persons (GFPs). The GFPs will be responsible for i) acting as community representatives in formal meetings between the project team and the local community he/she represents; ii) communicating the community members' grievances and concerns to the contractor during project implementation.

347. A pre-mobilization public consultation meeting will be convened by NHA's EALS Unit and attended by the GFPs, Supervision Consultant, contractor, Project representative and other interested parties (e.g. district level representatives, NGOs). The objectives of the meeting will be as follows:

b) Introduction of key personnel of each stakeholder including roles and responsibilities;
c) Presentation of project information of immediate concern to the communities by the contractor (timing and location of specific construction activities, design issues, access constraints etc.) This will include a brief summary of the EMP - its purpose and implementation arrangements;
d) Establishment and clarification of the GRM to be implemented during project implementation including proactive public relations activities proposed by the project team, Supervision Consultant and contractor to

ensure that communities are continually advised of project progress and associated constraints throughout project implementation period; and

e) Elicit and address the immediate concerns of the community based on the information provided above.

348. Following the pre-mobilization public consultation meeting, environmental complaints associated with the construction activity will be routinely handled through the GRM as explained below:

- Individuals will lodge their environmental complaint/grievance with their respective community's nominated GFP.
- The GFP will bring the individual's complaint to the attention of the contractor.
- The contractor will record the complaint in the onsite Environmental Complaints Register (ECR) in the presence of the GFP.
- The GFP will discuss the complaint with the contractor and have it resolved.
- If the contractor does not resolve the complaint within one week, then the GFP will bring the complaint to the attention of the Supervision Consultant's Environmental Specialist. The SC's Environment Specialist will then be responsible for coordinating with the contractor in solving the issue.
- If the complaint is not resolved within two weeks the GFP will present the complaint to the Grievance Redress Committee (GRC).

349. The GRC will be headed by the Project Director M4 with NHA's DD/AD (land) or DD/AD (environment) – depending upon the nature of the complaint - as member and focal person. Besides, the GRC will include the environment staff of the Project Management Unit/Supervision Consultants, environment staff of the contractor and representative of the local community (preferably the relevant GFP).

350. The GRC will have a period of two weeks to resolve the complaint and communicate this back to the community. The contractor will then record the complaint as resolved and closed in the ECR. This represents the first level of the GRM.

351. If the complaint is not satisfactorily resolved at this level, it will be referred by the GRC to the second level of GRM i.e. to the Environment, Afforestation, Land and Social (EALS) at NHA Headquarters, within seven days after communicating its decision to the complainant. The EALS will communicate to the complainant immediately regarding the receipt of his complaint, will scrutinize the record of the GRC, investigate the remedies available and request the complainant to produce any record in favour of his claim. After thorough review and scrutiny of the available record on the complaint, EALS staff shall visit the field to meet the complainant, and collect additional information and evidence if required. Once the investigations are completed EALS shall get its recommendations approved by Member Aided Projects and forward them to the Project Director and the

complainant accordingly within 30 days of receipt of the complaint. Should the complaint not be resolved through the GRM, the issue will be adjudicated through local legal processes.

352. In parallel to the ECR placed with the contractor, each GFP will maintain a record of the complaints received and will follow up on their resolution.

353. NHA's project office will also keep track of the status of all complaints through the Monthly Environmental Monitoring Reports submitted by the contractor to the SC and will ensure that they are resolved in a timely manner.

SECTION 12

CONCLUSIONS

354. The overall objective of the project is that it will provide accessibility to South North connection across the country leading to the development of National Trade Corridor. The construction of M-4 Motorway will link major cities of the country like Peshawar, Islamabad, Lahore and Faisalabad with Multan and southern areas. At national level this facility will trigger boost to mobility, economic development. Locally the segment of society from where the motorway will traverse will get developed having improved opportunities for catering better standard of life. The main objective of NHA for planning this Motorway is to provide a safe, congestion free and high speed facility to cope with ever increasing transportation demand for freight and passengers across the country and an augmented facility to commuters of the project area as well as to tourists.

355. The proposed motorway project components include construction of four lanes dual carriageway from Faisalabad-Khanewal and construction of ten Interchanges at different local road crossings. Bridges and culverts will be constructed on Spill Channel drains and canal crossings. The total width of both carriage ways 31.5 (6 lane) and land reserved for plantation will be 30 meters both side (15 meters on one side) within the RoW width of 100 meters.The carriageway will include paved shoulders at inner and outer side. The outer shoulder of each carriageway will be 3 meters wide with 0.5 meter rounding and the inner side will be 0.6 meter. The Right of Way (RoW) of the proposed Motorway Project is 100 meters wide, while it will be 40 meters at the locations where interchanges will be constructed. Major construction work will generally remain confined within the RoW.

356. The conclusions mentioned below are based on the findings of detailed Environmental Impact Assessment which has been carried out as per requirement of the Punjab- EPA Pakistan and Asian Development Bank Social Safe Guard Policy Statement (2009).

Identification of the Main Issues and Concerns

357. During the field surveys, significant efforts were made to identify the main social, cultural and environmental issues related to the construction and operation of the proposed Motorway. 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:

- Cutting of trees/bushes falling within the proposed ROW;
- Disturbance to the public movement during construction;
- Reduction in the daily routine activities of local residents during construction;

- Noise and air pollution due to the working of construction machinery during construction and traffic operation phases of the Project;
- Solid waste generation during construction;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Surface water bodies contamination due to soil erosion and construction activities.

Conclusions

358. After the construction of motorway, people living in the project area and the road users / travellers will get the following benefits:

- Less time will be required for travelling and reaching the destination;
- To accelerate the economic activity by providing smooth access to nation wide markets;
- During the construction phase, local labour will be accommodated in the construction activities leading to poverty alleviation;
- To provide sustainable delivery of a productive and efficient national highway system contributing to decreasing transportation cost;
- To provide the livelihood and to educate the poor people of the project area;
- Traffic load on N-5 will get reduced;
- It will also act as a vertiberal part of National Trade Corridor and major linking limb between Pakistan ,Central Asia and China;
- Trade among Middle Eastern countries, Pakistan and those of the land locked countries in the vicinity of Pakistan can be envisioned with the availability of this facility.

359. Project is socio-economically viable and environment friendly if EMP is implemented in true letter and spirit. Results of the EIA Study have shown that the impacts of the project activity on the physical environment will be negligible. However, there will be significant impacts on the biological and social environment. These impacts could be reduced by proper and judicious compensation to the affectees and well planned meticulous design of the facility and by implementing an appropriate tree plantation plan. The plantation in the will enhance the aesthetics; improve the landscape as well as the environmental conditions along the project area. In fact in times of diminishing economic and natural resources, using sustainable approaches in transportation infrastructure will help us to enhance quality of life and serve the transportation needs of the present leaving provision for future generations to meet their needs.

Annexure-I

Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000

PAKISTAN ENVIRONMENTAL PROTECTION AGENCY (REVIEW OF IEE AND EIA) REGULATIONS, 2000

S.R.O. 339 (1)/2001. - In exercise of the powers referred by section 33 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), Pakistan Environmental Protection Agency, with the approval of the Federal Government is pleased to make the following Rules, namely : -

1. Short title and commencement

(1) These regulations may be called the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000.

(2) They shall come into force at once.

2. Definitions

(1) In these regulations, unless there is anything repugnant in the subject or context –

(a) "Act" means the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997);

(b) "Director-General" means the Director-General of the Federal Agency;

(c) "EIA" means an environmental impact assessment as defined in section 2(xi);

(d) "IEE" means an initial environmental examination as defined in section 2(xxiv); and

(e) "section" means a section of the Act.

(2) All other words and expressions used in these regulations but not defined shall have the same meanings as are assigned to them in the Act.

3. Projects requiring an IEE

A proponent of a project falling in any category listed in Schedule I shall file an IEE with the Federal Agency, and the provisions of section 12 shall apply to such project.

4. Projects requiring an EIA

A proponent of a project falling in any category listed in Schedule II shall file an EIA with the Federal Agency, and the provisions of section 12 shall apply to such project.

5. Projects not requiring an IEE or EIA

(1) A proponent of a project not falling in any category listed in Schedules I and II shall not be required to file an IEE or EIA:

Provided that the proponent shall file –

(a) an EIA, if the project is likely to cause an adverse environmental effect;

(b) for projects not listed in Schedules I and II in respect of which the Federal Agency has issued guidelines for construction and

operation, an application for approval accompanied by an undertaking and an affidavit that the aforesaid guidelines shall be fully complied with.

(2) Notwithstanding anything contained in sub-regulation (1), the Federal Agency may direct the proponent of a project, whether or not listed in Schedule I or II, to file an IEE or EIA, for reasons to be recorded in such direction:

Provided that no such direction shall be issued without the recommendation in writing of the Environmental Assessment Advisory Committee constituted under Regulation 23.

(3) The provisions of section 12 shall apply to a project in respect of which an IEE or EIA is filed under sub-regulation (1) or (2).

6. Preparation of IEE and EIA

(1) The Federal Agency may issue guidelines for preparation of an IEE or an EIA, including guidelines of general applicability, and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to particular sector.

(2) Where guidelines have been issued under sub-regulation (1), an IEE or EIA shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify in the IEE or EIA any departure therefrom.

7. Review Fees

The proponent shall pay, at the time of submission of an IEE or EIA, a nonrefundable Review Fee to the Federal Agency, as per rates shown in Schedule III.

8. Filing of IEE and EIA

(1) Ten paper copies and two electronic copies of an IEE or EIA shall be filed with the Federal Agency.

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(2) Every IEE and EIA shall be accompanied by –

(a) an application, in the form prescribed in Schedule IV; and

(b) copy of receipt showing payment of the Review Fee.

9. Preliminary scrutiny

(1) Within 10 working days of filing of the IEE or EIA, the Federal Agency shall –

(a) confirm that the IEE or EIA is complete for purposes of initiation of the review process; or

(b) require the proponent to submit such additional information as may be specified; or

(c) return the IEE or EIA to the proponent for revision, clearly listing the points requiring further study and discussion.

(2) Nothing in sub-regulation (1) shall prohibit the Federal Agency from requiring the proponent to submit additional information at any stage during the review process.

10. Public participation

(1) In the case of an EIA, the Federal Agency shall, simultaneously with issue of confirmation of completeness under clause (a) of sub-regulation (1) of Regulation 9, cause to be published in any English or Urdu national

newspaper and in a local newspaper of general circulation in the area affected by the project, a public notice mentioning the type of project, its exact location, the name and address of the proponent and the places at which the EIA of the project can, subject to the restrictions in sub-section (3) of section 12, be accessed.
(2) The notice issued under sub-regulation (1) shall fix a date, time and place for public hearing of any comments on the project or its EIA.
(3) The date fixed under sub-regulation (2) shall not be earlier than 30 days from the date of publication of the notice.
(4) The Federal Agency shall also ensure the circulation of the EIA to the concerned Government Agencies and solicit their comments thereon.
(5) All comments received by the Federal Agency from the public or any Government Agency shall be collated, tabulated and duly considered by it before decision on the EIA.
PAKISTAN ENVIRONMENTAL PROTECTION AGEN4CY (REVIEW OF IEE AND EIA) REGULATIONS, 2000
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(6) The Federal Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

11. Review

(1) The Federal Agency shall make every effort to carry out its review of the IEE within 45 days, and of the EIA within 90 days, of issue of confirmation of completeness under Regulation 9.
(2) In reviewing the IEE or EIA, the Federal Agency shall consult such Committee of Experts as may be constituted for the purpose by the Director-General, and may also solicit views of the sectoral Advisory Committee, if any, constituted by the Federal Government under subsection (6) of section 5.
(3) The Director-General may, where he considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.
(4) The review of the IEE or EIA by the Federal Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under Regulation 10, and views of the committees mentioned in sub-regulations (2) and (3) above.

12. Decision

On completion of the review, the decision of the Federal Agency shall be communicated to the proponent in the form prescribed in Schedule V in the case of an IEE, and in the form prescribed in Schedule VI in the case of an EIA.

13. Conditions of approval

(1) Every approval of an IEE or EIA shall, in addition to such conditions as may be imposed by the Federal Agency, be subject to the condition that the project shall be designed and constructed, and mitigatory and other measures adopted, strictly in accordance with the IEE/EIA, unless any variation thereto have been specified in the approval by the Federal Agency.

(2) Where the Federal Agency accords its approval subject to certain conditions, the proponent shall –
(a) before commencing construction of the project, acknowledge acceptance of the stipulated conditions by executing an undertaking in the form prescribed in Schedule VII;
PAKISTAN ENVIRONMENTAL PROTECTION AGEN5CY (REVIEW OF IEE AND EIA) REGULATIONS, 2000
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(b) before commencing operation of the project, obtain from the Federal Agency written confirmation that the conditions of approval, and the requirements in the IEE/EIA relating to design and construction, adoption of mitigatory and other measures and other relevant matters, have been duly complied with.

14. Confirmation of compliance

(1) The request for confirmation of compliance under clause (b) of subregulation (2) of Regulation 13 shall be accompanied by an Environmental Management Plan indicating the measures and procedures proposed to be taken to manage or mitigate the environmental impacts for the life of the project, including provisions for monitoring, reporting and auditing.
(2) Where a request for confirmation of compliance is received from a proponent, the Federal Agency may carry out such inspection of the site and plant and machinery and seek such additional information from the proponent as it may deem fit: Provided that every effort shall be made by the Federal Agency to provide the requisite confirmation or otherwise within 15 days of receipt of the request, with complete information, from the proponent.
(3) The Federal Agency may, while issuing the requisite confirmation of compliance, impose such other conditions as the Environmental Management Plan, and the operation, maintenance and monitoring of the project as it may deem fit, and such conditions shall be deemed to be included in the conditions to which approval of the project is subject.

15. Deemed approval

The four-month period for communication of decision stipulated in sub-section (4) of section 12 shall commence from the date of filing of an IEE or EIA in respect of which confirmation of completeness is issued by the Federal Agency under clause (a) of sub-regulation (1) of Regulation 9.

16. Extension in review period

Where the Federal Government in a particular case extends the four-month period for communication of approval prescribed in sub-section (5) of section 12, it shall, in consultation with the Federal Agency, indicate the various steps of the review process to be taken during the extended period, and the estimated time required for each step.

17. Validity period of approval

(1) The approval accorded by a Federal Agency under section 12 read with Regulation 12 shall be valid, for commencement of construction, for a period of three years from the date of issue.
(2) If construction is commenced during the initial three year validity period, the validity of the approval shall stand extended for a further period of three years from the date of issue.
(3) After issue of confirmation of compliance, the approval shall be valid for a period of three years from the date thereof.

(4) The proponent may apply to the Federal Agency for extension in the validity periods mentioned in sub-regulations (1), (2) and (3), which may be granted by the Federal Agency in its discretion for such period not exceeding three years at a time, if the conditions of the approval do not require significant change: Provided that the Federal Agency may require the proponent to submit a fresh IEE or EIA, if in its opinion changes in location, design, construction and operation of the project so warrant.

18. Entry and inspection

(1) For purposes of verification of any matter relating to the review or to the conditions of approval of an IEE or EIA prior to, during or after commencement of construction or operation of a project, duly authorized staff of the Federal Agency shall be entitled to enter and inspect the project site, factory building and plant and equipment installed therein.

(2) The proponent shall ensure full cooperation of the project staff at site to facilitate the inspection, and shall provide such information as may be required by the Federal Agency for this purpose and pursuant thereto.

19. Monitoring

(1) After issue of approval, the proponent shall submit a report to the Federal Agency on completion of construction of the project.

(2) After issue of confirmation of compliance, the proponent shall submit an annual report summarizing operational performance of the project, with reference to the conditions of approval and maintenance and mitigatory measures adopted by the project.

(3) To enable the Federal Agency to effectively monitor compliance with the conditions of approval, the proponent shall furnish such additional information as the Federal Agency may require.

20. Cancellation of approval

(1) Notwithstanding anything contained in these Regulations, if, at any time, on the basis of information or report received or inspection carried out, the Federal Agency is of the opinion that the conditions of an approval have not been complied with, or that the information supplied by a proponent in the approved IEE or EIA is incorrect, it

shall issue notice to the proponent to show cause, within two weeks of receipt thereof, why the approval should not be cancelled.

(2) If no reply is received or if the reply is considered unsatisfactory, the Federal Agency may, after giving the proponent an opportunity of being heard:

(i) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or

(ii) cancel the approval.

(3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.

(4) Action taken under this Regulation shall be without prejudice to any other action that may be taken against the proponent und er the Act or rules or regulations or any other law for the time being in force.

21. Registers of IEE and EIA projects

Separate Registers to be maintained by the Federal Agency for IEE and EIA projects under sub-section (7) of section 12 shall be in the form prescribed in Schedule

VIII.

22. Environmentally sensitive areas

(1) The Federal Agency may, by notification in the official Gazette, designate an area to be an environmentally sensitive area.

(2) Notwithstanding anything contained in Regulations 3, 4 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an EIA with the Federal Agency.

(3) The Federal Agency may from time to time issue guidelines to assist proponents and other persons involved in the environmental assessme nt process to plan and prepare projects located in environmentally sensitive areas.

(4) Where guidelines have been issued under sub-regulation (3), the projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in the EIA pertaining to the project.

23. Environmental Assessment Advisory Committee

For purposes of rendering advice on all aspects of environmental assessment, including guidelines, procedures and categorization of projects, the Director-General shall constitute an Environmental Assessment Advisory Committee comprising –

(a) Director EIA, Federal Agency … Chairman

(b) One representative each of the Provincial Agencies … Members

(c) One representative each of the Federal Planning Commission and the Provincial Planning and Development Departments … Members

(d) Representatives of industry and non-Governmental organizations, and legal and other experts … Members

24. Other approvals

Issue of an approval under section 12 read with Regulation 12 shall not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law for the time being in force.

SCHEDULE I

(*See* Regulation 3)

List of projects requiring an IEE

A. Agriculture, Livestock and Fisheries

1. Poultry, livestock, stud and fish farms with total cost more than Rs.10 million
2. Projects involving repacking, formulation or warehousing of agricultural products

B. Energy

1. Hydroelectric power generation less than 50 MW
2. Thermal power generation less than 200 KW
3. Transmission lines less than 11 KV, and large distribution projects
4. Oil and gas transmission systems
5. Oil and gas extraction projects including exploration, production,

gathering systems, separation and storage
6. Waste-to-energy generation projects

C. Manufacturing and processing

1. Ceramics and glass units with total cost more than Rs.50 million
2. Food processing industries including sugar mills, beverages, milk and dairy products, with total cost less than Rs.100 million
3. Man- made fibers and resin projects with total cost less than Rs.100 million
4. Manufacturing of apparel, including dyeing and printing, with total cost more than Rs.25 million
5. Wood products with total cost more than Rs.25 million

D. Mining and mineral processing

1. Commercial extraction of sand, gravel, limestone, clay, sulphur and other minerals not included in Schedule II with total cost less than Rs.100 million
2. Crushing, grinding and separation processes

3. Smelting plants with total cost less than Rs.50 million

E. Transport

1. Federal or Provincial highways (except maintenance, rebuilding or reconstruction of existing metalled roads) with total cost less than Rs.50 million
2. Ports and harbor development for ships less than 500 gross tons

F. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume less than 50 million cubic meters of surface area less than 8 square kilometers
2. Irrigation and drainage projects serving less than 15,000 hectares
3. Small-scale irrigation systems with total cost less than Rs.50 million

G. Water supply and treatment

Water supply schemes and treatment plants with total cost less than Rs.25 million

H. Waste disposal

Waste disposal facility for domestic or industrial wastes, with annual capacity less than 10,000 cubic meters

I. Urban development and tourism

1. Housing schemes
2. Public facilities with significant off-site impacts (e.g. hospital wastes)
3. Urban development projects

J. Other projects

Any other project for which filing of an IEE is required by the Federal Agency under sub-regulation (2) of Regulation 5

SCHEDULE II

(*See* Regulation 4)

List of projects requiring an EIA

A. Energy

1. Hydroelectric power generation over 50 MW

2. Thermal power generation over 200 MW
3. Transmission lines (11 KV and above) and grid stations
4. Nuclear power plans
5. Petroleum refineries

B. Manufacturing and processing

1. Cement plants
2. Chemicals projects
3. Fertilizer plants
4. Food processing industries including sugar mills, beverages, milk and dairy products, with total cost of Rs.100 million and above
5. Industrial estates (including export processing zones)
6. Man-made fibers and resin projects with total cost of Rs.100 M and above
7. Pesticides (manufacture or formulation)
8. Petrochemicals complex
9. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, textiles (except apparel),printing and publishing, paints and dyes, oils and fats and vegetable ghee projects, with total cost more than Rs.10 million
10. Tanning and leather finishing projects

C. Mining and mineral processing

1. Mining and processing of coal, gold, copper, sulphur and precious stones
2. Mining and processing of major non- ferrous metals, iron and steel rolling
3. Smelting plants with total cost of Rs.50 million and above

PAKISTAN ENVIRONMENTAL PROTECTION AGEN1C2Y (REVIEW OF IEE AND EIA) REGULATIONS, 2000
12

D. Transport

1. Airports
2. Federal or Provincial highways or major roads (except maintenance, rebuilding or reconstruc tion of existing roads) with total cost of Rs.50 million and above
3. Ports and harbor development for ships of 500 gross tons and above
4. Railway works

E. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume of 50 million cubic meters and above or surface area of 8 square kilometers and above
2. Irrigation and drainage projects serving 15,000 hectares and above

F. Water supply and treatment

Water supply schemes and treatment plants with total cost of Rs.25 million and above

G. Waste Disposal

1. Waste disposal and/or storage of hazardous or toxic wastes (including landfill sites, incineration of hospital toxic waste)
2. Waste disposal facilities for domestic or industrial wastes, with annual capacity more than 10,000 cubic meters

H. Urban development and tourism

1. Land use studies and urban plans (large cities)
2. Large-scale tourism development projects with total cost more than Rs.50

million
I. Environmentally Sensitive Areas
All projects situated in environmentally sensitive areas
J. Other projects
1. Any other project for which filing of an EIA is required by the Federal Agency under sub-regulation (2) of Regulation 5.
2. Any other project likely to cause an adverse environmental effect
PAKISTAN ENVIRONMENTAL PROTECTION AGEN1C3Y (REVIEW OF IEE AND EIA) REGULATIONS, 2000
13
SCHEDULE III
(See Regulation 7)
IEE/EIA Review Fees
Total Project Cost IEE EIA
Upto Rs.5,000,000 NIL NIL
Rs.5,000,001 to 10,000,000 Rs.10,000 Rs.15,000
Greater than Rs.10,000,000 Rs.15,000 Rs.30,000
PAKISTAN ENVIRONMENTAL PROTECTION AGEN1C4Y (REVIEW OF IEE AND EIA) REGULATIONS, 2000
14
SCHEDULE IV
[*See* Regulation 8(2)(a)]
Application Form
1. Name and address of proponent
Phone:
Fax:
Telex:
2. Description of project
3. Location of project
4. Objectives of project
5. IEE/EIA attached? IEE/EIA : Yes/No
6. Have alternative sites been considered and reported in IEE/EIA?
Yes/No
7. Existing land use Land requirement
8. Is basic site data available, or has it been measured?
(only tick yes if the data is reported in the IEE/EIA)
Meterology (including rainfall)
Ambient air quality
Ambient water quality
Ground water quality
Available

Yes/No
Yes/No
Yes/No
Yes/No
Measured
Yes/No
Yes/No
Yes/No
Yes/No
9. Have estimates of the following been reported?
Water balance
Solid waste disposal
Liquid waste treatment
Estimated
Yes/No
Yes/No
Yes/No
Reported
Yes/No
Yes/No
Yes/No
10. Source of power Power requirement
11. Labour force (number)
Construction:
Operation:
Verification. I do solemnly affirm and declare that the information given above and contained in the attached IEE/EIA is true and correct to the best of my knowledge and belief.
Date _____ Signature, name and _____ designation of proponent
(with official stamp/seal)
PAKISTAN ENVIRONMENTAL PROTECTION AGEN1C5Y (REVIEW OF IEE AND EIA) REGULATIONS, 2000
15
SCHEDULE V
[*See* Regulation 12]
Decision on IEE
1. Name and address of proponent _____
_____
2. Description of project _____
3. Location of project _____
4. Date of filing of IEE _____
5. After careful review of the IEE, the Federation Agency has decided –
(a) to accord its approval, subject to the following conditions:

_____
_____
or (b) that the proponent should submit an EIA of the project, for the following reasons –

_____
_____
[Delete (a) or (b), whichever is inapplicable]
Dated _____
Tracking no.___
Director-General
Federal Agency
(with official stamp/seal)
PAKISTAN ENVIRONMENTAL PROTECTION AGEN1C6Y (REVIEW OF IEE AND EIA) REGULATIONS, 2000
16
SCHEDULE VI
[*See* Regulation 12]
Decision on EIA
1. Name and address of proponent _____
_____
2. Description of project _____
3. Location of project _____
4. Date of filing of EIA _____
5. After careful review of the EIA, and all comments thereon, the Federation Agency has decided –
(a) to accord its approval, subject to the following conditions:

_____
_____
or (b) that the proponent should submit an EIA with the following modifications-

_____
_____
or (c) to reject the project, being contrary to environmental objectives, for the following reasons:

_____
_____
[Delete (a)/(b)/(c), whichever is inapplicable]
Dated _____
Tracking no.___
Director-General
Federal Agency
(with official stamp/seal)
PAKISTAN ENVIRONMENTAL PROTECTION AGEN1C7Y (REVIEW OF IEE AND EIA) REGULATIONS, 2000
17
SCHEDULE VII
[*See* Regulation 13(2)]
Undertaking
I, (full name and address) as proponent for (name, description and location of project) do hereby solemnly affirm and declare that I fully understand and accept the conditions

contained in the approval accorded by the Federal Agency bearing tracking no._____ dated _____, and undertake to design, construct and operate the project strictly in accordance with the said conditions and the IEE/EIA.
Date _____ Signature, name and _____
designation of proponent
(with official stamp/seal)
Witnesses
(full names and addresses)
(1) _____
(2) _____
PAKISTAN ENVIRONMENTAL PROTECTION AGEN1C8Y (REVIEW OF IEE AND EIA) REGULATIONS, 2000
18

SCHEDULE VIII
(*See* Regulation 21)
Form of Registers for IEE and EIA projects

S. No.	Description	Relevant Provisions
1	2	3
1.	Tracking number	
2.	Category type (as per Schedules I and II)	
3.	Name of proponent	
4.	Name and designation of contact person	
5.	Name of consultant	
6.	Description of project	
7.	Location of project	
8.	Project capital cost	
9.	Date of receipt of IEE/EIA	
10.	Date of confirmation of comp leteness	
11.	Approval granted (Yes/No)	
12.	Date of approval granted or refused	
13.	Conditions of approval/reasons for refusal	
14.	Date of Undertaking	
15.	Date of extension of approval validity	
16.	Period of extension	
17.	Date of commencement of construction	
18.	Date of issue of confirmation of compliance	
19.	Date of commencement of operations	
20.	Dates of filing of monitoring reports	
21.	Date of cancellation, if applicable	

Annexure-II (a) (2007)

Environmental Quality Monitoring Test Results (Air, Noise, Water)

Separate file attached

Annexure-II (b) (2014)

Environmental Quality Monitoring Test Results (Air, Noise, Water)

SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

EPA CERTIFIED

SURFACE WATER ANALYSIS REPORT

Client Name:	NHA (National Highway Authority)	**Sample Location:**	Adjacent to Water Course in Chak No. 305/JB (Pre-Construction Phase) RD#59+200
Sampling Point:	Water Channel	**Nature of Sample:**	Surface Water
Sampling Date:	15-07-2014	**Date of Completion of Analysis:**	20-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/002 SW

Results:

Sr. No.	Parameter	Unit	Result	WHO maximum allowable guideline value
1	Temperature	^0C	24	----
2	pH	--	8.25	6.5-8.5
3	Total Dissolved Solids (TDS)	mg/l	390	1000
4	Conductivity	uS/cm	564	--
5	Total Suspended Solids (TSS)	mg/l	16	---
6	Chloride	mg/l	34	250
7	Fluoride	mg/l	0.27	1.5
8	Taste	Object./unobj.	Unobject.	Unobject
9	Odour	Object./unobj.	Unobject.	Unobject.
10	Colour	TCU	0	15
11	Iron	mg/l	0.05	0.3
12	Sodium	mg/l	130	200
13	Nitrate (as NO_3^-)	mg/l	11	50
14	Nitrite (as NO_2^-)	mg/l	0.08	3
15	Chromium	mg/l	BDL	0.050
16	Potassium	mg/l	0.02	--
17	Sulphate	mg/l	54	250
18	Total Alaklinty	mg/l	126	---
19	Total Hardness as $CaCO_3$	mg/l	82.58	500
20	Ca Hardness	mg/l	62	--
21	Turbidity	NTU	0	5
22	Total Coliform	Number/100ml	0	0/100 ml
23	E.Coli	Number/100ml	0	0/100 ml
24	Chemical Oxygen Demand (COD)	mg/l	118	150
25	Biochemical Oxygen Demand (BOD_5)	mg/l	54	80

BDL (Below Detection Limit)

Page 1 of 2

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

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Client Name:	NHA (National Highway Authority)	**Sample Location:**	Adjacent to Water Course in Chak No. 305/JB (Pre-Construction Phase) RD#59+200
Sampling Point:	Water Channel	**Nature of Sample:**	Surface Water
Sampling Date:	15-07-2014	**Reporting Date:**	20-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/002 SW

Note:

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- The client is responsible lawful usage of reported data in future.

Sample Analyzed By: Tariq Ibrahim

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 20-07-2014

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

SURFACE WATER ANALYSIS REPORT

Client Name:	NHA (National Highway Authority)	**Sample Location:**	Near end point of Section-II (Mouza 7-Ghag)(Pre-Construction Phase) RD#119+500
Sampling Point:	Water Channel	**Nature of Sample:**	Surface Water
Sampling Date:	14-07-2014	**Date of Completion of Analysis:**	20-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/004 SW

Results:

Sr. No.	Parameter	Unit	Result	WHO maximum allowable guideline value
1	Temperature	°C	24	----
2	pH	--	8.25	6.5-8.5
3	Total Dissolved Solids (TDS)	mg/l	89	1000
4	Conductivity	uS/cm	620	--
5	Total Suspended Solids (TSS)	mg/l	311	---
6	Chloride	mg/l	14	250
7	Fluoride	mg/l	0.17	1.5
8	Taste	Object./unobj.	Unobject.	Unobject
9	Odour	Object./unobj.	Unobject.	Unobject.
10	Colour	TCU	0	15
11	Iron	mg/l	0.02	0.3
12	Sodium	mg/l	30	200
13	Nitrate (as NO_3^-)	mg/l	8	50
14	Nitrite (as NO_2^-)	mg/l	0.06	3
15	Chromium	mg/l	BDL	0.050
16	Potassium	mg/l	0.02	--
17	Sulphate	mg/l	12	250
18	Total Alaklinty	mg/l	112	---
19	Total Hardness as $CaCO_3$	mg/l	15.33	500
20	Ca Hardness	mg/l	10	--
21	Turbidity	NTU	0	5
22	Total Coliform	Number/100ml	0	0/100 ml
23	E.Coli	Number/100ml	0	0/100 ml
24	Chemical Oxygen Demand (COD)	mg/l	132	150
	Biochemical Oxygen Demand (BOD_5)	mg/l	58	80

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

Client Name:	NHA (National Highway Authority)	**Sample Location:**	Near end point of Section-II (Mouza 7-Ghag)(Pre-Construction Phase) RD# 119+500
Sampling Point:	Water Channel	**Nature of Sample:**	Surface Water
Sampling Date:	14-07-2014	**Reporting Date:**	20-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/004 SW

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Sample Analyzed By: Tariq Ibrahim

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH
Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 20-07-2014

LAHORE.

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

NOISE LEVEL MONITORING

Client Name:	NHA (National Highway Authority)	**Project Location:**	Near end point of Section-II (Mouza 7-Ghag)(Pre-Construction Phase)
Monitoring Point:	RD:120+200	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	14-07-2014	**Time of Monitoring:**	11:30 AM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/004 NL

Results:

1.	Left side of RD	41.7	55.3	48.5
2.	Extreme Left side of RD	35.2	58.6	46.9
3	Right side of RD	38.8	53.2	46.0
4	Extreme Right side of RD	36.2	48.2	42.2
5	Left side of the road	38.6	59.8	49.2
6	Right side of the road	39.7	54.3	47.0
NEQS				Commercial Area Day Time: 65 dB A

Note:

- All the readings were taken in day time and when the construction was going on
- The average noise levels describe the overall ambient noise levels of the proposed site.
- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

Client Name:	NHA (National Highway Authority)	**Site Location :**	Adjacent to Govt. Elementary School for girls in Chak No. 396 JB (Pre-Construction Phase)
Monitoring Point:	Near RD:86+700	**Time Duration of Monitoring:**	1 Hour
Monitoring Date:	15-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/002
Instrument Used:	CO, NO_x and SO_x, PM_{10} Analyzers		

Monitoring Supervisor: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH
Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

AMBIENT AIR MONITORING REPORT

Client Name:	NHA (National Highway Authority)	**Site Location :**	At Water Course in Mouza Rakh Kotla (Pre-Construction Phase)
Monitoring Point:	Near RD:86+700	**Time Duration of Monitoring:**	1 Hours
Monitoring Date:	14-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/003
Instrument Used:	CO, NO_x and SO_x, PM_{10} Analyzers		

Results:

1	PM_{10}	(µg/m3)	Integrated Method	58	150
2	CO	mg/m^3	Gas Phase Chemiluminescence	1.2	10
3	NO_X	(µg/m3)	Gas Phase Chemiluminescence	34	80
4	SO_X	(µg/m3)	Ultraviolet Fluorescence Method	25	120

NEQS: National Environmental Quality Standards

Note:

- Quality was assured through self calibration of the instrument.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

AMBIENT AIR MONITORING REPORT

Client Name:	NHA (National Highway Authority)	**Site Location :**	Near end point of Section-II (Mouza 7-Ghag) (Pre-Construction Phase)
Monitoring Point:	Near RD:120+200	**Time Duration of Monitoring:**	1 Hour
Monitoring Date:	14-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/004

Instrument Used: CO, NO_x and SO_x, PM_{10} Analyzers

Results:

1	PM_{10}	(µg/m3)	Integrated Method	64	150
2	CO	mg/m^3	Gas Phase Chemiluminescence	1.2	10
3	NO_X	(µg/m3)	Gas Phase Chemiluminescence	32	80
4	SO_X	(µg/m3)	Ultraviolet Fluorescence Method	28	120

NEQS: National Environmental Quality Standards

Note:

- Quality was assured through self calibration of the instrument.
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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

EPA CERTIFIED

Client Name:	NHA(National Highway Authority)	**Site Location :**	Adjacent to Water Course in Chak No. 305/JB (Pre-Construction Phase)
Monitoring Point:	Near RD:59+200	**Time Duration of Monitoring:**	1 Hour
Monitoring Date:	15-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/001
Instrument Used:	CO, NO_x and SO_x, PM_{10} Analyzers		

Monitoring Supervisor: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH
Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

NOISE LEVEL MONITORING

Client Name:	NHA (National Highway Authority)	**Project Location:**	Adjacent to Govt. Elementary School for girls in Chak No. 396 JB(Pre-Construction Phase)
Monitoring Point:	RD:86+700	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	15-07-2014	**Time of Monitoring:**	01:00 PM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/002 NL

Results:

1.	Left side of RD	38.7	51.3	45.0
2.	Extreme Left side of RD	42.2	45.2	43.7
3	Right side of RD	36.8	44.6	40.7
4	Extreme Right side of RD	39.3	48.9	44.1
5	Left side of road	36.4	50.8	43.6
6	Right side of road	38.4	49.3	43.8
NEQS				**Commercial Area Day Time: 65 dB A**

Note:

- All the readings were taken in day time and when the construction was going on
- The average noise levels describe the overall ambient noise levels of the proposed site.
- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
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Phone : 92-213-2014331 Fax : 92-213-2014331
Email : karachi@seal.com.pk

EPA CERTIFIED

SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

Client Name:	NHA (National Highway Authority)	**Project Location:**	Near end point of Section-II (Mouza 7-Ghag)(Pre-Construction Phase)
Monitoring Point:	RD:120+200	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	14-07-2014	**Time of Monitoring:**	11:30 AM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/004 NL

Monitoring Supervisor: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH
Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

Solution Environmental & Analytical Laboratory LAHORE.

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

Client Name:	NHA (National Highway Authority)	**Project Location:**	Adjacent to Water Course in Chak No. 305/JB(Pre-Construction Phase)
Monitoring Point:	RD:59+200	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	15-07-2014	**Time of Monitoring:**	12:30 PM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/001 NL

Monitoring Supervisor: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH
Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Solution Environmental & Analytical Laboratory LAHORE.

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

Client Name:	NHA (National Highway Authority)	**Sample Location:**	Near end point of Section-II (Mouza 7-Ghag)(Pre-Construction Phase)
Sampling Point:	Water Channel	**Nature of Sample:**	Drinking Water
Sampling Date:	14-07-2014	**Reporting Date:**	19-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/004 DW

Note:

- **This report should be reproduced as a whole and not in parts.**
- The responsibility of the ethical use of the results reported in this report lies with the client. Consequently, the laboratory is absolved of its responsibility for any claim that may result through the use by the client or others of the results appearing in this report.
- **The report is not valid for any negotiation.**
- **The client is responsible lawful usage of reported data in future.**

Sample Analyzed By: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH

Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Solution Environmental & Analytical Laboratory LAHORE.

Name: Aleem Butt

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

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GROUND WATER ANALYSIS REPORT

Client Name:	NHA (National Highway Authority)	**Sample Location:**	Near end point of Section-II (Mouza 7-Ghag)(Pre-Construction Phase)
Sampling Point:	Water Channel	**Nature of Sample:**	Drinking Water
Sampling Date:	14-07-2014	**Date of Completion of Analysis:**	19-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/004 DW

Results:

1	Temperature	^0C	24	—
2	pH	--	8.25	6.5-8.5
3	Total Dissolved Solids (TDS)	mg/l	89	1000
4	Conductivity	uS/cm	620	--
5	Total Suspended Solids (TSS)	mg/l	311	—
6	Chloride	mg/l	14	250
7	Fluoride	mg/l	0.17	1.5
8	Taste	Object./unobj.	Unobject.	Unobject
9	Odour	Object./unobj.	Unobject.	Unobject.
10	Colour	TCU	0	15
11	Iron	mg/l	0.02	0.3
12	Sodium	mg/l	30	200
13	Nitrate (as NO_3^-)	mg/l	8	50
14	Nitrite (as NO_2^-)	mg/l	0.06	3
15	Chromium	mg/l	BDL	0.050
16	Potassium	mg/l	0.02	--
17	Sulphate	mg/l	12	250
18	Free Chlorine	mg/l	BDL	---
19	Total Hardness as $CaCO_3$	mg/l	15.33	500
20	Ca Hardness	mg/l	10	--
21	Turbidity	NTU	0	5
22	Total Coliform	Number/100ml	0	0/100 ml
23	E.Coli	Number/100ml	0	0/100 ml

BDL (Below Detection Limit)

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

PEPA CERTIFIED

Client Name:	NHA (National Highway Authority)	**Sample Location:**	Adjacent to Govt. Elementary School for girls in Chak No. 396 JB(Pre-Construction Phase)
Sampling Point:	House	**Nature of Sample:**	Drinking Water
Sampling Date:	15-07-2014	**Reporting Date:**	19-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/001 DW

Note:

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Sample Analyzed By: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

Solution Environmental & Analytical Laboratory LAHORE.

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

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GROUND WATER ANALYSIS REPORT

Client Name:	NHA (National Highway Authority)	**Sample Location:**	Adjacent to Govt. Elementary School for girls in Chak No. 396 JB(Pre-Construction Phase)
Sampling Point:	House	**Nature of Sample:**	Drinking Water
Sampling Date:	15-07-2014	**Date of Completion of Analysis:**	19-07-2014
Sampling By:	SEAL	**Reference No.:**	SEAL/NHA/14/001 DW

Results:

1	Temperature	°C	26	----
2	pH	--	9.91	6.5-8.5
3	Total Dissolved Solids (TDS)	mg/l	1201	1000
4	Conductivity	uS/cm	648	--
5	Total Suspended Solids (TSS)	mg/l	03	---
6	Chloride	mg/l	68	250
7	Fluoride	mg/l	0.27	1.5
8	Taste	Object./unobj.	Unobject.	Unobject
9	Odour	Object./unobj.	Unobject.	Unobject.
10	Colour	TCU	0	15
11	Iron	mg/l	0.05	0.3
12	Sodium	mg/l	130	200
13	Nitrate (as NO_3^-)	mg/l	11	50
14	Nitrite (as NO_2^-)	mg/l	0.08	3
15	Chromium	mg/l	BDL	0.050
16	Potassium	mg/l	1.4	--
17	Sulphate	mg/l	240	250
18	Free Chlorine	mg/l	BDL	---
19	Total Hardness as $CaCO_3$	mg/l	468	500
20	Ca Hardness	mg/l	279.2	--
21	Turbidity	NTU	0	5
22	Total Coliform	Number/100ml	0	0/100 ml
23	E.Coli	Number/100ml	0	0/100 ml

BDL (Below Detection Limit)

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

AMBIENT AIR MONITORING REPORT

Client Name:	NHA (National Highway Authority)	**Site Location :**	Adjacent to Govt. Elementary School for girls in Chak No. 396 JB (Pre-Construction Phase)
Monitoring Point:	Near RD:86+700	**Time Duration of Monitoring:**	1 Hour
Monitoring Date:	15-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/002
Instrument Used:	CO, NO_x and SO_x, PM_{10} Analyzers		

Results:

1	PM_{10}	(µg/m3)	Integrated Method	48	150
2	CO	mg/m^3	Gas Phase Chemiluminescence	1.2	10
3	NO_X	(µg/m3)	Gas Phase Chemiluminescence	18	80
4	SO_X	(µg/m3)	Ultraviolet Fluorescence Method	34	120

NEQS: National Environmental Quality Standards

Note:

- Quality was assured through self calibration of the instrument.
- The measurements were carried out on client request.
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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

Client Name:	NHA (National Highway Authority)	**Site Location :**	Near end point of Section-II (Mouza 7-Ghag) (Pre-Construction Phase)
Monitoring Point:	Near RD:120+200	**Time Duration of Monitoring:**	1 Hour
Monitoring Date:	14-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/004
Instrument Used:	CO, NO_x and SO_x, PM_{10} Analyzers		

Monitoring Supervisor: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

Solution Environmental & Analytical Laboratory LAHORE.

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

AMBIENT AIR MONITORING REPORT

Client Name:	NHA (National Highway Authority)	**Site Location :**	Adjacent to Water Course in Chak No. 305/JB (Pre-Construction Phase)
Monitoring Point:	Near RD:59+200	**Time Duration of Monitoring:**	1 Hour
Monitoring Date:	15-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/001

Instrument Used: **CO, NO_x and SO_x, PM_{10} Analyzers**

Results:

1	PM_{10}	(µg/m3)	Integrated Method	51	150
2	CO	mg/m^3	Gas Phase Chemiluminescence	1.2	10
3	NO_X	(µg/m3)	Gas Phase Chemiluminescence	14	80
4	SO_X	(µg/m3)	Ultraviolet Fluorescence Method	30	120

NEQS: National Environmental Quality Standards

Note:

- Quality was assured through self calibration of the instrument.
- The measurements were carried out on client request.
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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

PEPA CERTIFIED

NOISE LEVEL MONITORING

Client Name:	NHA (National Highway Authority)	**Project Location:**	Adjacent to Water Course in Chak No. 305/JB(Pre-Construction Phase)
Monitoring Point:	RD:59+200	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	15-07-2014	**Time of Monitoring:**	12:30 PM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/001 NL

Results:

Note:

1.	Left side of RD	33.6	47.1	41.4
2.	Extreme Left side of RD	34.9	47.4	41.2
3	Right side of RD	33.3	39.7	36.5
4	Extreme Right side of RD	35.2	42.2	38.7
5	Left side of road	36.4	44.0	40.2
6	Right side of road	34.8	40.2	37.5
NEQS				Commercial Area Day Time: 65 dB A

- All the readings were taken in day time and when the construction was going on.
- The average noise levels describe the overall ambient noise levels of the proposed site.
- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
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Client Name:	NHA (National Highway Authority)	**Project Location:**	Adjacent to Govt. Elementary School for girls in Chak No. 396 JB(Pre-Construction Phase)
Monitoring Point:	RD:86+700	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	15-07-2014	**Time of Monitoring:**	01:00 PM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/002 NL

Monitoring Supervisor: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH
Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

Solution Environmental & Analytical Laboratory LAHORE.

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

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Client Name:	NHA (National Highway Authority)	**Project Location:**	At Water Course in Mouza Rakh Kotla(Pre-Construction Phase)
Monitoring Point:	RD:119+500	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	14-07-2014	**Time of Monitoring:**	12:30 PM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/003 NL

Monitoring Supervisor: Muhammad Mohsin

Signature: Mohsin

Name of Chief Analyst with Seal: TAHIR SHAH
Chief Chemist

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

NOISE LEVEL MONITORING

Client Name:	NHA (National Highway Authority)	**Project Location:**	At Water Course in Mouza Rakh Kotla(Pre-Construction Phase)
Monitoring Point:	RD:119+500	**Instrument Used**	Digital Sound Level Meter Model No. TM-102
Monitoring Date:	14-07-2014	**Time of Monitoring:**	12:30 PM
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/003 NL

Results:

1.	Left side of RD	36.1	41.9	39.0
2.	Extreme Left side of RD	39.7	51.6	45.6
3	Right side of RD	40.2	50.9	45.6
4	Extreme Right side of RD	39.2	42.6	40.9
5	Left side of the road	37.8	52.6	45.2
6	Right side of the road	36.2	46.4	41.3
NEQS				Commercial Area Day Time: 65 dB A

Note:

- All the readings were taken in day time and when the construction was going on
- The average noise levels describe the overall ambient noise levels of the proposed site.
- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
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SOLUTION ENVIRONMENTAL & ANALYTICAL LABORATORY

Client Name:	NHA (National Highway Authority)	**Site Location :**	At Water Course in Mouza Rakh Kotla (Pre-Construction Phase)
Monitoring Point:	Near RD:59+200	**Time Duration of Monitoring:**	1 Hour
Monitoring Date:	14-07-2014	**Date of Completion of Analysis:**	19-07-2014
Monitoring By:	SEAL	**Reference No.:**	SEAL/NHA/14/003
Instrument Used:	CO, NO_x and SO_x, PM_{10} Analyzers		

Monitoring Supervisor: Muhammad Mohsin

Signature:

Name of Chief Analyst with Seal: TAHIR SHAH

Signature of Chief Analyst:

Signature of Incharge Environmental Laboratory:

Name: Aleem Butt

Designation: Chief Environmentalist

Date: 19-07-2014

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NATIONAL HIGHWAY AUTHORITY

Office of the Project Director (M-4) Section- II
House No.144, Housing Colony No. 2, Jhang Road,
Toba Tek Singh. Tel & Fax 046-2511561

No: 1(1) PD (M-4)/Sec-II/NHA/2014/ 126- Dated July 22 2014.

Director (Environment)
National Highway Authority
Islamabad.

SUBJECT: **ENVIRNOMENTAL TESTING REPORTS AT SELECTED LOCATIONS OF GOJRA – SHORKOT SECTION (PACKAGE-II) MOTORWAY M-4 (PRE CONSTRUCTION PHASE).**

Ref: (i) Director (Environment) NHA HQ Islamabad site visit M-4 (Package-II) dated June 24 & 25, 2014.

(ii) This office letter Nos. 1(1) PD (M-4)/Sec-II/NHA/2014/96 &116 dated June 26 and July 11, 2014 respectively.

No. 499 Div (Env)
Date:- 24-07-2014

1. Enclosed please find herewith environmental test reports (24 pages) in original prepared and submitted by M/s Solution Environmental and Analytical Laboratory Lahore after field testing as per following detail;

S.No	Location	Environmental Tests Conducted	Remarks
1	59+200	Air, Noise & Water	Adjacent to water course in Chak No. 305/JB
2	86+700	" " "	Adjacent to Govt. Elementary School for girls in Chak No.396 JB
3	119+500	" " "	At water course in Mouza Rakh Kotla.
4	120+200	" " "	Near end Point of Section-II (Mouza 7-Ghag)

2. Above is forwarded for information record and further necessary action for preparation of revised EIA report to be submitted to ADB.

Encl. Test Reports (24 pages)

22.07.14

(MUHAMMAD ANEES CHAUDHRY)
Project Director (M-4) Section-II

CC:

- General Manager (M-4), NHA Lahore
- Project Director (M-4) Sec-I NHA Faisalabad
- M/s Solution Environmental and Analytical Laboratory Lahore

Annexure-III

Departments Visited

List of Departments

1 Revenue Office Department

2 Punjab Highway Department

3 Building Department

4 NHA Maintenance Department

5 Environmental Protection Agency (EPA) Punjab,

6 Forest Department

7 Wild Life Department

Annexure-IV (2007)

Stakeholders Concerns Regarding Environmental and Social Issues

(Separate file attached)

Annexure-IV (2014)

Stakeholders Concerns Regarding Environmental and Social Issues

Faisalabad – Khanewal Motorway Project (M-4)

Summary of Public Disclosure Meetings

Public meetings were held with the view to disseminate information about the Resettlement and Environment issues mitigated in the EIA process and solicit APs viewpoints. This section contains the scanned copies of the attendance sheets as well. After dissemination of Environmental Management Plan, the following common issues were discussed in the form of question and answer session (including comments, suggestions of the Pas) in all the affected villages.

Question-1 Is there any arrangement of tree plantation on replacement of cut off trees?

Answer 18,000 trees will be cut off for the construction of M-4 and 80,000 new trees will be implant on the both side of the motorway.

Question-2 Is there any change in water table due to motorway construction?

Answer There will be no change in water table due to motorway construction

Question-3 What measure will be adopted to mitigate borrows pits?

Answer Soil will be borrowed only from selected places and it will never be dig out in the radius of 100 meter from M-4. Top soil layer will be preserved for plantation.

Question-4 What measures will be taken to control the noise problem in the surrounding localities of the RoW?

Answer Tree plantation will control the noise problem and sound barriers will be constructed along the residential areas.

Question-5 What measures will be taken to control air pollution during construction stage?

Answer Fabric filters and wet scrubbers will be used on asphalt hot mix and Beaching plant.

Question-6 What measures contractor will adopt to dispose off construction waste?

Answer Places will be selected and all used water, oil, and wastages will be dumped on these selected places.

Question-7 Will there be any accessibility to our cultural places (graveyard, shrine etc.)?

Answer The culturally important sites will be provided access and this factor has been well considered in the design.

Question-8 What will be the limit of construction work?

Answer All the construction work will be confined within the proposed Right of Way (RoW).

Question-9 What will be the time for payment of compensation?

Answer Al the payment will be made prior to commencement of construction work.

Question-10 What will be the compensation for loss of trees?

Answer The compensation for fruit trees will be made on scientific basis considering a number of factors such as type, age, production per year etc. For non-fruit trees, compensation will be made according to market value based on volume of wood produced by these trees.

Question-11 What will be the compensation for the land left within the interchanges?

Answer If the remaining land become useless and inaccessible then it will be compensated as per market value plus 15 percent for compulsory land acquisition.

Question-12 When will the proposed project be implemented?

Answer The commencement date for construction of the proposed project is the beginning of the year 2015 after payment of compensation has been made. The proposed project will be completed by the end of the year 2017.

Question-13 The proposed motorway will be fenced on both sides, which will hamper movement across it. What alternatives have you proposed to deal with this issue?

Answer The interchanges will be provided at required places such as populated centres. Underpasses will also be provided at the routes providing common access to a number of villages.

Question-14 What will be the source of borrow materials for construction?

Answer Borrow materials will be taken from such areas where there is an agreement with the land owners for the purchase or lease of such lands. Final locations will be decided by the contractors in consultation with the Construction Supervision Consultant. However, these areas will be located away from the features such as roads, watercourses etc. Necessary mitigation measures will be taken to reduce air, noise pollution.

Question-15 Who to contact to get further details about the proposed project?

Answer NHA office near Sayyanwala Interchange, (Faisalabad) can be approached for further queries about the proposed project. It is expected to establish a help line to provide information for telephonic enquiries.

Question-16 Interchanges will be located at a distance. Is there any other alternative to approach the proposed Motorway?

Answer The service road will be provided all along the proposed Motorway, with flyovers/underpasses at appropriate locations.

Suggestion APs suggested that underpasses should be spacious enough to facilitate easy movement of agriculture related machinery across the proposed Motorway. Specially, the sugarcane loaded tractor trolleys measuring 15 ft. x 15 ft will be desirable.

Question-17 What will be done for infrastructures like tracks, water courses, canals etc.?

Answer All the important infrastructures will be restored by providing culverts, bridges, flyovers & underpasses.

Question-18 Will the farmers be compensated for all their assets?

Answer Farmers will be paid compensation for all their assets including trees, houses, tube wells, hand pumps etc.

Question-19 Will the service road be provided along the motorway?

Answer Yes, service road will be provided on both sides of the road

Question-20 Will the existing routes be above or under the proposed motorway?

Answer The existing routes will be both at grade and elevated in the form of underpasses & flyovers.

Scanned Copies of attendance sheets recorded in October 2014 Public consultation.

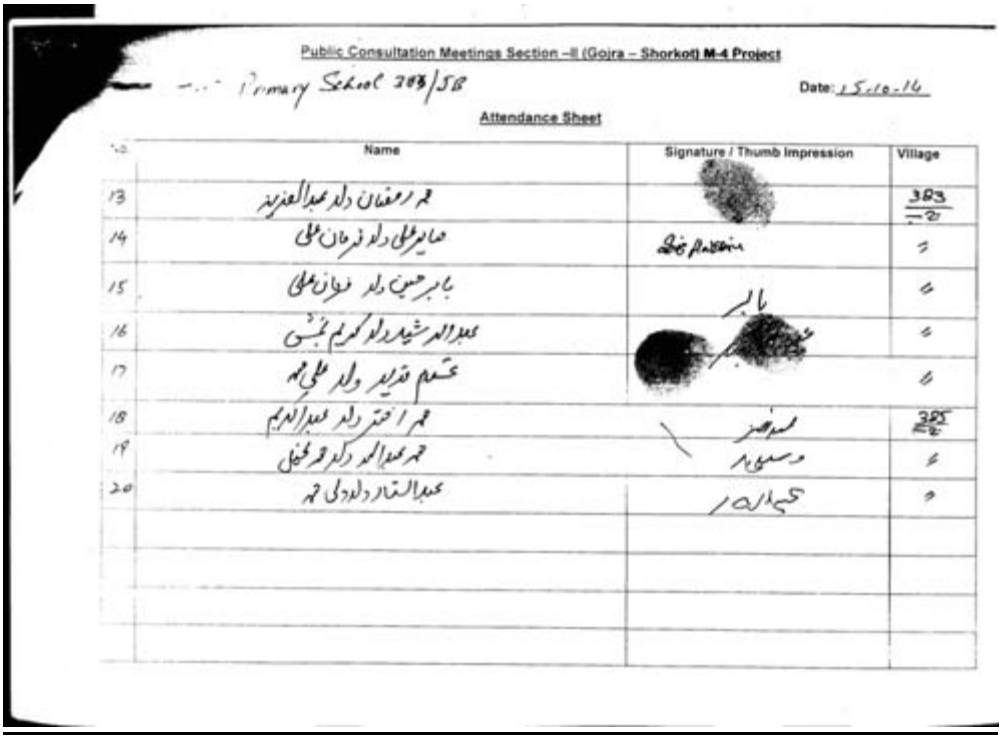
Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School (Ele) 383/JB

Date: 15-10-14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
1	دلدار حسین ولد محمد طفیل	[illegible]	338 [illegible]
2	فاروق اعظم ولد محمد ارشاد	فاروق اعظم	〃
3	شہزاد احمد ولد منور حسین	[illegible]	390 [illegible]
4	محمد شاہد شاہین ولد محمد یعقوب	[illegible]	〃
5	سلطان بخش ولد محمد مشتاق	سلطان بخش	384 [illegible]
6	محمد ریاض ولد غالب حسین		〃
7	ناصر محمود ولد غالب حسین	[illegible]	〃
8	محمد آصف ولد محمد یعقوب	محمد آصف	383 [illegible]
9	لیاقت علی ولد محمد سلیم	[illegible]	〃
10	سعید احمد ولد اللہ دتہ	سعید احمد	〃
11	محمد اعجاز ولد قاسم علی	[illegible]	〃
12	محمد اعجاز ولد خوشی محمد	[illegible]	〃

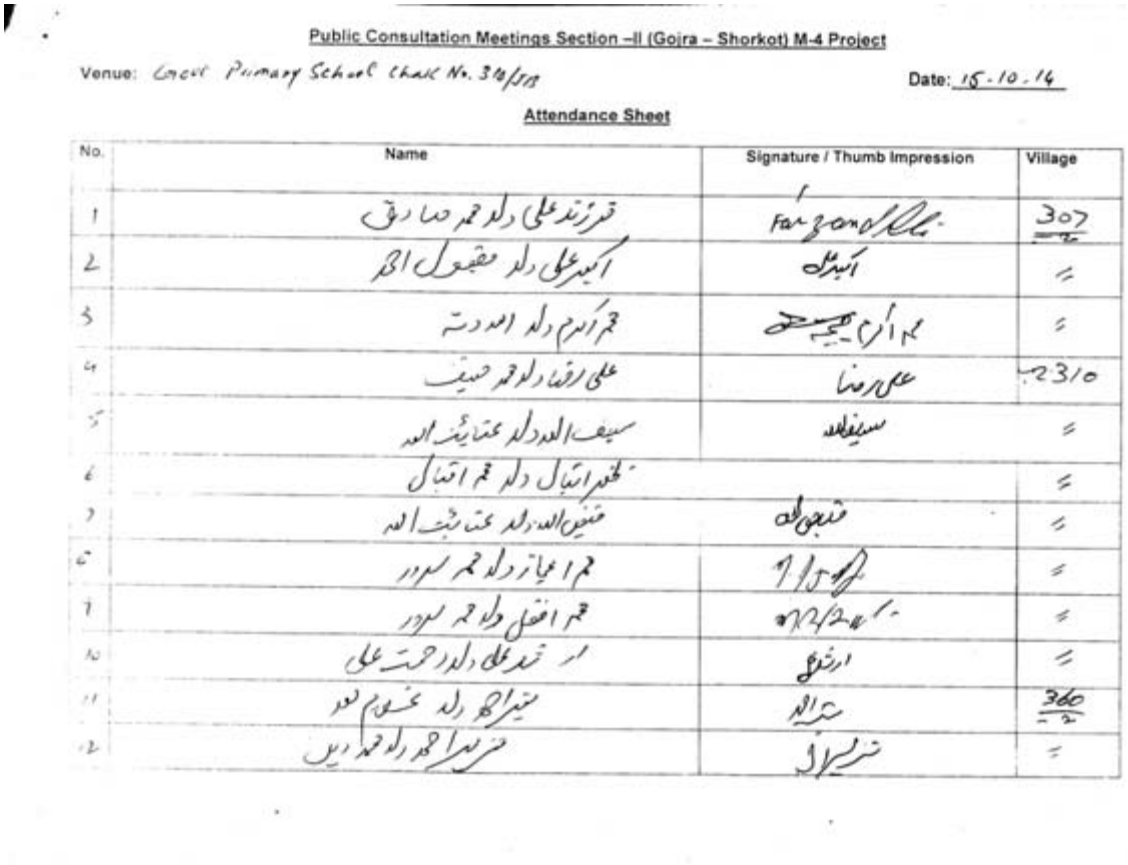


Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

... Primary School 388/SB Date: 15.10.14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
13	محمد رمضان ولد عبدالعزیز		383
14	صابر علی ولد فرمان علی		〃
15	بابر حسین ولد فرمان علی		〃
16	عبدالرشید ولد کریم بخش		〃
17	عشم قدیر ولد علی محمد		〃
18	محمد اختر ولد عبدالکریم		385
19	محمد عبدالله ولد محمد خلیل		〃
20	عبدالستار ولد ولی محمد		〃



Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School Chak No. 388/SB Date: 15.10.14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
1	فرزند علی ولد محمد صادق		307
2	اکبر علی ولد مقبول احمد		〃
3	محمد اکرم ولد امداد		〃
4	علی رضا ولد محمد حنیف		2310
5	سیف الله ولد عنایت الله		〃
6	ظفر اقبال ولد محمد اقبال		〃
7	متین الله ولد عنایت الله		〃
8	محمد اعجاز ولد محمد سرور		〃
9	محمد اقبال ولد محمد سرور		〃
10	ارشد علی ولد رحمت علی		〃
11	شیراز ولد محمد نور		360
12	شہزاد ولد محمد دین		〃

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School Chak No. 310/JB Date: 15.10.14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
13	بشیر ولد محمد دین	بشیر	360
14	غلام رسول ولد محمد علی		438
15	طالب حسین ولد محمد علی		〃
16	محمت عباس ولد غلام عباس	Asmat Abbas	305
17	محمد نواز ولد غلام اکبر	محمد نواز	〃
18	الطاف حسین ولد محمد شفیع		〃
19	محمد یونس ولد اکبر علی		〃
20	محمد کریم ولد محمد حسین		304
21	محمد افضل ولد محمد حسین		〃
22	محمد مصطفیٰ ولد محمد یاسین		〃
23	محمد لقمان ولد محمد صدیق		〃
24	غلام مصطفیٰ ولد الہ دتہ		311

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School Chak No. 310/JB Date: 15-10-14

Attendance Sheet

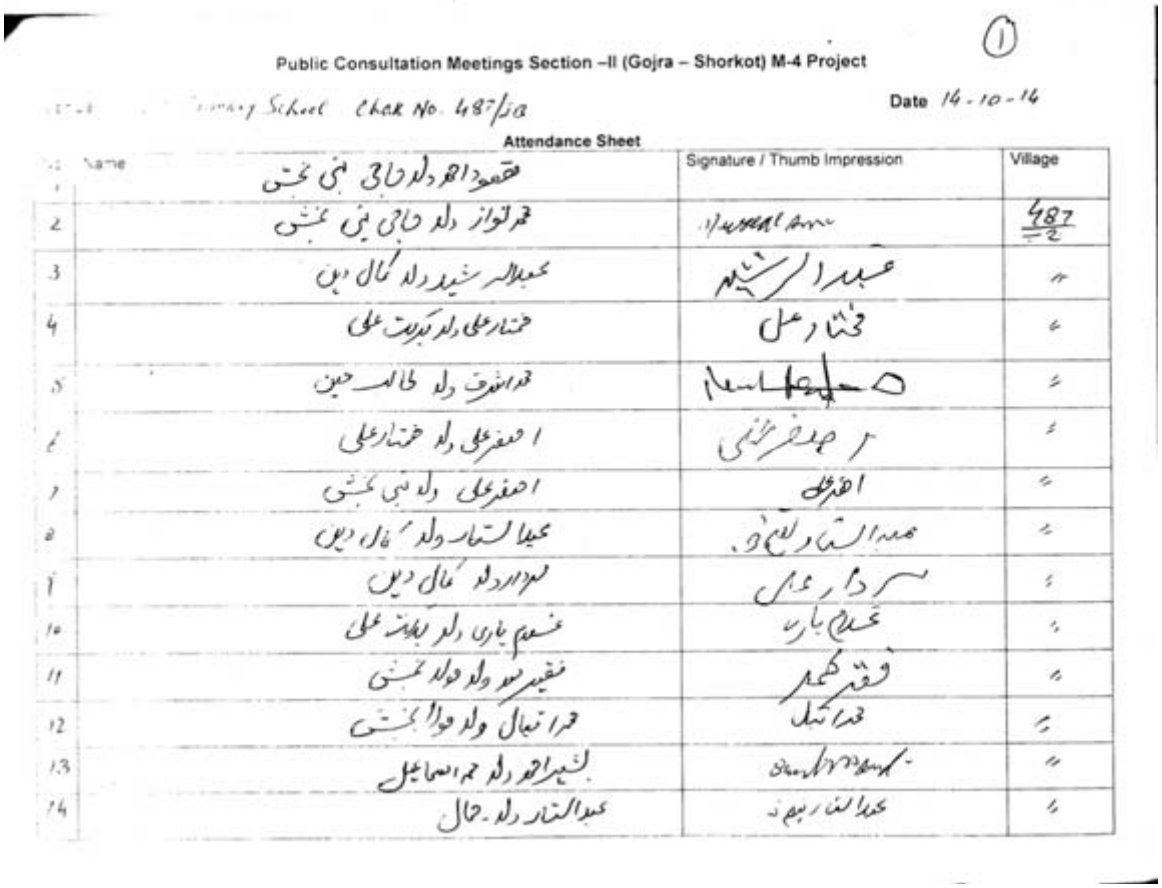
No.	Name	Signature / Thumb Impression	Village
25	محمد وقاص ولد روشن دین	محمد وقاص	311
26	محمد آصف ولد محمد محسن	محمد آصف	317
27	ظہیر اقبال ولد محمد نواز	Mazhar	307

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School Chak No. 310/JB Date: 15-10-14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
13	بشیر احمد ولد محمد دین	بشیر احمد	360
14	غلام رسول ولد محمد علی		438
15	طالب حسین ولد محمد علی		"
16	محمت عباس ولد غلام عباس	Mumtaz Abbas	305
17	محمد نواز ولد غلام اکبر	محمد نواز	"
18	الطاف حسین ولد محمد شفیع		"
19	محمد یونس ولد اکبر علی		"
20	محمد کریم ولد محمد حسین	محمد کریم	304
21	محمد افضل ولد محمد حسین	محمد افضل	"
22	محمد مصطفیٰ ولد محمد یاسین		"
23	محمد لقمان ولد محمد مصطفیٰ	محمد لقمان	"
24	غلام مصطفیٰ ولد الہ دتہ	غلام مصطفیٰ	311



(1)

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Primary School Chak No. 487/GB Date 14-10-16

Attendance Sheet

Sr.	Name	Signature / Thumb Impression	Village
1	مقصود احمد ولد حاجی بنی بخش		
2	محمد نواز ولد حاجی بنی بخش		487/2
3	محمد اللہ رشید ولد کمال دین		〃
4	مختار علی ولد برکت علی		〃
5	محمد اشرف ولد خالد حسین		〃
6	اصغر علی ولد مختار علی		〃
7	اصغر علی ولد بنی بخش		〃
8	محمد ستار ولد کمال دین		〃
9	سردار ولد کمال دین		〃
10	غلام باری ولد برکت علی		〃
11	فقیر محمد ولد حاجی بخش		〃
12	محمد نبال ولد حاجی بخش		〃
13	بشیر احمد ولد محمد اسماعیل		〃
14	عبدالستار ولد۔ حال		〃

(2)

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School Chak # 487/JB

Date: 14-10-14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
15	محمد جمیل ولد طالب حسین	M. Jamil	487
16	بابر علی ولد رانا شوکت علی	[illegible]	498/2
17	طارق جاوید ولد اکبر علی	Tariq Javed	489/2
18	اشفاق احمد ولد محمد عبداللہ	اشفاق احمد	//
19	محمد اسلم ولد حاجی محمد یوسف	[illegible]	//
20	اللہ بخش ولد امیر خان		490
21	مشتاق احمد ولد امیر خان		//
22	محمد اشفاق ولد مختار احمد	محمد اشفاق	//
23	محمد اسحاق ولد محمد شفیع	محمد اسحاق	//
24	محمد افضل ولد محمد علی	محمد افضل	//
25	محمد مراد ولد امیر خان		//
26	غلام حسین ولد امیر خان		//

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School Chak 396/JB

Date: 15-10-14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
1	شبیر عباس ولد محمد نواز	شبیر عباس	469/2
2	محمد امین ولد غلام نذیر	محمد امین	//
3	رب نواز ولد بہادر خان	[illegible]	//
4	محمد دراز ولد اللہ دتہ	Muhammad Daraz	400/2
5	محمد صادق ولد چراغ دین		//
6	محمد عمران ولد محمد اسماعیل	[illegible]	396/2
7	نذیر احمد ولد محمد دریام	نذیر احمد [illegible]	//
8	محمد اقبال ولد لال دین		//
9	راجہ علی شان ولد خدا داد	[illegible]	//
10	محمد ریاض ولد رحیم داد		//
11	راجہ لیاقت علی ولد اسلم خان	راجہ لیاقت	//
12	حق نواز ولد مراد	حق نواز	//

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Govt Primary School Chak No. 396/JB

Date: 15-10-14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
13	محمد طارق ولد محمد اسلم	محمد طارق	401/JB
14	محمد عمران ولد تاج محمد	M. Imran	"
15	فقیر محمد	فقیر محمد	398/JB
16	محمد یار ولد کالا خان	[illegible]	396/JB

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Primary School 7 Gagh

Date: 14.10.14

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
1	محمد اکرم شاہ ولد میاں صاحب زمان شاہ قریشی ہاشمی	[illegible]	[illegible]
2	امان اللہ ولد محمد رمضان	امان اللہ	"
3	ضیاء اللہ ولد محمد شریف	ضیاء اللہ	"
4	سرفراز ولد میاں فاضل	سرفراز	"
5	جمعہ دین ولد محمد رمضان	جمعہ دین	"
6	اللہ دتہ ولد نواز [illegible]		"
7	محمد ارشاد ولد فاضل	[illegible]	[illegible]
8	میر عادل ولد [illegible] خان	عادل	"
9	جعفر حسین ولد محمد صادق	محمد جعفر	"
10	اعجاز حسین ولد غلام حسین	اعجاز حسین	"
11	سرفراز ولد غلام حسین	سرفراز خان	"
12	خالد علی ولد میاں خدا بخش	[illegible]	"

Public Consultation Meetings Section –II (Gojra – Shorkot) M-4 Project

Venue: Primary School Chak No. 7-Gagh

Date: 14-10-14.

Attendance Sheet

No.	Name	Signature / Thumb Impression	Village
13	اختر رضا یسین ولد مظفر علی	[illegible]	[illegible]
14	محمد صادق ولد بہادر	محمد صادق	[illegible]
15	محمد رمضان ولد پیرا دل خان		〃
16	تنویر حسین ولد محمد جمیل	تنویر حسین	〃
17	دوست محمد ولد لیاور خان	دوست محمد	〃
18	حاجی محمد رمضان ولد نادر خان	حاجی محمد رمضان	〃
19	محمد نواز ولد طالب حسین	محمد نواز	〃
20	سجاد حسین ولد طالب حسین	سجاد حسین	〃
21	محمد حیات ولد محمد نواز		〃
22	عبدالکریم ولد محمد فاضل		〃
23	عبدالمجید ولد محمد رمضان		〃
24	باقر ولد امیر خان		

As the public was well the public consultation along section-II ROW as mention below;

Fig-2 starting point of section-II near Gojra interchange

Fig-3 Chakri 383 JB Tehsil & District Toba Tak Singh

Fig-4 Chakri 383 JB Tehsil & District Toba Tak Singh

Fig-5 Chak 397 JB Tehsil & District Toba Tak Singh

Fig-6 Chak 383 JB Tehsil & District Toba Tak Singh

Fig-7 Chak 383 JB Tehsil & District Toba Tak Singh

Fig-8 Chak 383 JB Tehsil & District Toba Tak Singh

Fig-9 Chak 383 JB Tehsil & District Toba Tak Singh

Fig-10 Government Boys High School Chak 383 JB Tehsil & District Toba Tak Singh

Fig-11 Government Boys High School Chak 383 JB Tehsil & District Toba Tak Singh

Fig-12 RD 80+100 Tehsil & District Toba Tak Singh

Fig-13 RD 80+100 Tehsil & District Toba Tak Singh

Fig-14 Public Consultation RD 80+100 Tehsil & District Toba Tak Singh

Fig-15 Public Consultation RD 80+100 Tehsil & District Toba Tak Singh

Fig-16 Trees of Punjab Government at RD 80+100 Tehsil & District Toba Tak Singh

Fig-17 Trees of Punjab Government at RD 80+100 Tehsil & District Toba Tak Singh

Fig-18 Dead Trees of Punjab Government at RD 80+100 Tehsil & District Toba Tak Singh

Fig-19 RD 80+100 Tehsil & District Toba Tak Singh

Fig-20 Boundary wall of Govt. High School is 200 Meters away from RD 84+637

Fig-21 Boundary wall of graveyard away from ROW at 84+637

Fig-22 Graveyard away from ROW at RD 84+637

Fig-23 Public House away from ROW at RD 84+637

Fig-23 Watercourse at RD 86+700

Fig-24 RD 86+700

Fig-25 Chak 377 JB RD 86+637

Fig-26 Govt. Primary School for Boys is 21 meters away from RD 86+637 which is considered as a sensitive reciptor

Fig-26 Public Consultant RD 86+637

Fig-26 Public Consultant and illegal encroacher RD 86+637

Fig-27 Public Consultant and RD 86+637

Fig-28 Illegal encroacher RD 86+637

Fig-29 Public Property away from RD 87+100

Fig-30 Public Consultation RD 120+100

Fig-31 Public Consultation RD 120+100

Annexure-V

Cumulative Environmental Impact Assessment

ADB Asian Development Bank

Cumulative Environmental Impact Assessment

Motorway M-4 Gojra–Shorkot Section

Final Report

R5V03MCA
August 10, 2015

Prepared by:
Hagler Bailly Pakistan

Prepared for:
National Highway Authority

Hagler Bailly Pakistan

Motorway M-4 Gojra–Shorkot Section

Cumulative Environmental Impact Assessment

Final Report

HBP Ref.: R5V03MCA

August 10, 2015

Asian Development Bank (ADB)

Manila, Philippines

Contents

Appendices:

Exhibits

1. Introduction

The Asian Development Bank (ADB) under the National Trade Corridor Highway Investment Program (NTCHIP) is assisting the Government of Pakistan (GoP) in improving road connectivity along the main North-South National Highway Corridor (NHC) that will support the National Trade Corridor (NTC)[1]. The ADB is considering financing the 61-kilometer (km) long, Section 2 (Gojra–Shorkot), of the Faisalabad to Khanewal Motorway, M-4 (see **Exhibit 1.1**).

This report documents the Cumulative Environmental Impact Assessment (CEIA) of the Section–2 of M-4 in combination with the past, present and reasonably foreseeable future development along the alignment of existing M-3 and Section–1 of M-4 motorways (the 'Project') to comply with the requirements of ADB Safeguards Policy Statement 2009[2] (SPS 2009) with respect to cumulative and induced impacts of the Project. For this purpose, ADB made available the services of Mr Vaqar Zakaria, Environmental Specialist, through Hagler Bailly Pakistan (Pvt.) Ltd. (HBP) to National Highway Authority (NHA).

1.1 Background

The NTCHIP was approved by the GoP in 2005. The NTCHIP Program is financed by ADB through a Multi-tranche Financing Facility (MFF-0016) which was approved in 2007. The MFF consists of several tranches, each covering several subprojects.

The Tranche–1 of NTCHIP includes construction of a two lane, 184 km long dual carriageway by the NHA connecting Faisalabad to Khanewal (M-4 Motorway or M-4 Project, see **Exhibit 1.1**), including full depth asphalt pavement, bridges, flyovers, underpasses and interchanges. The Motorway has been designed to provide a safe, congestion-free and high-speed corridor for the traffic expected on the route that is an important part of the projected transportation network in the country. This motorway will also improve the communication network within Punjab.

The M-4 Project was divided into three sections for implementation: **Section–1:** (Faisalabad–Gojra), **Section–2** (Gojra–Shorkot), and **Section–3** (Shorkot–Khanewal). The **Section–4** of the project includes construction of two bridges, one over Sadhnai Spill Channel and the other on River Ravi. The Section–1 of M-4 (Faisalabad–Gojra) has been completed and opened for traffic on March 16, 2015. Construction of Section–2 of the M-4 (Gojra–Shorkot) is expected to start shortly. Section–2 of M-4 will be implemented under Tranche–4 of NTCHIP. In addition to these, M-4 Extension Project with total length of 63 km connecting Khanewal to Multan is currently in its completion stage. The Section–3 of the M-4 will be connected to this extension to extend M-4 Motorway to Multan city.

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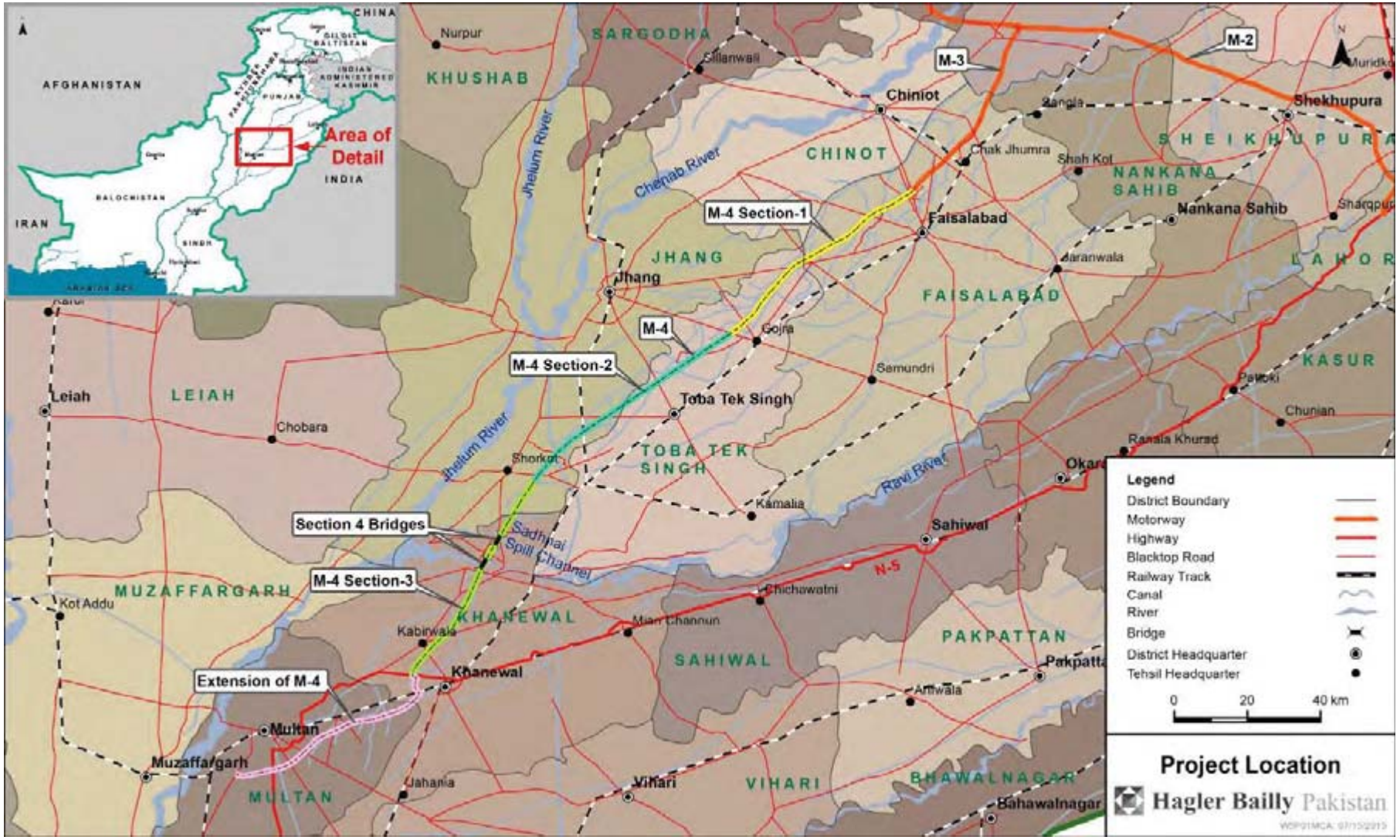
1 40075–023: National Trade Corridor Highway Investment Program, Tranche–1 Project Data Sheet. Asian Development Bank, (source: http://adb.org/projects)

2 Asian Development Bank, "ADB Policy Paper; Safeguard Policy Statement" Manila, June 2009.

Exhibit 1.1: Project Location



As the construction of M-4, under ADB's policy on environment falls under "Category A" an EIA was prepared for all the four sections of the M-4 Project (Faisalabad–Khanewal)[3]. Subsequently, ADB approved and adopted a new safeguards policy that has been implemented since 2010—the ADB SPS 2009. To comply with the requirements of the SPS 2009, this CEIA has been conducted.

1.2 Objectives of the CEIA Study

The objectives of the CEIA, as provided in the Terms of Reference (ToR), are:

- Identification and assessment of past, present, and reasonable foreseeable future developments in the Project's area of influence;
- Identification and assessment of specific environmental resources, ecosystem or human environment that would be vulnerable in view of the development activity;
- Assessment of impacts of the Project in combination with operation of M-3 and M-4 motorways and other past, present and reasonably foreseeable future developments in the area and on identified valuable environmental resources, ecosystem and human environment; and
- Proposition of measures to mitigate significant impacts, and as much as possible, build them into Project design, and where not possible, propose specific mitigation measures to avoid and offset of such cumulative impacts.

1.3 CEIA Requirements in ADB SPS 2009

The ADB SPS 2009 in its Policy Principles require conducting "an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential trans-boundary and global impacts, including climate change."[4].

Section D of the ADB SPS 2009, in its Subsection 6 requires analysis of impacts in the context of project's area of influence, encompassing "areas and communities potentially affected by cumulative impacts from further planned development of the project, other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that are realistically defined at the time the assessment is undertaken"[5].

The ADB SPS Policy Principles are designed to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. The second point of the policy principles required to "Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical,

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[3] National Highway Authority, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway (M-4)" Asian Development Bank, Manila, Philippines, March 2007 (updated in 2014).

[4] Asian Development Bank, "ADB Policy Paper; Safeguard Policy Statement" Manila, June 2009.

[5] Asian Development Bank, "ADB Policy Paper; Safeguard Policy Statement" Manila, June 2009.

biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential trans-boundary and global impacts, including climate change. Use strategic environmental assessment where appropriate.[6]

1.4 National Requirements

The Pakistan Environmental Protection Act 1997, the forerunner of current provincial environmental laws in Pakistan is silent on cumulative environmental assessment. Section 2(xi) of the Act defines environmental impact assessment as "an environmental study comprising collection of data, prediction of qua1itative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigatory and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations…" Following devolution of legislative powers to the provinces, the provincial legislatures have enacted provincial environmental laws. These new laws are based on the Pakistan Environmental Protection Act 1997 with minor differences. Although, they still use the same definition of "environmental impact assessment", several of the laws have introduced the strategic environmental assessment as a tool to assess the environmental impacts of policy, plan and programs.[7]

The Pakistan Environmental Protection Agency (Pak-EPA) introduced a series of environmental guidelines in 1997. The law[8] requires that "[w]here guidelines have been issued … an EIA shall be prepared, to the extent practicable, in accordance therewith…" The requirement for cumulative environmental impact assessment is included in two of the guidelines. The *Guidelines for the Preparation and Review of Environmental Reports*[9] requires that cumulative impact shall be considered during the scoping and impact assessment phases.

The Pak-EPA sectoral guidelines for major roads,[10] provide more specific guidelines for cumulative impacts. It provides the guidelines included in **Exhibit1.2**.

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6 Asian Development Bank, "ADB Policy Paper; Safeguard Policy Statement" Manila, June 2009.

7 The provincial environmental protection laws of Sindh, Balochistan and Khyber Pakhtunkhwa have introduced the requirement for strategic environmental assessment.

8 Pakistan Environmental Protection Agency, Review of Initial Environmental Assessment and Environmental Impact Assessment Regulations 2000

9 Pakistan Environmental Protection Agency. Guidelines for the Preparation and Review of Environmental Reports. November 1997.

10 Pakistan Environmental Protection Agency. Sectoral Guidelines for Environmental Reports: Major Roads. October 1997.

Exhibit 1.2: Pak-EPA Guidelines on Cumulative Impact of Major Roads

The principal cumulative impacts of road proposals result from increased traffic, causing increased fuel usage and air emissions. Particularly in urban areas, the air emissions can lead to the production of photo-chemical smog. Overall increases in fuel use and air emissions contribute to the Greenhouse effect, a world-wide phenomenon. Where the anticipated levels of vehicle usage are expected to significantly contribute to fuel use and the overall emissions already being experienced, these issues should be considered.

Other aspects that may relate to the cumulative impacts of particular road proposals include:

- the potential for cumulative impacts from other existing or planned transport facilities in the region;
- any advantages or disadvantages from clustering development and road facilities in this location;
- whether the road would prevent, inhibit or improve the development of (or affect the viability of) other forms of transport, now or in the future;
- whether the proposal would attract development, and the likely impacts of that development;
- any long term cumulative impacts on the issues listed from 3.1 to 3.16 above.

Cumulative impacts are often the most difficult to mitigate, and can best be addressed through early identification and design changes. In many cases (e.g. urban sprawl, regional air quality, and drinking water quality) they require a regional approach by government. The key to the successful management of cumulative impacts is knowledge of the limits to the assimilative capacity of the receiving environment.

2. Conceptual Approach and Methodology

The environmental impact assessment (EIA)[11] is now an established tool, a mandatory requirement in almost all the countries in the world, for assessing the environmental and social impacts of development projects. The emphasis of EIA is on the environmental and social impact of a single project. Even if all the projects in a geographical locations are studied through their respective EIA studies, how the projects will collectively change the environment is not captured in the studies. This assertion is based on the understanding that environment and ecosystems are non-linear systems. The cumulative impact of a number of projects will not be equal to the sum of incremental impacts of individual projects—it is likely to be more. Therefore, considering the limitations of ESIA studies, the countries and organizations, understanding the importance of environment and a possible change in it as the key factor to impact its biophysical integrity, now emphasize and direct the project proponents and donors to conduct cumulative environmental assessments of the projects.

Cumulative impacts are those that result from the incremental impact of a project when assessed in combination with other existing and reasonably foreseeable future developments in a rationally set geographical and temporal scale. Cumulative impacts of a project are limited to those impacts only which are generally recognized as important on the basis of scientific concerns and concerns of the local communities located around the project area which can be affected by the project development and other Developments in their vicinity.

This CEIA study considers these concepts to identify and assess the possible environmental and social impacts related to the development of M-4 Motorway in combination with other developments in the Study Area.

2.1 Why CEIA?

CEIA signifies a systematic impediment in environmental and social impact assessment (ESIA) because the spatial horizon of impact assessment is expanded and multifaceted as compared to ESIA, and the interactions between human activities and VECs increase in number and intricacy. The overall objectives of a cumulative environmental assessment studies are:

- Safeguard the subject and future development's cumulative social and environmental impacts and risks to not exceed a threshold that could compromise the sustainability of VECs;
- Ensure that the subject and future development's value and feasibility are not limited by cumulative social and environmental impacts and risks; and
- Support development of regional governance structures for decision making and managing cumulative impacts.

[11] Alternatively also called Environmental and Social Impact Assessment (ESIA)

2.2 Study Methodology

There are a number of guidelines for conducting CEIA. The methodology used in this study has been adapted from the guidelines of International Finance Corporation,[12] Canadian Environment Agency[13] and the American Association of State Highway and Transportation Association.[14] The broad steps of CEIA are provided below.

Step 1: Define the **Proposed Actions.**

Proposed Actions are the activities and other actions that have an effect on the environment and are subject of the CEIA. This includes the Proposed Project for which usually the EIA is conducted. Proposed Actions also includes other activities, whether undertaken as part of a Project or arising over time due to the development of the Project. A mine development and road developed to access the mine site are examples of a project. Public traffic on the access road and increased hunting due to the better access are examples of activities.

The information on Proposed Actions is usually provided by the Project proponents and the EIA of the proposed Project.

Chapter 3 of the report provides the details of the Proposed Action.

Step 2: Define the **Corridor of Impact**.

The Corridor of Impact (CoI) is the area in which the environmental and social impacts of the Proposed Action are likely to occur. This information is obtained from the EIA of the Proposed Action.

The CoI is defined in Chapter 3 of the report.

Step 3: Undertake **Scoping Consultations** with community and institutional stakeholders.

The Scoping Consultations are undertaken to:

a) inform the stakeholders about the study;

b) identify the reasonably foreseeable developments (see Step 4 for definition);

c) identify the valuable environmental and social components; (see Step 5 for definition); and

d) record the concerns of the stakeholders about the impact of the existing developments in the area.

The scoping consultation process and the results are provided in Chapter 4 of the report.

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[12] International Finance Corporation. Good Practice Handbook—Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. 2014

[13] Canadian Environmental Assessment Agency. *Cumulative Effects Assessment Practitioners Guide*. 1999.

[14] Center for Environmental Excellence, American Association of State Highway and Transportation Officials. *Assessing Indirect Effects and Cumulative Impacts under NEPA*. 2011

Step 4: Identify the **Reasonably Foreseeable Developments**.

Reasonably Foreseeable Developments (RFD) are all developments, whether inside or outside the CoI, that can affect the VECs (see Step 5) positively or negatively. The RFD includes:

a) Developments with footprints within the CoI that may affect the VECs being assessed. Footprints include associated components (e.g., access roads, powerlines), and include air or areas of land or water directly disturbed;

b) Developments outside the CoI if it is likely that any of their components may affect the VECs or interact with Proposed Action to modify the effect of the Proposed Action on the VECs;

c) Past development that may still cause effects on the VECs; and

d) Future actions that are under consideration, planned, or under development for which there is sufficient reasons to believe that they will be realized.

The reasonably foreseeable developments are discussed in Chapter 5.

Step 5: Identify **Valuable Environmental And Social Components (VECs)** in the CoI.

VECs are the biophysical attributes of the environment which are considered to be significant in assessing risk associated with the cumulative impacts of the Proposed Action and reasonably foreseeable developments (see Step 5). VECs may include wildlife habitats (such as terrestrial and fresh water ecosystems to support biodiversity); environmental processes (such as hydrological cycle and nutrient cycling); physical features (such as air, noise, water, and soil); flora and fauna (such as resident and migratory birds and medicinal plants); and social conditions (such as public health, livelihood, and access). The VECs are identified on the basis of literature review and scoping consultations.

VECs for the CEIA are identified in Chapter 6.

Step 6: Establish the **Baseline Conditions of the VECs**.

The current conditions of the VECs are defined as baseline. The cumulative impacts of the Proposed Action or Reasonably Foreseeable Developments are changes in the VECs.

The environmental and social baseline conditions of the identified VECs were established by reviewing previous EIAs conducted by NHA and other and other published literature available.

The baseline conditions of the VECs are described in Chapter 6.

Step 7: **Predict the cumulative impacts** of the Proposed Action and RFD on the VECs.

The prediction of the change in the conditions of the VECs is undertaken using qualitative and quantitative techniques. These include, for example, dispersion modeling for air quality impacts, noise modeling, and socioeconomic impacts.

The predictions of cumulative impacts are subject of Chapter 7 of the report.

Step 8: Establish **Threshold Criteria** for each VEC.

The focus of the CEIA is to understand whether cumulative impacts of the Proposed Action and RFD will affect the sustainability or viability of a VEC as indicated by the predicted condition of the VEC. It is, therefore, required to establish the limit of acceptable change or the thresholds—the limits beyond which change in the condition of the VEC results in rapid degradation. This may include, for example, disturbance to an aquatic habitat resulting in the rapid collapse of a fish population, or seepage of soil contaminant to drinking potable water aquifers. Without establishing the threshold criteria, it will not be possible to assess the significant of the predicted change in the conditions of the VECs. Threshold Criteria may be based on scientific assessment, societal values or a combination of these and may include targets, standards and guidelines, carrying capacity.

Threshold Criteria are established in Chapter 7 of the report where they are used to assess the significance of the predicted change in the condition of the VEC.

Step 9: Recommend plans for **monitoring and management** of cumulative environmental and social impacts on the VECs.

In this last step of the CEIA, the measures required to ensure that the change in the conditions of the VECs due to combined effects of the Proposed Action and the RFD does not exceed the Threshold Criteria are identified. It may also include specific plans, the roles of the various government agencies and project proponents.

The environmental and social mitigation plans are discussed in Chapter 8 of the report.

3. Proposed Action

The Proposed Action (alternatively referred to as proposed Project) comprises construction of 4-land motorway from Gojra to Shorkot. The actions is briefly described below.

3.1 M-4 Motorway

The M-4 Motorway will connect Faisalabad with Multan through a new 4-lane, dual-carriageway highway. The alignment of the M-4 can be seen in **Exhibit 1.1**.

The construction of whole alignment of M-4 is divided into parts as follows:

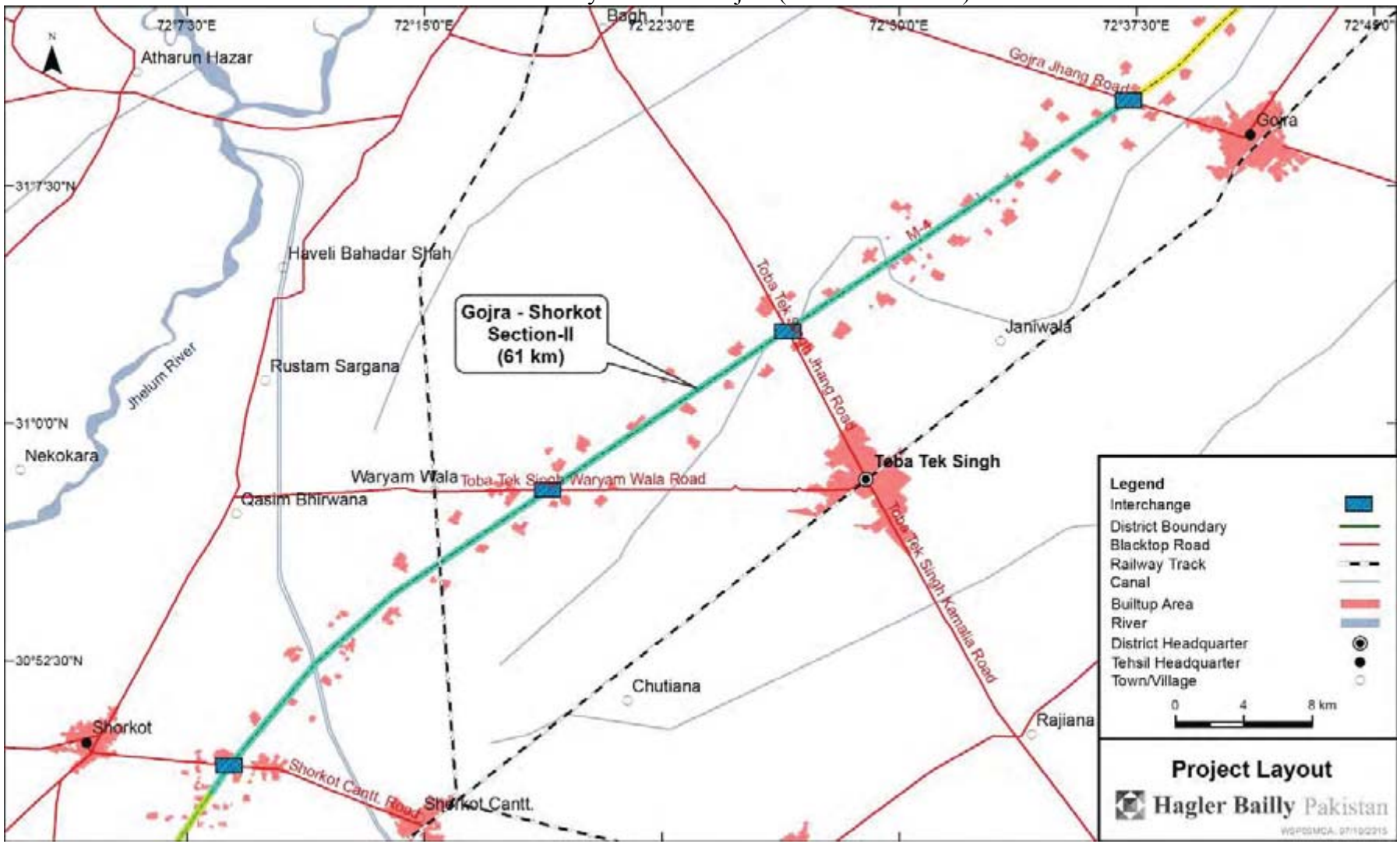
- Section 1: Faisalabad–Gojra (59 km) implemented as Tranche-1 of NTCHIP and is now operational.
- Section 2: Gojra–Shorkot (61 km)
- Section 3: Shorkot–Khanewal (64 km);
- M-4 Extension: In addition to the above three sections of total length 184-km, an extension of M-4 was planned between Khanewal and Multan. This 63-km section, which runs parallel to the national highway N-5, has been constructed and is now operational.

The Project components include construction of four lanes dual carriageway and construction of interchanges at different road crossings. Bridges will be constructed on crossings with major drains, canal crossings and spill channels. Tree plantation will be carried out on both side of right of way (RoW) to ensure conservation and safeguard of the environment.

3.2 Section 2 of M-4 Motorway

Section 2 of the Motorway extends from Gojra to Shorkot. It has a proposed length of 61 km. This section, which is the subject of this CEIA, is shown in **Exhibit 3.1**.

Exhibit 3.1: Layout of the Project (Section–2 of M-4)



3.2.1 The Carriageway

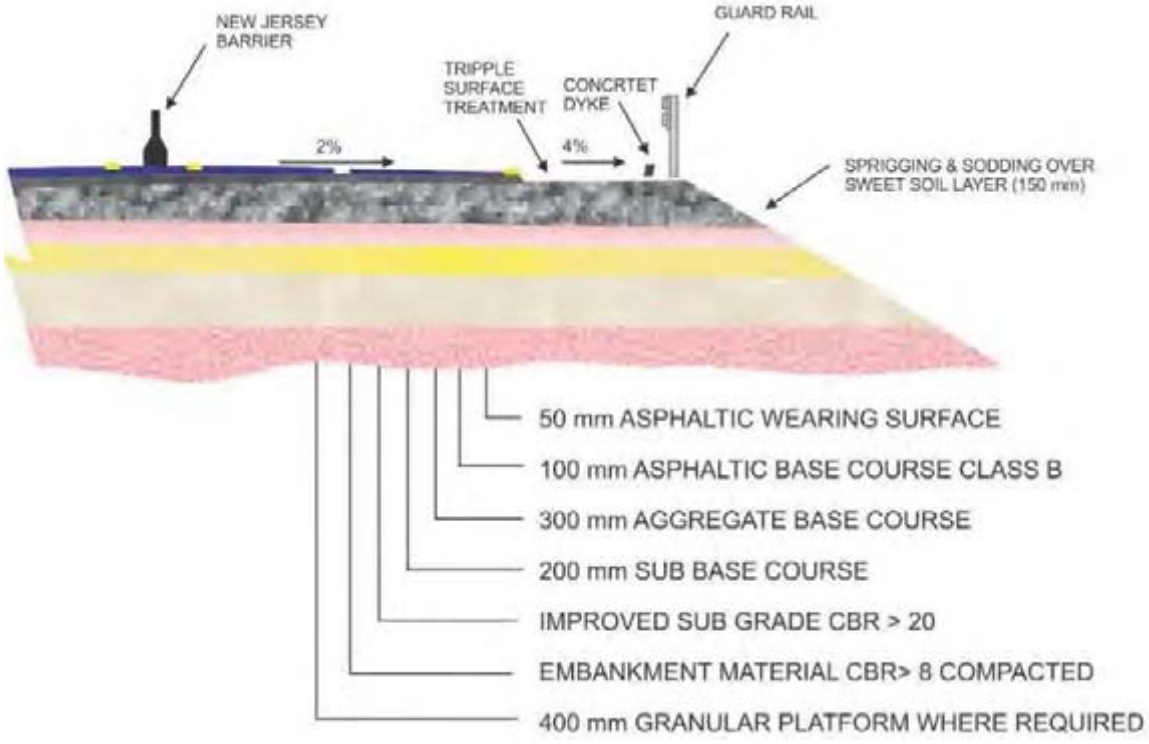
The total width of both carriage ways will be 31.5 m. This is broken down as follows:

Median	1.4 m
Motorable lanes	14.6 m (3.65 m × 4 lanes)
Land reserved for future lanes	7.3 m (3.65 m × 2 lanes)
Inner shoulders	1.2 m (0.6 m × 2)
Outer shoulders with rounding	7 m (3.5 m × 2)

3.2.2 Pavement Structure

The pavement structure will be a minimum of 0.75 m. The breakdown is shown in **Exhibit 3.2**.

Exhibit 3.2: Cross Section of Pavement Structure



3.2.3 Interchanges

Ten interchanges were planned on the M-4 to provide access to the traffic of the areas it is passing through. Four interchanges have been constructed on its Section–1.

In the proposed Section–2 of M-4, three interchanges will be constructed at Toba Tek Singh-Jhang Road km (80+169), Toba Tek Singh-Warriamwala Road km (93+671), Shorkot Cantt-Shorkot City Road km (118+584). The interchange will be provided with two lanes each lane of 3.5 m wide with one meter shoulder at outer sides.

The rest of the three interchanges are yet to be planned for Section–3 of the M-4 motorway.

3.2.4 Bridges

Two main bridges will be constructed on River Ravi and Sadhnai Spill Canal. Both of these will be in Section 3 of the M-4. In addition to these, various small bridges over irrigation canals will be constructed on the M-4.

In the Section–2 of M-4 motorway 8 bridges will be constructed at different canal and drain crossings. The details of these bridges are provided in **Exhibit 3.3**.

Exhibit 3.3: Bridges

No	*Chainage*[15]	*Length (m)*
1	73 + 461	25
2	80 + 168	30
3	82 + 139	25
4	93 + 632	30
5	103 + 592	45
6	110 + 878	120
7	111 + 039	40
8	118 + 588	30

3.2.5 Underpasses

The underpasses will be constructed at various road crossings. The link roads across the RoW of the Project will pass through these underpasses. For these underpasses the width of the land strip will follow the existing carriageway.

3.2.6 Rest Areas

Rest Areas will be provided after a certain distance on the proposed Motorway to facilitate travelers. For these rest area locations, a strip of 150 m width and 200 m length will be reserved on either side of the motorway.

3.2.7 Service Areas

Service Areas will be provided to facilitate travelers. Restaurants and petrol pumps (filling stations) will be located. A strip of 250 m width and 700 m length will be reserved for the Service Area. The toilets in the Service Area will be equipped with septic tanks of sufficient capacities. Sewage of the septic tanks will be disposed of at the designated waste disposal sites.

[15] The chainage provides the location of a marker on a road from the point of origin. The chainage for the M-4 starts from Faisalabad. The first number represents the distance in km and the second number in meters. In the same manner, these chainage provide the locations of the bridges with reference to the first chainage on M-4. For e.g. the first bridge is located at a distance of 73 km and 460.92 m from the origin of M-4 (Chainage 1+000, Faisalabad)

Currently, two locations for the construction of service area on Section–1 and Section–2 of M-4 have been proposed; one near Charaghabad interchange nearly 5 km towards Faisalabad on Section–1, while the second at Moza Jamani, at a distance of 10 km from proposed Toba Tek Singh interchange on Section–2 of M-4.

3.2.8 Project Right of Way

The total width of the Right of Way (RoW) of the proposed Motorway Project is 100 m. This includes 31.5 m of carriage way, 30 m of land reserved for plantation (15 m on each side) and the remaining land for service track and other provisions.

About 608 hectares (ha) of land will be acquired of which 468 hectares (1,156 acres) will be private land while the remaining 140 ha (347 acres) will be state-owned land.

3.3 Corridor of Impact

The corridor of impact (CoI) for the Proposed Action includes the project footprint and all the area on both sides of the Section 2 of the M-4 where the environmental and social impact of the proposed project is likely to be felt. The width of the CoI will vary with the nature of the impact. For example, for noise it is likely to be less than a kilometer, for air quality it may extend to two kilometers, whereas for traffic and socioeconomic aspects it is likely to be more and may include the entire motorway M-4 and M-3, the motorway connecting Motorway M-2 (Islamabad-Lahore) with Faisalabad.

4. Stakeholder Consultations

Consultations were conducted with institutional stakeholders and communities in the Study Area to record their views and concerns about the M-4 Motorway. The institutional stakeholder consultations focused on identifying reasonably foreseeable future developments in the Study Area which may, in combination with operation of M-4 can affect the biophysical environment of the Study Area. Consultations with communities were conducted to identify the Valued Environmental and Social Components (VECs), determine the dependence of the communities on the VECs, and their perceptions about the development of M-4 and its impact on VECs.

Consultation meetings with institutional stakeholders were held from July 01 to July 03, 2015, while consultations with communities located near M-3 Faisalabad industrial Estate and along the alignment of M-4 were conducted on July 04 and 05, 2015.

This section summarizes the issues raised by the institutions and communities related to the development of M-4, and a list of the VECs of the Study Area as identified by the communities consulted.

4.1 Consultation Methodology

The World Bank and ADB guidelines for consultation and participation as summarized in this section were followed.

4.1.1 Good Practice Principles

According to World Bank Good Practice Principles[16], the consultations need to be undertaken in good faith, while remaining impartial. The good practice principles which will be observed during the consultations are:

- *Cultural sensitivity* – this requires understanding and appreciation of the social institutions, values, and culture of the communities in the project area and respect for the historical, cultural, environmental, political and social backgrounds of the communities which are affected by a project;
- *Interactive approach* – stakeholders' engagement should not be limited to one-way dissemination of information. Stakeholder comments should be fed into the decision making processes for the proposed project design;
- *Open, transparent and informative* – government, institutions, industries and communities who are interested or can be affected by the proposed developments should have access to relevant information, in a simple and understandable format;

[16] International Finance Corporation "Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets" World Bank Group, Washington, D.C. United States of America, May 2007.

- *Inclusive and equitable* – Ensure that all stakeholder groups are represented, including less represented groups such as women, children, elderly and poor people;
- *Appropriateness and flexibility* – stakeholder engagement methodologies (meetings, workshops etc.) must be appropriate to the specific phase of the PESR and CIA process and the stakeholder groups identified. The consultation should also be adjusted according to the resources available;
- *Capacity building* – capacity building should be a part of interaction with stakeholders, wherever appropriate and practicable.

4.1.2 ADB Stakeholder Participation Guidelines

Asian Development Bank considers stakeholder participation as a tool to support good governance, citizenship, and accountability and promotes innovation, responsiveness, and sustainability, linked directly to development effectiveness. ADB in its stakeholder engagement guidelines provided in ADB–Guide to Participation[17], emphasis on following best practices to be adopted while involving stakeholders in decision making process

Core Principles of Stakeholder Participation

The stakeholder engagement ensures participation of affected and interested groups in development activities. The depth of the involvement of the stakeholders vary depending upon developmental context, however, several principles remain constant.[18] They include:

- **Promote accountability and transparency**: Participatory mechanisms hold decision makers accountable to their stakeholders. They promote communication and openness about activities, and transparency in the objectives of participation and degree of stakeholder influence.
- **Allow for participation at all levels**: People participate at any and all levels of decision making (policy, program, and project) through timely, flexible activities that suit their skills, abilities, and interests.
- **Make participation accessible to all**: All people are valued equally, opportunities for participation are adequately communicated and offered fairly, and barriers that stop particular groups getting involved are challenged.
- **Value diversity**: The diversity of people's experiences, backgrounds, beliefs, and skills offer a unique resource for society. Celebrating and capitalizing on this is key to participation.
- **Ensure participation is voluntary**: People involve themselves in decision making because they believe in the importance of issues at stake and that their participation will make a difference. Avoid coercion.

[17] Asian Development Bank, "Strengthening participation for development results: An Asian Development Bank guide to participation" Mandaluyong City, Philippines: Asian Development Bank, 2012

[18] Ibid

- **Encourage stakeholders to create their own ideas and solutions**: In community-led participatory approaches people take action themselves in ways they choose.

To ensure adequate participation, following steps will be coursed to achieve measurable results[19]:

1. analyze stakeholders to understand who is interested in development activities and their relationships;
2. consulting with stakeholder groups in reviewing a policy or strategy or in designing a project to understand their views
3. engaging stakeholders systematically through an agreed Participation Plan; and
4. informing stakeholders of the accountability mechanism.

Tools for Participation in Project Cycle

The ADB project cycle is structured around 7 tools which ensures effective and timely involvement of stakeholders and record their suggestions and concerns to incorporate in decision making process. A brief on these 7 tools is provided below:

Tool 1: Stakeholder Analysis and Consultation

This includes the steps involved in identification and analysis of stakeholders who may have an interest in ADB's, its client or recipient activities. Stakeholder analysis helps exploring the interests of the stakeholders. Identified stakeholder inputs are requested and considered as part of an inclusive policy, program, or project development or review process.

On the basis of the above, 4 stakeholder groups were identified. List of these including stakeholder names is provided in **Exhibit 4.1**.

Exhibit 4.1: Identified Stakeholders

Stakeholder Group	*Stakeholders*	*Stakeholder Interests*
Government and Semi–Government Institutions	Punjab Small Industries Corporation	Development of industrial units/estates/parks along the alignment or in the nearby vicinity of the M-4 identifying it as a link facilitating transportation of raw material to and finished products form the industries.
	Pakistan Industrial Development Corporation	
	Directorate of Industries, Punjab	
	Punjab Industrial Estate Development and Management Company	
	Punjab Highway Department	
	Faisalabad Industrial Estate Development and Management Company	

[19] Asian Development Bank, "Strengthening participation for development results: An Asian Development Bank guide to participation" Mandaluyong City, Philippines: Asian Development Bank, 2012

Stakeholder Group	*Stakeholders*	*Stakeholder Interests*
Industry and Trade Associations	Multan Chamber of Commerce and Industries	To promote the interests of their members associated with the industrial growth in the country due to development of infrastructure contributing towards flow of material from industries in national and international markets
	Faisalabad Chamber of Commerce and Industries	
Transporters Associations	Multan General Bus and Truck Stand	Business plans to start transportation services through motorways rather than Grand Trunk Road (GT Road) identifying M-4 as more efficient and convenient route to reach northern part of the country (Islamabad/Rawalpindi, Peshawar etc.)
	Faisalabad General Bus and Truck Stand	
Communities	Residing along the alignment of M-4 motorway	Easy access to major cities of Pakistan for better health, education and employment opportunities. They may also have concerns associated with the development of motorway, especially safety issues due to traffic influx and public health due to possible increase in noise and vehicular emissions.

Tool 2: Maximizing Participation in the Design and the Monitoring Framework

This follows the a five step participatory approach following ADB's Design and Monitoring Framework (DMF), 2007 ensuring the involvement of stakeholders from feasibility to final design and implementation stage of a project. The five step approach includes the following steps:

- Stakeholder analysis to identify key stakeholders;
- Problem analysis to pin down the major concerns of stakeholder related to the proposed development;
- Objective analysis to convert problems into objectives to identify future solutions of each problem;
- Result–chain analysis to identify stakeholder specific result chains to achieve desirable goals/outcomes; and
- DMF matrix to collaborate decisions and stakeholder inputs at each and every step of the development of a project.

Tool 3: Participatory Assessment

Participatory assessment methods and approaches have been developed to better understand the social and cultural context of development and to design interventions for local conditions. The core principles involved in participatory assessment are:

- Involves stakeholders as active participants—not just as passive sources of information;
- Promotes learning between ADB/recipient/client and stakeholders at various levels;
- Builds local people's capacities to analyze, reflect, and act; and
- Catalyzes commitment into actions

Following the participatory assessment core principles, community consultations were held as an integral part of this CEIA study. The findings of the community consultations are discussed in later sections here.

Tool 4: Developing a Participation Plan

This tool directs to design a participation plan including information generation to be shared with the stakeholders, consultation, and collaboration and in certain projects partnerships as well.

A stakeholder engagement plan was developed for this project. The SEP is attached as **Appendix A** with this document.

Tool 5: Developing a Stakeholder Communication Strategy

This requires developing a strategy for dissemination of information among stakeholders. It includes information dissemination, education and awareness raising; and also goes further to encourage dialogue, foster behavior change, and mitigate risks. It entails getting information to particular audiences (communities, government officials, industries etc.) and listening to their feedback, and responding.

During the informal discussions with the community stakeholders, specific details on the CEIA study were shared and their suggestions and inputs related to the existing M-3 and Section–1 of M-4, proposed Section–2 of M-4 and other future development including Section–4 and Section–4 of M-4, development and probable expansion of M-3 Faisalabad Industrial Estate (FIE) were welcomed. A map of the Study Area, showing sections of M-4 and with reference to the location of the community was shown to the key respondents to develop their understanding on the area, developments and what possible impacts can they experience by the developments on them.

Tool 6: Working with Civil Society Organizations

Civil society organizations can be described broadly as organizations distinct from the government and the private sector which operate around shared interests, purposes, and values. Common examples of these organizations are Local/International Non-Governmental Organizations (LNGOs/INGOs), Community Based Organizations (CBOs), Informal or Unorganized Civil Society Groups etc. Working along with these organizations add value to the consultation process as they operate in areas with different functions varying from public health, community awareness, provision of skilled training to provision of water supply and energy supplying stations and networks. These organizations help is consultations and act as an advisory to facilitate consultation process.

During the community consultations, no such organization was found to be active in the Study Area. People from different communities reported presence of many of these during floods of 2010-11 in the south Punjab, however, currently, no organization was reported to be active in the area.

Tool 7: Participatory Monitoring and Evaluation

This directs to involve stakeholder during monitoring and evaluation process designed for a project to ensure their participation to mitigate the adverse impacts of a development project on the biophysical environmental of an area. Their basic role is to provide information and feedback related to the mitigation and monitoring measures undertaken to minimize the impact of development activities.

During the development of Section–2 and remaining sections of the M-4, the communities will be involved in every decision making process. Their inputs will be recorded and incorporated in plans to improve the efficacy of the mitigation plans to minimize the adverse environmental and social impacts of the development of M-4 and other future developments in the Study Area.

4.1.3 Communities

Consultations were conducted with the communities within their settlements to ensure, encourage, facilitate and maximize their participation. The information about the Project along with the map of the Study Area (**Exhibit 1.1**) was shared with the attendees during community consultations.

Eight consultation meetings were held in the Study Area. List of consulted communities, names of persons from each community (only males[20]) and geographic coordinates are provided in **Exhibit 4.2**, while location of consulted communities is provided on a map in **Exhibit 4.3**.

4.2 Summary of Consultations with Community Stakeholder

A summary of discussions conducted with the communities is provided in **Exhibit 4.4**, while the list of identified VECs along with the perception of communities on them is provided in **Exhibit 4.5**.

[20] Due to cultural sensitivities the names of the consulted females could not be presented in the report.

Exhibit 4.2: List of Consulted Communities

Community Name	*Consulted Personnel*	*Geographical Coordinates*	
		Latitude	*Longitude*
Chak 161/ RB	▶ Mehar Zulfiqar Ali (numberdar) ▶ Talib Hussain ▶ Muhammad Iqbal ▶ Fateh Sher	31° 35' 57.2"	73° 09' 43.8"
Chak 31/JB	▶ Ali Hussain Khan ▶ Hamid Ali ▶ Syed Imtiaz ul HassSan	31° 29' 28.0"	72° 52' 24.6"
Chak 355/JB	▶ Yousuf Ali Jutt ▶ Abbas Ali ▶ Rafique Ahmed ▶ Muhammad Asif	31° 10' 39.4"	72° 36' 14.7"
Chak 383/JB	▶ Muhammad Latif (numberdar)	31° 02' 32.2"	72° 26' 52.8"
Kot Islam	▶ Muhammad Irfan Sheikh ▶ Hakim Ali	30° 35' 10.75"	72° 02' 55.4"
Auqaf Market	▶ Sheikh Sajid Abbad	30° 33' 46.3"	72° 06' 45.6"
Abdul Hakeem	▶ Abdul Khaliq ▶ Muhammad Yousuf Nonari	30° 22' 13.1"	71° 52' 58.75"
Near Nestle Factory, towards Khanewal	▶ Muhammad Hafeez ▶ Ch Adnan Ali	30° 49' 42.7"	72° 04' 30.4"

Exhibit 4.3: Community Consultation Locations

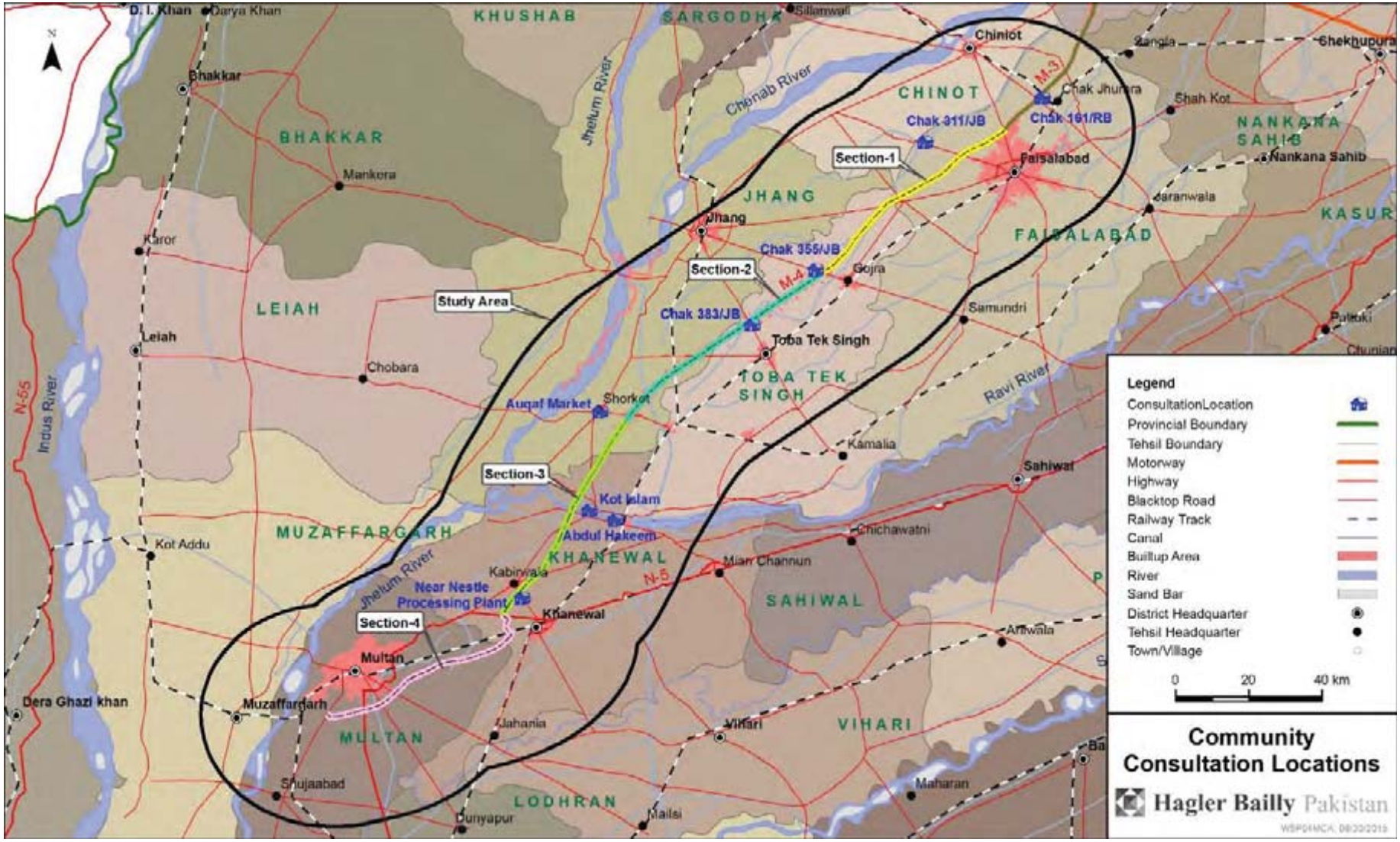


Exhibit 4.4: Summary of Discussions

Development Aspects	*Respondent Community*	*Summary of Concerns/Suggestion/Perceptions*
Development of M-3 Faisalabad Industrial Estate (FIE) in combination with location of M-3 and M-4 motorways	Residents of Chak 161/RB	The FIE is stretched over an area 4,500 acres with few textile and steel mills operating in it. For the development of FIE, the land was acquired from the residents of the village and other villages in its vicinity. The key respondents from the village reported that their land has badly suffered from water logging and salinity in the past leaving very few fertile stretches. This had adversely impacted their socioeconomic wellbeing due to reduction in agriculture yield and absence of any other permanent source of income. The development of FIE, which was located close to M-3 to connect it with motorway network in the country has brought opportunities for the community. Their infertile agriculture land has been purchased at a reasonable rate and the residents hope that the development of industries in the area will provide both skilled and unskilled jobs to the villages located in the vicinity of the FIE. The residents appreciated the developments in the area and did not share any concerns related to the development of either motorway network or the FIE in their neighborhood.
Location of Aminpur interchange at a distance of 15 km to the west of the settlement on Section–1 of M-4	Chak 31/JB	The location of the settlement is vital as it connects to three districts (Faisalabad, Chiniot and Jhang) via road and is located on the route from where traffic from Faisalabad diverts to either Chiniot or Jhang (**Exhibit 3.3**). The respondents shared positive views related to the location of the interchange identifying it as an important development to route the traffic to Jhang and Multan. The construction of Section–1 has not positively or negatively affected the settlement, however, the residents perceived that the further extension of M-4 to reach Multan will divert traffic coming from Sialkot, reaching Chiniot and heading to Multan passing through their main bazar. This will provide new business opportunities to them, facilitate the transportation of their agricultural produce to both Sialkot and Multan, and will positively impact the socioeconomic conditions of the area. The key informants also reported safety issues related to the increase in traffic flow. In addition, the consulted females did not report any concerns or offer suggestions related to the development of M-4 motorway.

Development Aspects	*Respondent Community*	*Summary of Concerns/Suggestion/Perceptions*
Location of Gojra interchange located approximately 4 km to the east of the village (junction of Section–1 and Section–2 of M-4)	Chak 355/JB	The community reported concerns related to the induced developments triggered by the location of interchange and RoW of M-4. The key informants reported that development of Section–2 and Section–3 of M-4 will increase the traffic influx in the area diverting traffic from existing Jhan–Multan road to M-4 compromising their living conditions, safety and increased noise levels. The respondents also reported access issues across the alignment of M-4 noting that the passageways are provided at an approximate distance of 5 to 6 km from each causing difficulties for the locals. As local transport is not available and individual transport such as motorbikes and cars are owned by a very small number of people, the residents have to walk through this distance to cross the M-4 from the provided passageway.
Passage of RoW of section–2 of M-4 from the agriculture fields of the village	Chak 383/JB	The agriculture land acquired for the passage of motorway was the only source of income for the villagers. The land holdings have been divided at various locations and in some cases very little land is left on the opposite side of the RoW. The key respondents reported the compensation paid for the acquired land as insignificant to compensate for their loss and told that farmers should have been compensated with land for land. The females of the community reported safety issues due to expected increase in traffic on Toba–Jhang road. In addition they reported concerns related to increased noise levels especially at night.
The impact of development and location of M-4 on the existing traffic and welfare and well-being of the communities located in its nearby vicinity	Kot Islam	Currently both heavy and light traffic uses Shorkot–Khanewal road to reach Multan (**Exhibit 5.3**). The development of M-4 will result in diversion of this traffic to M-4 improving the road safety for the residents. The respondents reported several incidents of fatal accidents near the settlement of Islam Kot.
Location of proposed Abdul Hakeem interchange at a distance of approximately 12 km to the west of M-4	Abdul Hakeem	The respondents from the community did not raise any concern related to the development of interchange or the passage of RoW through their agriculture fields. The community, overall appreciated the development of M-4 identifying it as a major breakthrough in the road infrastructure of the country facilitating transportation of both goods and passengers from northern to the southern part of the country.

Development Aspects	*Respondent Community*	*Summary of Concerns/Suggestion/Perceptions*
Route of M-4	Scattered settlements near Nestle Processing Plant and poultry feed mill, Khanewal	The community was consulted to identify the importance of roads, especially motorway in the development of industries in the area. Main sources of livelihood were employment in the industries, working as a daily wage labor in the agricultural fields, and running small scale dairy business supplying milk to the Nestle plant. The respondents recognized M-4 as a major development in the country which will trigger industrial growth along its alignment due to easy transportation of raw material to the industry and efficient delivery of finished goods to the markets.

Exhibit 4.5: Identified VECs and their Current Status

VECs	*Key Component*	*Status*
Physical environment	Air	The area adjacent to the M-4 is mostly rural with very few industrial units. Currently the air quality in the vicinity of M-4 route is therefore not compromised
	Noise	Noise levels near major road crossing on the M-4 are expected to increase due to increase in traffic on the roads connecting to M-4. Disturbance due to increased noise levels can be an issue.
Social conditions	Livelihood	Livelihood in the area is associated with agricultural land. Alternate sources of livelihood are very limited. M-4 and its expected induced developments may increase employment opportunities for the population in the Study Area.
	Access	A few respondents reported access issues across the RoW.

4.3 Summary of Consultations with Institutional Stakeholders

Consultations with institutional stakeholder were conducted in cities of Lahore, Multan and Faisalabad with government, semi-government and private institutions to identify their future plans to develop industries, and industrial estates or parks along the alignment of the M-4 motorway.

Presently Faisalabad industrial Estate (FIE) is the only major industrial development in the Study Area. FIE covers an area of 4,500 acres, with long term plans to extend it to 10,000 acres by 2020. The categories of planned industrial units with number of industries in each category provided in **Exhibit 4.6**.

Exhibit 4.6: Category and Number of Planned Industrial Units in Phase I of FIE

Type of Industry	*Number of Units*[21]
Textiles	35
Engineering/Construction	18
Chemicals	15
Electronics/Electrical	11
Pharmaceuticals	18
Food Processing	05
Ware Housing	08
Others[22]	07

In addition to the FIE, Punjab Small Industries Corporation (PSIC) identified few small scale industrial villages and artisan villages in District Faisalabad, Khanewal, and Tehsil Shorkot of District Jhang. Mr Khalid, Director Planning, PSIC said that development of M-4 will provide efficient, economic and convenient transportation for the finished products from these estates making them attractive to small scale businessmen for investment.

[21] These number of units are based on the actual plots sold to the specific proponents by Faisalabad Industrial Estate Development and Management Company.

[22] The others include a 110 MW Coal Fired Power plant and other cottage industries.

The Multan General Bus and Truck Association recognized M-4 as an important business opportunity for their members to transport goods and passengers to the northern part of the Pakistan at a lower cost and in less time.

The logs of the institutional stakeholder consultations are attached as **Appendix B**. Photographs of both community and institutional stakeholders are provided in **Exhibit 4.7**.

Exhibit 4.7: Photographs of Stakeholder Consultations

Consultation with Punjab Highway Department

Consultation with Secretary General Bus and Truck Stand, Multan

Consultation with President of Multan Chamber of Commerce and Industry

Consultation in Chak 161/RB

Consultation with Women in Chak 31/JB

Consultation with Women in Chak 383/JB

5. Reasonably Foreseeable Developments

Consultations with institutional stakeholders (**Section 4**) indicate that other than the continuing growth and expansion of the cities in the vicinity of M-4 such as Faisalabad, Multan, Gojra, and Jhang, there are no plans for additional developments such as industrial zones and housing schemes that can considered to be triggered by M-4 Motorway. The Faisalabad Industrial Estate located to the south of M-3 Motorway near Shaianwala interchange, at an approximate geodesic distance of 10 km from the Faisalabad city (**Exhibit 1.1**) launched in 2004 is the only major existing development that will benefit from and is likely to add to the impacts of the M-4 Motorway.

5.1 Faisalabad Industrial Estate

M-3 Faisalabad Industrial Estate (FIE) aims to promote industrial development in the country. To manage the development of FIE, Faisalabad Industrial Estate Development and Management Company (FIEDMC) was established under Section 42 of the Companies Ordinance, 1984, on the basis of Public Private Partnership to achieve orderly, planned and rapid industrialization of the launched Estate[23]. FIEDMC is actively engaged in developing FIE as a modern industrial city, spread over an area of 4,500 acres (1,821 hectares).

5.1.1 Objectives of FIEDMC

FIE is an EIA approved, socially compliant industrial estate with following objectives[24]:

- To provide world class infrastructure setting up large scale industrial units, SME's, warehouses and related commercial concerns to compete in the world.
- To reduce poverty through employment generation, provision of conducive work environment to the workers along with skill development.
- To promote exports in all fields of industry.
- To promote liaison between industry and the government.
- To bring Foreign Direct Investments (FDI) in Pakistan.

The FIE is divided into two phases; Phase I, stretched over an area of 1,565.95 acres, and Phase II comprised of 2,934.05 acres of land. The Phase I of the Estate is further divided into two sub-phases; Phase IA and IB. Phase I of the FIE is fully developed with state of the art infrastructure including roads, electricity and gas supply pipelines and sewerage network.

FIEDMC has undertaken two major projects of in economic interest of the country, which include:

[23] Planning and Development Department, “Punjab Industrial Sector Plan, 2018” Government of Punjab, Lahore, Pakistan, January, 2015.

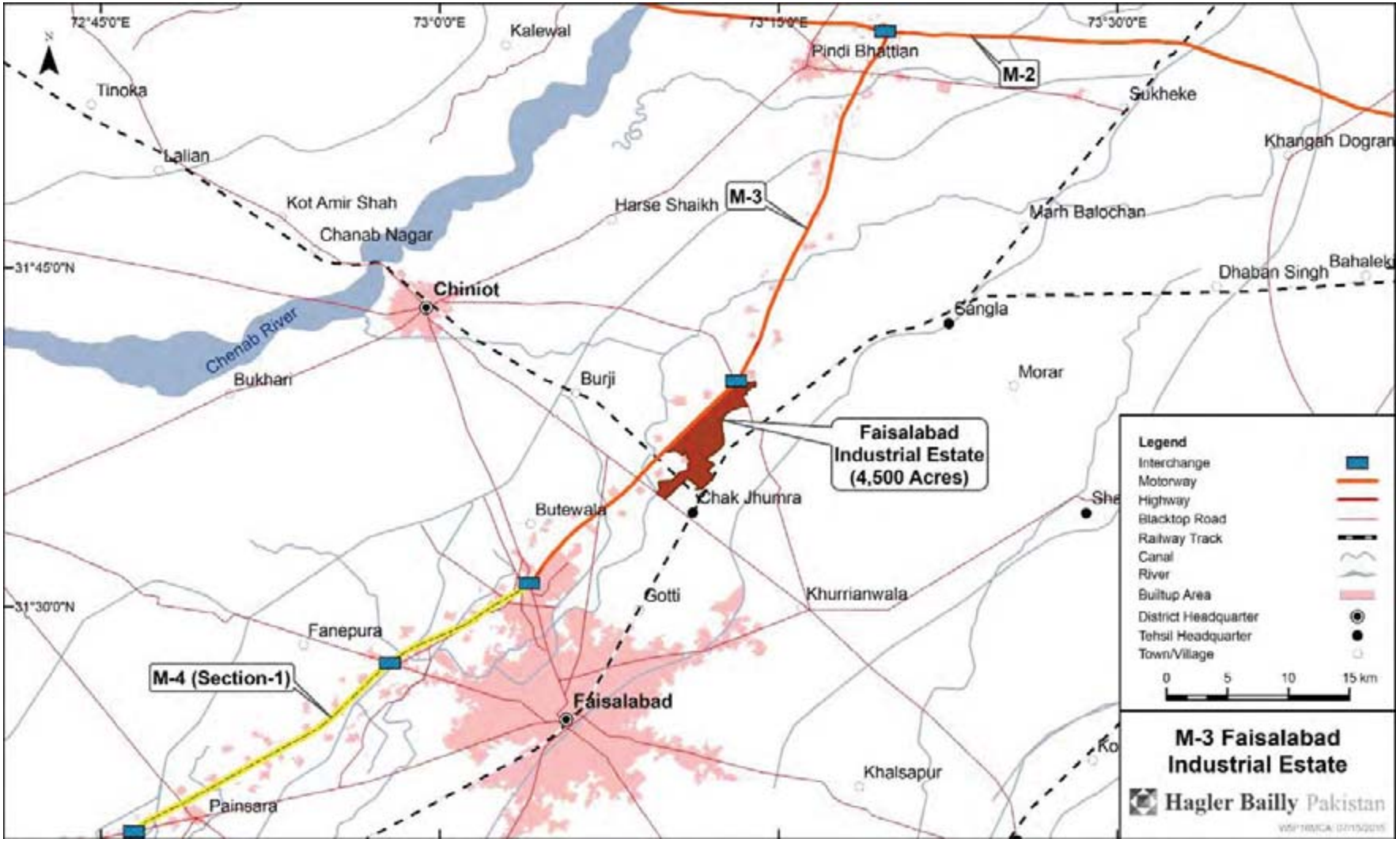
[24] The objectives of FIEDMC, as provided on its official website (www.fiedmc.com.pk), are rephrased here.

- Value Addition City (VAC); spread over an area of 215 acres within the Phase I of FIE. VAC is a fully functional city designed to cater the requirements of small and medium sized enterprises (SMEs).
- M–3 Industrial City; other than VAC, the rest of the FIE is known as M–3 Industrial City

To the date, land for 117 industrial units in Phase I, covering an area of 777 acres, have been purchased by various investors is provided in **Exhibit 4.6**[25] while the location of the FIE with reference to the alignment of M–3 is provided on a map in **Exhibit 5.1**.

[25] The list of the category of industry was shared by Iram Shahzadi, Assistant Manager Marketing, FIEDMC, Faisalabad during consultation meetings. For more details please see **Section 4** and **Appendix B** of this report**.**

Exhibit 5.1: Location of M–3 Faisalabad Industrial Estate



5.1.2 FIEDMC Policy to Facilitate Industrial Development

The processes for developing an industrial unit starting from acquisition of land to the provision of utilities are highly streamlined in the country. However, FIEDMC, through its policy reforms to achieve developmental goals, ensures substantial reduction in the time taken for firms to setup new businesses[26]. The number of days for FIEDMC to provide service to its investors is provided in **Exhibit 5.2**.

Exhibit 5.2: FIEDMC Fast Processing Time

Process	*Processing Time in FIEDMC (in days)*
Allotment of plot	1
Transfer of plot	3
Mortgage	1
Approval of maps	3
Provision of utility services	7

Such policy reforms to provide effective and efficient services along with provision of state of the art infrastructure has made FIE as a model industrial area in the country attracting investment of both local and foreign investors.

5.1.3 FIEDMC Future Developments

The proposed programs and projects to meet the FIEDMC growth targets to support economic growth in the country are provided in **Exhibit 5.3**, while FIEDMC timeline of actions to achieve these targets are provided in **Exhibit 5.4**[27]**.**

5.2 Motorway

For the purpose of this study the Section 3 of the M-4 is considered a reasonably foreseeable development.

[26] Planning and Development Department, “Punjab Industrial Sector Plan, 2018” Government of Punjab, Lahore, Pakistan, January, 2015

[27] Ibid

Exhibit 5.3: FIEDMC Proposed Projects/Developments

Project	*Size (in hectares)*	*Cost to Government (in Rs)*	*Funding*	*Commercial Activities*	*Expected Employment Generation*
Development of Faisalabad Ruyi Textile Park	202.34	None	Self-Finance. Foreign Investment of USD 1.0 billion	Development of vendor industry and supply chain with social compliances	35,000
Development of Vendor Industry with Ruyi, China	217	None	Government of Punjab and FIEDMC	Sheds shall be provided ready for installation of machinery thereby saving capital cost on purchase of land & construction of building	50,000
Development of Weaving City	40.5	2.5 Billion	Government of Punjab and FIEDMC	Common facilities such as wood seasoning & crafting plants, business incubation center etc.	80,000
Development of Furniture City	40.5	Unknown	FIEDMC and Trade Development Authority of Pakistan	Common facilities such as factory outlets, export product showcase, etc.	25,000
Development of FIEDMC Expo Center	20.23	500 Million	Government of Punjab (70%) and FIEDMC (30%)	Common high quality industrial infrastructure	
Development of Infrastructure Phase 1-B of M-3 Industrial City	202.34	800 Million	Government of Punjab	This common facility will reduce the cost of doing business	35,000
Development of Combined Effluent Treatment Plant (CETP)	28.32	3.0 Billion	Export Processing Zone Authority and FIEDMC	–	–
Establishment of FIEDMC Export Processing Zone / Special Economic Zone at M-3 Industrial City	80.94	Unknown	Government of Punjab and FIEDMC	–	20,000
Development of 110 MW Coal-Fired Power Plant	44.5	Unknown	Punjab Power Development Board and FIEDMC	Electricity production for the industries located within the FIE	Unknown

Exhibit 5.4: FIEDMC Timeline of Actions

Plan	*Timeline*
Foreign Direct Investment of US$ 1.0 billion: Development and Establishment of Faisalabad Ruyi Textile Park	2016
Foreign Direct Investment of US$ 1.0 billion: Development of Vendor Industry with Ruyi, China	2018
Establishment and Development of Weaving City	2017
Establishment and Development of Furniture City	2017
Establishment and Development of FIEDMC EXPO Center	2018
Development of Infrastructure Phase IB of M-3 Industrial City	2016
Establishment of FIEDMC Export Processing Zone	2018
Establishment and Development of Combined Effluent	2018

6. Environmental and Social Baseline of VECs

This section describes the existing biophysical environment of the Study Area.

The environmental baseline is developed with respect to various aspects of the environment such as physical, ecological and social components of the environment. The direct corridor of impact of the motorway lies in the immediate vicinity of its alignment, however, the cumulative and induced impacts may extend to the broader Study Area (see **Section 1.3**) for which consultations were conducted to identify the existing and reasonably foreseeable future developments around the Project (see **Section 3**).

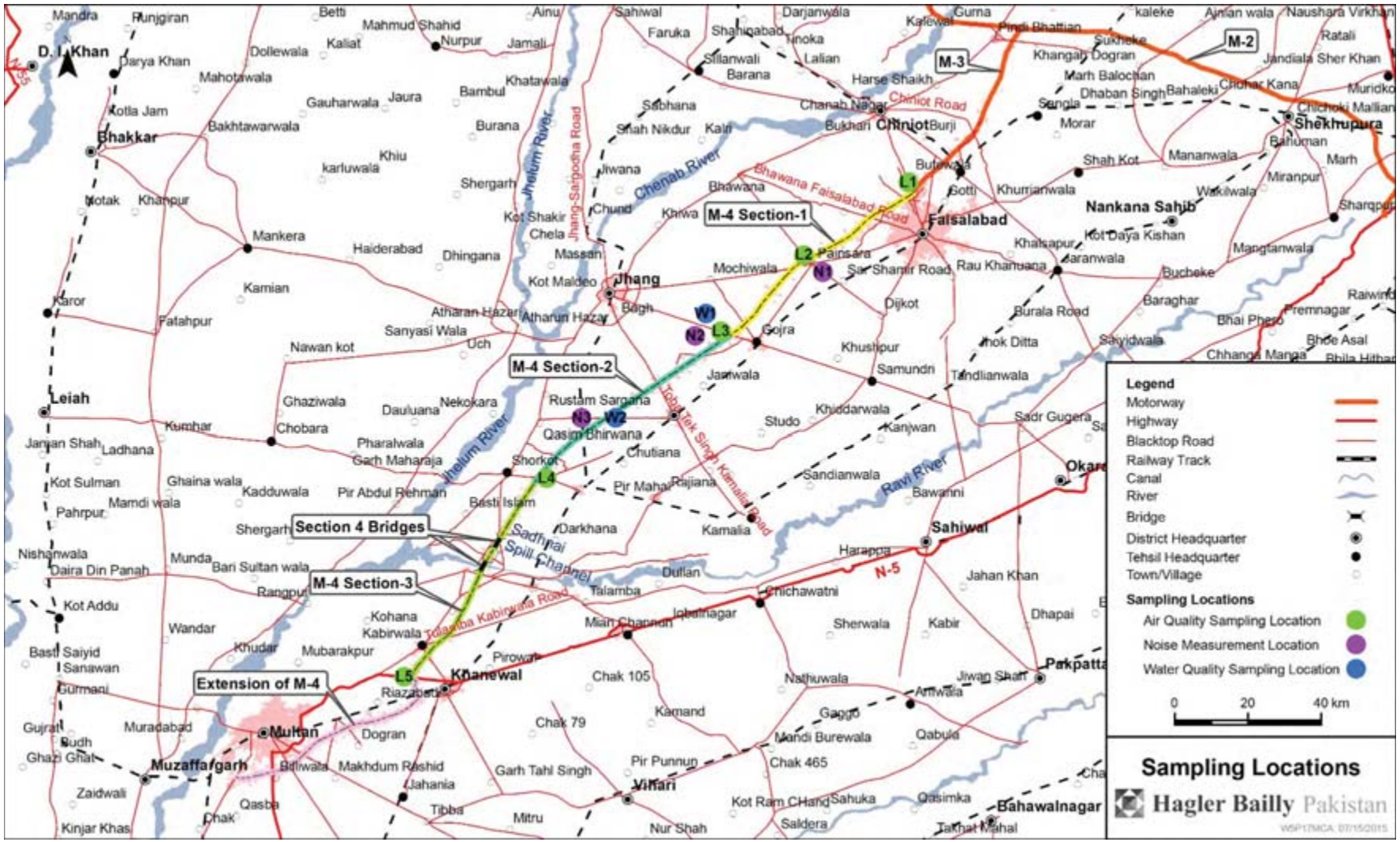
The discussion in this section covers the area's physical and biological resources, including air quality water resources, climate, vegetation and wildlife and demographic profile. These baselines are derived from the previous EIAs conducted by NHA and other literature providing information about the Project area.

6.1 Physical Environment

The M-4 starts from Faisalabad connecting to Multan with a total length of 184 km. The motorway crosses through the cities of Gojra in District Toba Tek Singh, Toba Tek Singh near chak 383/jb, Shorkot city in District Jhang, Khanewal city reaching Multan. The entire route of the M-4 is known for its agricultural produce comprising of wheat, oranges, sugarcane, rice and mangoes as the principle crops.

The map of the sampling locations where air noise and water quality were recorded during previous EIA(s) conducted in the area is provided as **Exhibit 6.1**.

Exhibit 6.1: Sampling Location of Air, Water and Noise Sampling Locations



6.1.1 Meteorology

The climate of the area areas from which the M-4 passes has two extremes – hot summer and mild winters. The summer season starts from April and continues till October. After that the temperature starts to fall with cooler nights. June and July are the hottest months in the year. The onset of winter is in November which continues till March. The coldest months are December, January and February.

The maximum and minimum temperatures in summer are 41 °C and 27 °C respectively and in winters 19 °C and 4 °C respectively[28].

The mean monthly temperature, precipitation and humidity data are provided in **Exhibit 6.2** (Faisalabad, Toba Tek Singh and Jhang) and **Exhibit 6.3** (Khanewal)[29].

Exhibit 6.2: Mean Climatic Data (Faisalabad, Toba Tek Singh, Jhang)

Month	*Monthly Temperature (°C)*		*Precipitation (mm)*	*Relative Humidity (%)*
	Maximum	*Minimum*		
January	19.4	4.1	11.5	66.0
February	21.9	7.1	20.1	61.2
March	26.7	12.3	25.7	58.2
April	33.5	18.0	16.9	46.5
May	38.4	22.7	16.1	37.5
June	41.5	31.8	27.9	41.7
July	40.1	32.4	115.0	61.5
August	38.1	26.6	89.8	65.9
September	35.7	23.7	28.6	59.9
October	33.0	17.1	3.8	54.7
November	27.2	10.3	3.0	62.7
December	21.4	5.1	8.6	66.5
Annual Average	**31.2**	**17.6**	**372.3**	**56.6**

The Project area has low rainfall. The bulk of monsoon precipitation occurs in July and August, with monthly averages of 115.0 mm and 89.8 mm respectively. Minimum rainfall occurs in the month of November which is 3.0 mm.

[28] Lamia Islam Khan, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway, (M-4)" Lahore School of Economic, Lahore, Pakistan, 2014.

[29] Mean climatic data is take from Environmental Impact Assessment Report of M-4 Motorway conducted by NHA in 2007 and updated in 2014.

Exhibit 6.3: Mean Climatic Data (Khanewal)

Month	*Monthly Temperature (°C)*		*Precipitation (mm)*	*Relative Humidity (%)*
	Maximum	*Minimum*		
January	21.0	4.5	7.2	62.3
February	23.2	7.6	9.5	56.4
March	28.5	13.4	19.5	51.6
April	35.5	19.5	12.2	40.1
May	40.4	26.4	3.7	33.2
June	43.7	30.6	12.3	39.9
July	41.1	28.0	61.3	56.0
August	38.6	24.9	32.6	59.7
September	37.2	18.2	10.6	56.3
October	34.6	10.9	1.6	51.6
November	28.5	5.5	2.4	51.4
December	22.5	17.8	6.9	66.6
Annual Average	**35.1**	**18.9**	**186.8**	**5.9**

6.1.2 Air Quality

The M-4 passes through the agricultural fields with no industrial developments along its alignment. The only industrial development found in the Study Area is the M-3 Faisalabad Industrial Estate (FIE) which is currently under development. Therefore, the industrial emissions were recorded to be minimal during the sampling carried out in previous EIA of M-4 conducted in 2007.

However, due to presence of traffic on various road junctions and highways leading to M-3 andM-4 motorways, and dry climate of the area (**see Exhibit 6.3** and **Exhibit 6.4**), the particulate matter in the Study Area is found to be high.

The average ambient air quality of the Study Area is provided in **Exhibit 6.4**[30].

Exhibit 6.4: Ambient Air Quality

Parameters	*Average Test Results*					*NEQS*[31] *for Ambient Air Quality*
	L1	*L2*	*L3*	*L4*	*L5*	
CO	1.20	0.33	0.70	0.48	1.40	5 mg/m^3 (8 hours)
NO_2	0.02	<0.01	0.02	0.01	0.02	40 µg/m^3 (annual)
SO_2	0.02	<0.01	0.01	0.01	0.01	80 µg/m^3 (annual)
PM_{10}	266.3	142.6	228.5	135.2	287.28	120 µg/m^3 (annual)

Location L1: Faisalabad-Sargodha Road, **Location L2**: Painsara-Bhawana Road, **Location L3**: Gojra-Jhang Road. **Location L4**: Shorkot Cantt Road, **Location L5**: Khanewal Multan Road

[30] **Exhibit 2.3** is taken form Environmental Impact Assessment of Faisalabad–Khanewal Motorway, (M-4) prepared by Lamia Islam Khan in 2014 as her MS Thesis.

[31] National Environmental Quality Standards, http://environment.gov.pk/NEQS/SRO-2010-NEQS%20Air-Water-Noise.pdf

Source: SGS Pakistan

6.1.3 Surface and Ground Water Quality

The M-4 Motorway crosses over the Ravi and the Chenab rivers. Irrigation canals including Jhang Branch Canal and canals emerging from Trimmu Head namely Trimmu Sidhnai Link Canal and Haveli Canal serve as the major water source for irrigation in District Jhang and Toba Tek Singh in which the Study Area is located.

The water for other uses and drinking purposes is mostly obtained from ground. Hand pumps and tube wells are installed in nearly every village in the Study Area serving as the major sources of groundwater for the residents.

The surface and ground water quality of the Study Area was sampled and analyzed as a part of the previous EIA prepared by NHA.[32] The results of the surface and ground water sampling and analysis that are representative of the Study Area are provided in **Exhibit 6.5** and **Exhibit 6.6**.

Exhibit 6.5: Results of Surface Water Sampling

Parameters	*Sampling Location*		*NEQS for Liquid Effluents into Inland Waters*
	Gojra–Jhang Road (W1)	*Toba–Warriam Road (W2)*	
pH (mg/L)	8.93	8.86	6 to 9
Biological Oxygen Demand (BOD)	9	12.5	$(BOD)^{5:}$ 80
Chemical Oxygen Demand (COD)	16	20	150
Total Suspended Solids (TSS)	31	45	200
Total Dissolved Solids (TDS)	150	170	3,500
Chloride (Cl) mg/L	9.9	9.7	1,000
Fluoride (Fl) mg/L	0.22	0.28	10
Dissolved Oxygen (DO)	4.5	5	–
Conductivity	293	288	–
Nitrates (NO_3) mg/L	4.2	4.3	–
Sodium (mg/L)	8	7	–
Total Alkalinity	110	125	–
Turbidity NTU	15	28	–
Hardness	140	150	–
Taste	Tasteless	Tasteless	–
Odor	Odorless	Odorless	–

[32] National Highway Authority, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway (M-4)" Asian Development Bank, Manila, Philippines, March 2007 (updated in 2014).

Parameters	*Sampling Location*		*NEQS for Liquid Effluents into Inland Waters*
	Gojra–Jhang Road (W1)	*Toba–Warriam Road (W2)*	
Color	Colorless	Colorless	–
Total Colony Count	TNTC[33]/ml	780/ml	–
Total Coliform	TNTC/100 ml	TNTC/100 ml	–
Faecal Colony	24/100 ml	3/100 ml	–
Faecal Streptococci/Enterococci	Absent/100 ml	Absent/100 ml	–

W represents the water sampling locations shown in **Exhibit 6.1**.

Exhibit 6.6: Results of Groundwater Sampling

Parameters	*Sampling Location*		*NEQS for Liquid Effluents into Inland Waters*
	Gojra–Jhang Road	*Toba–Warriam Road*	
pH (mg/L)	8.52	7.88	6 to 9
Total Dissolved Solids (TDS)	3,915	1,495	3,500
Chlorides (Cl) mg/L	825	489	1,000
Fluoride (Fl) mg/L	1.04	0.6	10
Nitrates (NO_3) mg/L	14	5.7	–
Sodium (mg/L)	1040	286	–
Arsenic (mg/L)	<0.01	<0.01	1.0
Total Colony Count	3510/ml	TNTC/ml	–
Total Coliform	TNTC/100 ml	53/100 ml	–
Faecal Colony	Absent100 ml	Absent/100 ml	–
Faecal Streptococci/Enterococci	Absent/100 ml	Absent/100 ml	–

The surface water in project area is good for agriculture and all the parameters are within the limits prescribed by NEQS. The concentration of Total Dissolved Solids (TDS), chlorides and sodium was high in groundwater along Gojra-Jhang Road which is indicative of mixing from the deeper aquifers which are saline in this area. Faecal coliform (E coli) was found in ground water.

6.1.4 Ambient Noise

With some exceptions near Faisalabad and Multan, the M-4 passes through an area which is predominantly agricultural (**Exhibit 1.1**). There are no major industrial, commercial or residential areas located near the RoW. To determine the existing noise levels, measurements were carried out at the different roads in the Study Area where noise levels

[33] Too Numerous To Count

were expected to be highest due to existing traffic. The results which are representative of the Study Area are provided in **Exhibit 6.7**[34].

Exhibit 6.7: Ambient Noise Levels

No	*Time*	*Measurement Locations*								
		Painsara–Bhawan Road (N1)			*Gojra–Jhang Road (N2)*			*Toba–Warriam Road (N3)*		
		LAeq	*LAmax*	*LAmin*	*LAeq*	*LAmax*	*LAmin*	*LAeq*	*LAmax*	*LAmin*
1	7:00 am	67.9	71.1	53.2	69.2	78.8	52.6	79.9	85.5	64.3
2	9:00 am	66.6	70.3	55.9	76.3	85.4	54.3	71.2	82.5	65.9
3	11:00 am	65.2	72.7	58.3	75.4	89.6	59.5	73.2	86.5	67.2
4	13:00 pm	65.8	72.9	58.1	75.1	94.2	63.3	76.3	91.5	64.7
5	15:00 pm	60.4	73.6	55.7	78.6	92.1	67.7	76.8	91.0	64.7
6	17:00 pm	62.3	71.4	49.6	74.7	86.9	62.1	76.6	91.4	64.3
7	19:00 pm	60.1	68.2	51.4	69.8	74.2	56.9	78.3	92.4	63.1
8	21:00 pm	59.7	69.2	48.9	70.1	84.3	59.8	71.6	84.8	64.3.

NEQS (for single vehicle): 85 dB (A) at 7.5 m from the road

NEQS (Day Time, 6 am to 10 pm): Residential: 55 dB (A) Leq, Commercial: 65 dB (A) Leq

NEQS (Night Time, 10pm to 6am): Residential: 45 dB (A) Leq, Commercial: 55 dB (A) Leq

WHO: 70 dB (A) Leq for industrial, commercial areas and traffic zones

Where Leq as per NEQS is time weighted average for the sound in decibels in scale A which is relatable to human hearing.

Source: SGS Pakistan

N represents the noise measurement location shown in **Exhibit 2.1**.

The results show that equivalent continuous noise levels (L_{Aeq}) fall well within NEQS. However, the ambient noise levels already exceed the prescribed WHO limits at measurement locations on Gojra–Jhang and Toba–Warriam roads.

6.1.5 Agriculture and Cropping Patterns

Agriculture in the Study Area is mainly supported by canal irrigation. Shortage of water occurs mostly in winter season due to decreased flow in the rivers that feed the irrigation canals. A list of major Rabbi and Kharif crops in the Study Area is provided in **Exhibit 6.8**[35].

[34] These ambient noise levels are based on secondary data obtained from the previous EIA study conducted for M–4 Motorway**. Reference:** Lamia Islam Khan, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway, (M-4)" Lahore School of Economic, Lahore, Pakistan, 2014.

[35] Lamia Islam Khan, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway, (M-4)" Lahore School of Economic, Lahore, Pakistan, 2014.

Exhibit 6.8: Major Crops of the Study Area

Tehsil	*Cropping Pattern*	
	Rabbi	*Kharif*
Gojra	Wheat and vegetables	Sugarcane, potato, cotton, fodder
Toba Tek Singh	Wheat and fodder	Sugarcane, cotton, fodder
Shorkot	Wheat and fodder	Sugarcane, cotton, rice

6.2 Ecological Resources

Most of the Study Area was originally covered by tropical thorn forest which was largely converted into agriculture area when the canal irrigation was introduced about a hundred years back. Some of the major ecological features of the Study Area are described in this section.

6.2.1 Crops and Trees

Major crops grown and cultivated in the districts of the Study Area vary seasonally. In winter season wheat and fodder are grown and during summer sugarcane, rice, cotton and maize are cultivated.

Citrus and guava orchards are common in the areas located along Section–1 and Section–2 of the M-4 while and mango orchards are common in Shorkot, Kabirwala and Khanewal areas. Tree plantations are found along the borders of agricultural fields and along the irrigation channels. Shisham (*Dalbergia sisso*) and Kikar (*Acacia nilotica*) are the main tree species. Other species growing in this area are Eucalyptus (*Eucalyptus camaidulensis*), Semul (*Bombax ceiba*), Bakin/Dharek (*Melia azerdarac*), Jaman (*Syzigium cumini*), Sukhchain (*Pongamia glabra*), Mulberry (*Morus alba*), Beri (*Zizipus mauritiana*) and Khajoor (*Phoenix dactilifera*). Roadside plantations include Shisham, Kikar, Farash (*Tamarlx aphylia*) and Eucalyptus. Bohr *(Ficus bengalnesis*), Neem (*Azadiraccta indica*), Beri and Bakain are commonly planted at the farms[36].

Natural vegetation includes Karir (*Capparis apnylla*), Aak (*Calotropis procera*), Kana (*Saccharum bengalensis*), Khabbal (*Cynodon dactylon*), Lamb (*Aristida depressa*), Gorkha (*Lasiurus sindicus*) which are present in graveyards or in the open area along the roads and also along some canals. Koondar (*Typha angustata*) grows along water ponds and wet places[37].

6.2.2 Mammals

Most of the mammals found in the Study Area are species that depend on agriculture and settlements for food. These include "Jackal (*Canis aureus*), Mongoose (*Herpestes janvanicus*), Jungle Cat (*Felis chaus*), Hedgehog (*Hemiechinus collaris*), and Five Stripped Palm Squirrel (*Funambulus pennantii*). Porcupine (*Hystrix indica*) also exists in the area. Small mammals including Indian Mole Rat (*Bandicota bengalensis*), Soft

[36] Lamia Islam Khan, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway, (M-4)" Lahore School of Economic, Lahore, Pakistan, 2014.

[37] Ibid

Furred Rat (*Millardia mettada*), Field Mouse (*Mus musculus*), Indian Gerbil (*Tatera indica*), and House Shrew (*Suncus marinus*) are the common pests of agriculture crops.

Domestic livestock includes buffalo, cattle, goats, sheep, and donkeys. Some farmers are also engaged in horse breeding[38]. Camels are found occasionally. Livestock is mainly farm fed.

6.2.3 Birds

The intensive use of pesticides in the Study Area has impacted bird population adversely[39]. Black and grey partridges (*Francolinus francolinus* and *F. pondicerianus*) are the most affected as they are also hunted and captured to be kept as pets. "Other bird species known to occur in this area are Cattle Egret (*Bubulcus ibis*), Pond Heron (*Ardeola grayii*), Myna (*Acridotheres tristis*) Red Vented Bulbul (*Pyaonotus cafer*), Jungle Babbler (*Tordoides striatus*), Bluth's Reed Warbler (*Acrocephalus dumetorum*), Indian Great Reed Warbler (*A. stentoreus*), Black Kite (*Mivus migrans*), Black Shouldered Kite (*Elanus caeruleus*), Koel (*Eudynamys scolopacea*), King Crow (*Dicrurus macrocersus*), Common Crow (*Corvus splendens*) and House Sparrow (*Passer domesticus*)[40]

6.2.4 Endangered Species

There are no floral or faunal species in the Study Area that are included in the Red Data Book of IUCN[41]. The populations of birds are reported to be declining over time due to pesticide sprays in agricultural crops. Population of Shisham tree is also reported to be declining mainly due to drought conditions[42].

Some of the pictures of the Study Area, taken during the consultation survey are provided in **Exhibit 6.9**.

Exhibit 6.9: Photographs of the Land Cover and Livestock in the Study Area

[38] Information is extracted from the Livestock Department, Punjab

[39] National Highway Authority, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway (M-4)" Asian Development Bank, Manila, Philippines, March 2007 (updated in 2014).

[40] National Highway Authority, "Environmental Impact Assessment of M-4, 2007, updated in 2014" Islamabad, 2014.

[41] Jean-Christophe Vié, Craig Hilton-Taylor, Caroline Pollock, James Ragle, Jane Smart, Simon Stuart and Rashila Tong, "The IUCN Red List: A Key Conservation Tool" International Union for the Conservation of Nature, Gland, Switzerland, 2008.

[42] Lamia Islam Khan, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway, (M-4)" Lahore School of Economic, Lahore, Pakistan, 2014.

Irrigation channel

Fodder fields

Mango Orchards

Thorny bushes

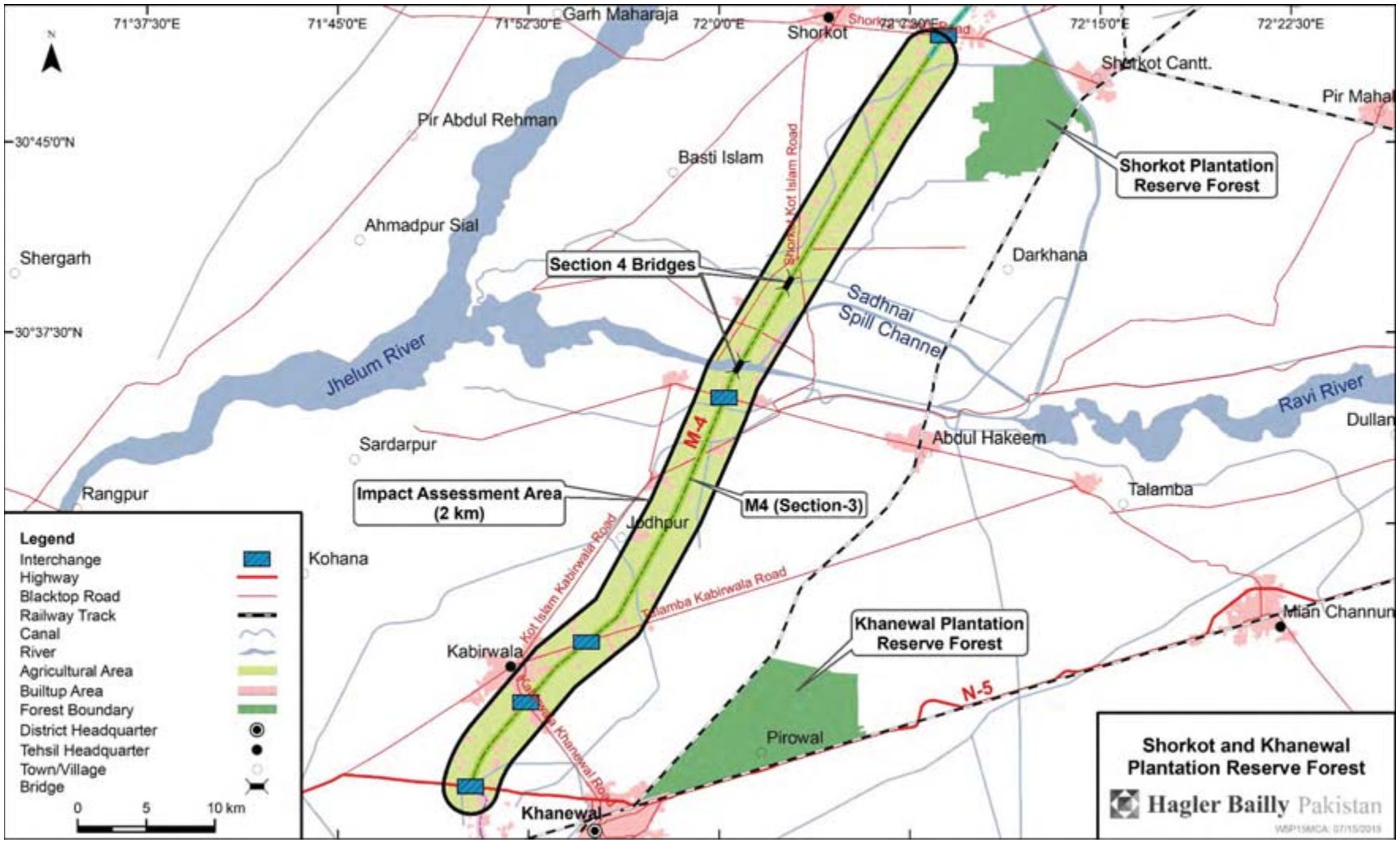
Orange orchards

Commonly found livestock

6.2.5 Sensitive Areas

Shorkot and Khanewal Irrigated Forest Plantations are the two protected forests located in the vicinity of the Study Area. Both these are located eight to ten kilometers away from the alignment of the M-4, to the east of Shorkot and Khanewal interchanges respectively. The locations of these interchanges are shown on a map provided in **Exhibit 6.10**.

Exhibit 6.10: Location of Plantation Reserve Forests



6.3 Demographic Profile

M-4 is located in rural area of Punjab. Most of the people living in the villages in the Study Area are dependent on agriculture for their livelihoods. *Punjabi* is the mother tongue in the area. In very few areas, near Khanewal and Kabirwala, *Siraiki* is also spoken. The dress pattern is same in all the areas with *Shalwar kameez* and *dhoti kurta* as common dresses of males and *Shalwar kameez for* females.

6.3.1 Demography

Faisalabad, Gojra, Toba Tek Singh, Shorkot, Kabirwala and Khanewal are the prominent cities located along the M-4 within the Study Area. M-4 will improve connectivity of these cities with each other, and with other major cities in the country.

Tehsil Gojra: This Tehsil[43] in District Toba Tek Singh had total population of 495,096 with growth rate of 1.94% as recorded in 1998 census. Population composition was 105 females as compared to 100 males. 24% of the population resided in urban areas and 76% lived in rural areas. Average house hold size was 7.2[44].

Tehsil Toba Tek Singh: Total population of this Tehsil was 617,035 with growth rate of 2.07% as recorded in 1998 census." "Population composition was 107 females as compared to 100 males. 10% of the population resided in urban areas and 90% lived in rural areas. Average house hold size was 5.2[45].

Tehsil Shorkot: Total population of this Tehsil was 670,255 with growth rate of 2.23% as recorded in 1998 census. Population composition was 108 females as compared to 100 males. 85% of the population resided in rural areas and just 15% lived in urban areas. Average house hold size was 6.9[46].

Kabirwala: This tehsil had population of 659,612 with growth rate of 2.19% as recorded in 1998 census. Population composition was 107 females as compared to 100 males. 15% of the population resided in urban areas and 85% lived in rural areas. Average house hold size was 7[47].

Khanewal: The current population of Khanewal is 2,376,000 with 52% males and 48% females. The estimated annual population growth rate is 2.4%. Life expectancy at birth is 61. years and adult literacy rate is 45%6 . Population density is 4767 persons per square kilometer. The percentage break-up of the rural and urban population is 82.5 and 17.55 respectively which shows that majority of the population lives in rural areas[48].

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[43] A Tehsil is an administrative subdivision of a District. A District may have three to five tehsils.

[44] National Highway Authority, "Environmental Impact Assessment of M-4, 2007, updated in 2014" Islamabad, 2014.

[45] Ibid

[46] Ibid

[47] Ibid

[48] Contech International Health Consultants and JSI Research and Training Institute, "District Health Profile Khanewal" United States Agency for International Development, 2005.

6.3.2 Settlement Pattern

The settlements pattern greatly varies in the Study Area (**Exhibit 1.1**). Faisalabad is the third largest city of Pakistan both in terms of population and GDP. District Headquarter Toba Tek Singh, Tehsil Shorkot and Kabirwala and District Khanewal are among the developed cities of the Study Area having established infrastructure with availability of amenities like health, education and communication infrastructure for their residents. These cities are systematically arranged into housing colonies and socities facilitated with paved road structures. The route of M-4 passes mostly through agricultural areas with rural settlements/villages located along the route.

7. Cumulative Impact on VECs

7.1 Noise Impact Assessment

Noise is defined as a loud, undesired sound that interferes with normal environmental and social activities. It is considered a nuisance if it affects the well-being of the surrounding community. Exposure to A–Weighted[49], Leq[50], also written as L_{Aeq} exceeding 85 dB(A) for a continuous period of 1 hour, can result in hearing impairments[51]. Other physiological disorders associated with increased noise levels include increased heart rates and neuro-physiological disorders.

Increased noise levels are also found to be the major cause of interference in regular communications (such as noisy workplaces and markets) reducing the understanding of conversations, sleep disturbances (particularly effecting the residents of the communities located in the immediate vicinity of airports, highways and industrial areas), impairing learning abilities of students in schools impacted by the noise due to their location in proximity to the noisy facilities and decline in work performance[52].

The impact of increased noise levels during operation of the M-4 Motorway is expected to impact the sensitive receptors located in the immediate vicinity of its alignment. The noise impacts will depend upon various factors such as traffic density on M-4, vehicle mix i.e. percentage of heavy transport vehicles (HTV) and light transport vehicles (LTV) on the road, the peak time of traffic flow and distance of the nearest community from the M-4.

7.1.1 Model Used and Limitations

Noise modeling was conducted for M-3 and all the sections of M-4, including its Extension. Rigolett Noise Model[53] based on JavaScript was used to model the traffic noise. The model incorporates traffic and geometry data of the subject segments of the roads to predict noise levels at variable distances. The L_{eq} and L_{dn}[54] associated with the traffic on the M-4 were modeled to predict the noise levels at various distances from the alignment of M-4. This model has the following limitations, which as explained below, are not material to the noise assessment carried out in this study.

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[49] A–Weighting is the most commonly used weighting scale, as it also predicts quite well the damage risk of the ear. Sound level measured with A-weighting scale filters out much of the low-frequency noise they measure, similar to the response of the human ear.

[50] Leq or LAeq is the sound pressure level in decibels (dB), equivalent to the total sound energy over a given period of time.

[51] Birgitta Berglund, Thomas Lindvall, Dietrich H Schwela, “Guidelines for Community Noise” World Health Organization, Geneva, Switzerland, 1999.

[52] Camp Dresser & McKee Inc, “14b. Health Impacts of Noise; Technical Report” Los Angeles World Airport, U.S Department of Transportation, Federal Aviation Administration, January, 2001.

[53] http://rigolett.home.xs4all.nl/, http://rigolett.home.xs4all.nl/ENGELS/vlgcalc.htm

[54] The A-weighted day-night equivalent sound level (Ldn) is defined as a continuous 24 hour Leq with 10 dBA added to all signals recorded between the hours of 10:00 pm. and 7:00 am (night time). The 10 dBA weighting accounts for the heightened noise sensitivity of people during night sleeping hours.

1. The model defines night time as 10 pm to 7 am, as opposed to 10 pm to 6 am in the NEQS (**Exhibit 6.7**). Traffic levels increase slightly in early morning, so the model will very slightly overstate the results for night time noise levels as the average is calculated in terms of Leq. The compliance assessment with respect to night time noise levels will therefore be slightly conservative.
2. Ldn provides the 24 hour Leq with 10 dBA added to all signals recorded between the hours of 10:00 pm. and 7:00 am. The model does not separately provide day time Leq. However, given an addition of 10 dBA in the night time noise levels, the Ldn will overstate the day time noise levels by 2 to 4 dB(A) as long as the difference between Ldn and Leq for night time is less than 10. The results of the modeling indicate that the day time noise limits are always met when the night time limits are complied with, which are far more stringent.

7.1.2 Configurations Modeled

Four configurations for which traffic was modeled[55] were assumed for the traffic noise assessment. The details of the network configurations selected for the modeling are provided below.

Network Configuration –1

This network configuration represents the situation before the opening of any of the M-4 Motorway. The traffic from M-2, in this case, can only reach Faisalabad (origin of M-4) through M-3. Thus, this configuration only provides traffic projection for M-3 Motorway. This configuration was not modeled as no section of M-4 is operational under this configuration.

Network Configuration –2

This network configuration represents the situation after the opening of the Faisalabad–Gojra (Section–1) and Khanewal–Multan (Extension of M-4)) sections of the M-4 Motorway. The Section–1 of the M-4 has been opened for the traffic in March 2015, while the construction of the Extension of M-4, reaching Multan from Khanewal is in its final stage and the motorway will be opened for the traffic within year 2015. Therefore, the traffic noise was modelled for the traffic projections of year 2015 only, considering that these two will be the only sections of M-4 turned operational this year.

Network Configuration –3

This network configuration represents the situation after the opening of the Section–2 of the M-4 (Gojra–Shorkot). The construction of this section is expected to commence in 2015 and opened for traffic in or before 2020.

NHA and ADB are currently in negotiations to finalize the implementation plan for the development of remaining sections of M-4. Therefore, it is also expected that

[55] J M Duggan Consulting, "M-4 Pakistan Traffic Model Forecasting Report – V2", Asian Development Bank, Manila, Philippines, July 15, 2015.

construction of Section–3 (Shorkot–Khanewal) of M-4 also starts along with construction of Section–2.

Accordingly, traffic projections of both Configuration –3 and Configuration –4 (described below) were modeled for year 2020 with M-3, Section–1, Extension of M-4 and Section–2 opened and for the whole M-4 opened for the traffic in 2020.

Network Configuration –4

This final configuration represents the fully connected and operational M-3 and M-4 motorways starting from Faisalabad reaching Multan. This configuration was modelled to note traffic noise on these motorways in year 2025. This configuration represents the noise levels associated with the maximum projected traffic in 2025 on these motorways.

The tabular representation providing details of the modelled options in 2015, 2020 and 2025 is summarized in **Exhibit 7.1**.

Exhibit 7.1: Modeled Network Configurations

Year	*Noise Modeling Conducted For*	*Operating Sections of Motorways*
2015	Configuration –2	M-3, Section–1 and Extension of M-4
2020	Configuration –3,	M-3, Section–1, Extension of M-4 and Section–2
2020	Configuration –4	Both M-3 and M-4 completely open
2025	Configuration –4	Both M-3 and M-4 fully opened

The traffic noise was modelled to calculate both L_{dn} and L_{eq} for night time for the projected traffic volumes. The modeling results and noise impact assessment are discussed below.

7.1.3 Modeling Assumptions

The M-3 and M-4 passes through agricultural land bordering both sides of the motorways throughout the length (53 and 184 km respectively). The area comprises of vast planes with no to minimum variation in topography. During the consultation survey conducted for CEIA study, it was noted that the area bordering the alignment of M-3 and M-4 is covered wheat, sugarcane and paddy fields interspaced with mango and orange orchards.

Considering the similarities in topography and land cover and consistent speed limits for LTV and HTV on M-3 and Section–1 of M-4, constant parameters were used in the software to define the geometry of the area and speed of the LTV and HTV. These are provided in **Exhibit 7.2**. The main window of the model is shown in **Exhibit 7.3**.

Exhibit 7.2: Modeling Parameters

Parameter	*Used Value*	*Explanation*
Speed of cars (km/h)	120	LTV speed limit on motorways in Pakistan (except Salt Range on M-2)
Speed of buses/trucks	110	HTV speed limit on motorways in Pakistan (except Salt Range on M-2)

Parameter	*Used Value*	*Explanation*
(km/h)		
Height of road (m)	4[56]	The M-3 runs at an elevation of 2 m from the ground level, whereas, M-4 is planned and constructed at elevations of 2 m in areas without provision of underpasses and 6 m in areas where underpasses are provided to facilitate access of locals across the alignment of the road. Therefore, average height of 4 m was used in the model.
Horizontal distance from the center of the road (m)	10 to 500	Variable distances were inserted to record the extent to which unbearable noise from the traffic could propagate.
Height of house or observer (m)	5 (as default)	There is no well-developed infrastructure located along the alignment of M-3 and M-4 motorways. However, very few farm houses were found to be scattered in some area during consultation survey. The height of the observer, thus could not be exactly determined. Consequently, default height of the observer from the software was used for noise modeling.
View angle (gradian[57])	127	For full view
Soil absorption by soil (absorption fraction)	0.4	This is estimated from the Random-Incidence Absorption and Scattering Coefficient of Vegetation Study[58]
Percentage of reflection of reflecting surface on the opposite side	0 (no surface)	Most of the area along the alignment of the M-3 and M-4 motorways is arable land. Therefore 'no surface' scenario was used for noise modeling
Distance of reflective surface on opposite side (m)	0	Due to absence of any reflecting surface
Height of reflecting object (m)	0	Same as above
Distance of intersection (m) for straight road	150	Intersections produce generally more noise than free flowing traffic. A value of "0" is interpreted as no intersection present, whereas distance over 150 m in the software does not calculate any effect of traffic on intersections. Valued between 0 and 150 calculated the effect of the intersections. For the traffic noise modeling of M-4, value of 150 was used

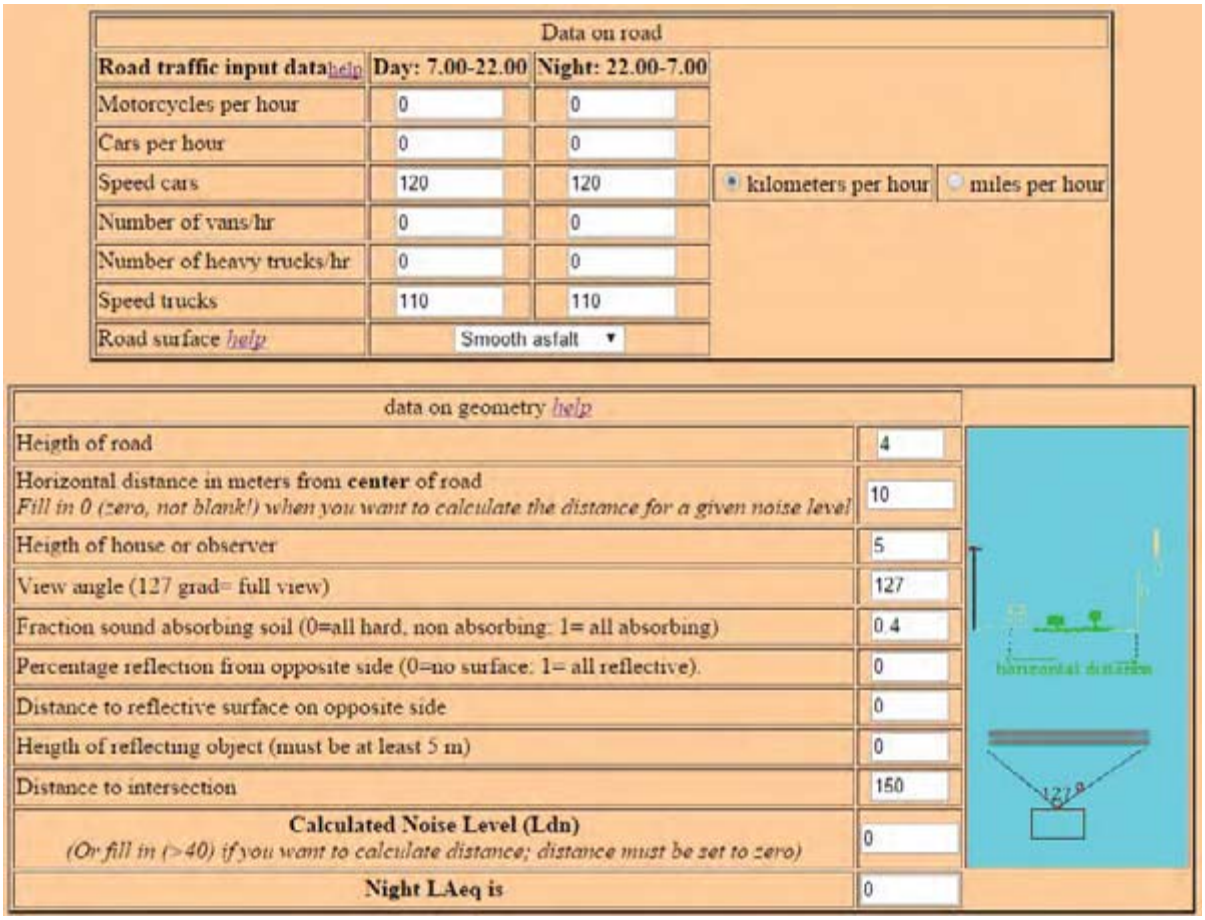
[56] M–4 will have 570 pipe and 105 box culverts in total. Out of these, the section II (Gojra–Shorkot) of M–4 will be constructed with 234 pipe and 49 box culverts. The average difference between any two culverts will be 250 m. Therefore average height of 4 m was used for noise modeling.

[57] The gradian is a unit of plane angle, equivalent to 1/400 of a turn. It is also known as gon, grad, or grade. One grad equals 9/10 of a degree or π/200 of a radian.

[58] Hong-Seok Yang, Jian Kang, Chris Cheal, "Random-Incidence Absorption and Scattering Coefficient of Vegetation" School of Architecture, University of Sheffield, Western Bank, Sheffield, United Kingdom, February 04, 2013. The study concludes an average fraction absorption value of 0.4 with moderate moisture content and vegetation.

Parameter	*Used Value*	*Explanation*
		as there are only 10 interchange (4 constructed) on the entire length of M-4 which is 184 km. The inclusion of distance between 0 and 150 from interchange was expected to provide a scenario dominated by the change in traffic patterns due to presence of interchanges. Therefore, to model the noise of the smooth flowing traffic on M-4, distance of 150 m was used to cancel the effects of intersection.
Distance of intersection (m) near intersection	50	To assess the impact of traffic noise near interchanges, distance of 50m was used to model the noise for network configuration option–4 for year 2020 and 2025 as these configuration provides the noise associated with the maximum possible traffic in 2025 with all the sections of M–4 operational.

Exhibit 7.3: Main Window of the Rigolett Noise Model



7.1.4 Results and Assessment of Noise Impacts

The noise modeling results for each modeled configuration are provided in **Exhibit 7.4** to **Exhibit 7.7**. The Leq represents the night time (10:00 pm to 7:00 am) noise levels, while Ldn provides the 24 hour Leq with 10 dBA added to all signals recorded between the hours of 10:00 pm. and 7:00 am. The traffic data for each modeled configuration is

attached as **Appendix D** of this report. The night time L_{eq} exceeding NEQS of 45 dB(A) are shaded as grey in these exhibits. A standard of 55 dB(A) L_{eq} was assumed for the 24 hour L_{dn} in view of addition of 10 dBA to the night time noise values for calculation of L_{dn}, and a limit of 45 dBA for night time NEQS. As Ld, the daytime Leq, is likely to be less than Ldn, this represents a conservative approach.

The graphical representation of the results for night time noise levels is provided in **Exhibit 7.8** to **Exhibit 7.12**.

Exhibit 7.4: Noise Modeling Results of Configuration–2 in 2015

Modeled Segment	*At 10 m from the edge of the Road*		*At 50 m from the edge of the Road*		*At 100 m from the edge of the Road*		*At 200 m from the edge of the Road*		*At 500 m from the edge of the Road*	
	Ldn 24 Hours	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*
M-3	70	63	62	55	58	51	54	46	47	39
Section–1 of M-4	69	62	61	54	57	50	52	45	46	38
Extension of M-4	68	61	60	52	56	48	51	44	44	37

Night Time NEQS for noise: 45dB(A) Leq, 24 Hour limit for noise: 55dB(A) Leq

Exhibit 7.5: Noise Modeling Results of Configuration–3 in 2020

Modeled Segment	*At 10 m from the edge of the Road*		*At 50 m from the edge of the Road*		*At 100 m from the edge of the Road*		*At 200 m from the edge of the Road*		*At 500 m from the edge of the Road*	
	Ldn 24 Hours	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*
M-3	72	64	64	56	59	52	55	47	48	41
Section–1 of M-4	72	64	63	56	59	52	55	47	48	40
Extension of M-4	67	60	59	52	55	47	50	43	43	36
Section–2 of M-4	71	64	63	55	59	51	54	47	47	40

Exhibit 7.6: Noise Modeling Results of Configuration–4 in 2020 (M-4 Fully Operational)

Modeled Segment	*At 10 m from the edge of the Road*		*At 50 m from the edge of the Road*		*At 100 m from the edge of the Road*		*At 200 m from the edge of the Road*		*At 500 m from the edge of the Road*	
	Ldn 24 Hours	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*
M-3	74	66	66	58	62	54	57	50	50	43
Section–1 of M-4	74	66	66	58	62	54	57	50	50	43
Extension of M-4	69	62	61	54	57	49	52	45	45	38
Section–2 of M-4	74	67	66	59	62	55	58	50	51	43
Section–3 of M-4	75	68	67	60	63	55	58	51	51	44
Section–3 of M-4 (near interchange)	77	69	69	61	65	57	60	53	53	46

Night Time NEQS for noise: 45 dB(A) Leq, 24 Hour limit for noise: 55dB(A) Leq

Exhibit 7.7: Noise Modeling Results of Configuration–4 in 2025 (M-4 Fully Operational)

Modeled Segment	*At 10 m from the edge of the Road*		*At 50 m from the edge of the Road*		*At 100 m from the edge of the Road*		*At 200 m from the edge of the Road*		*At 500 m from the edge of the Road*	
	Ldn 24 Hours	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*	*Ldn 24 Hours*	*Leq Night Time*
M-3	75	68	67	60	63	55	58	51	52	44
Section–1 of M-4	75	68	67	60	63	56	59	51	52	44
Extension of M-4	71	64	63	56	59	52	55	47	48	40
Section–2 of M-4	76	68	68	60	64	56	59	52	52	45
Section–3 of M-4	77	69	69	61	65	57	60	53	53	46
Section–3 of M-4 (near interchange)	78	71	70	63	66	59	62	54	55	47

Night time NEQS for noise: 45dB(A) Leq, 24 Hour limit for noise: 55dB(A) Leq

Exhibit 7.8: Calculated Night Time Noise Levels (Leq) for M–3

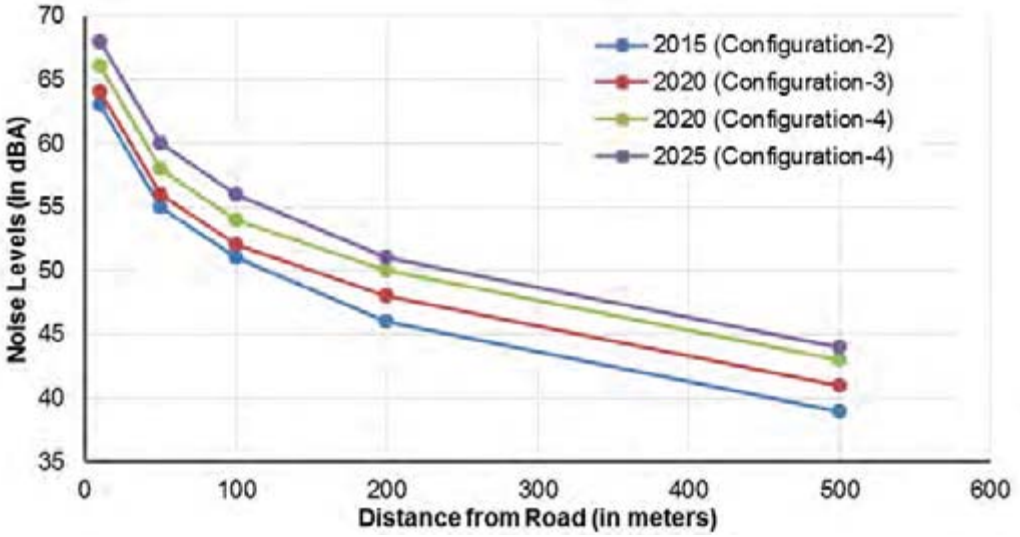


Exhibit 7.9: Calculated Night Time Noise Levels (Leq) for Section–1 of M–4

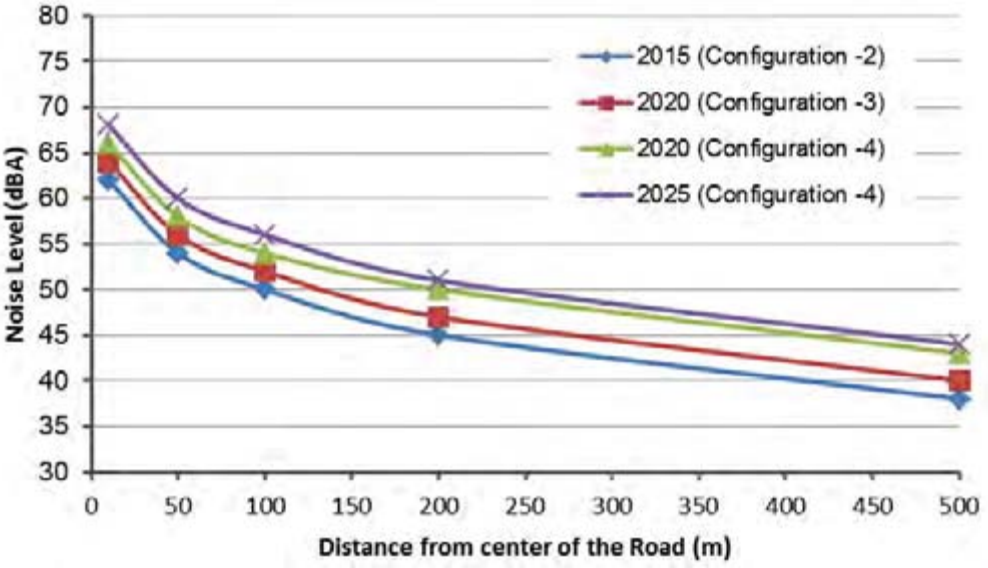


Exhibit 7.10: Calculated Night Time Noise Levels (Leq) for Extension of M–4

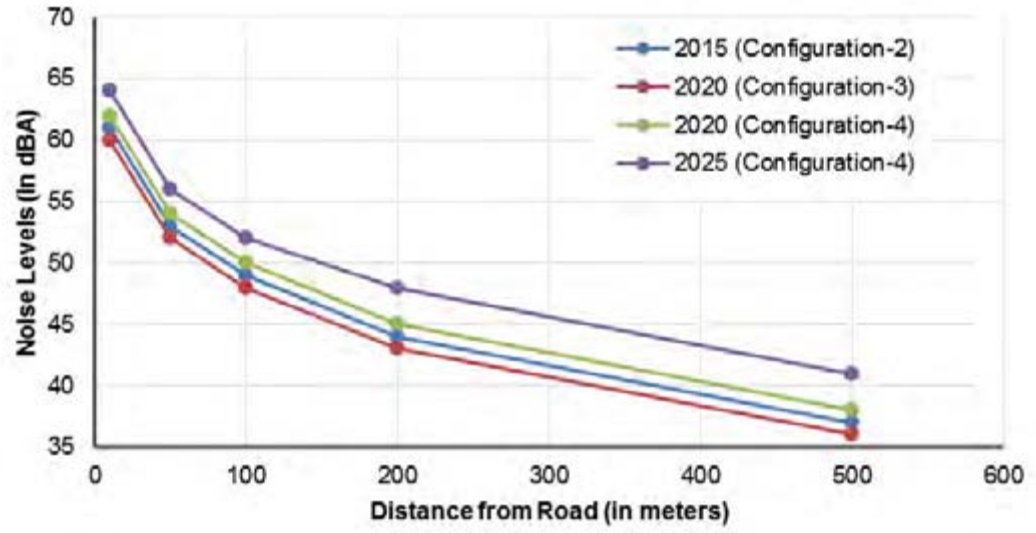


Exhibit 7.11: Calculated Night Time Noise Levels (Leq) for Section–2 of M–4

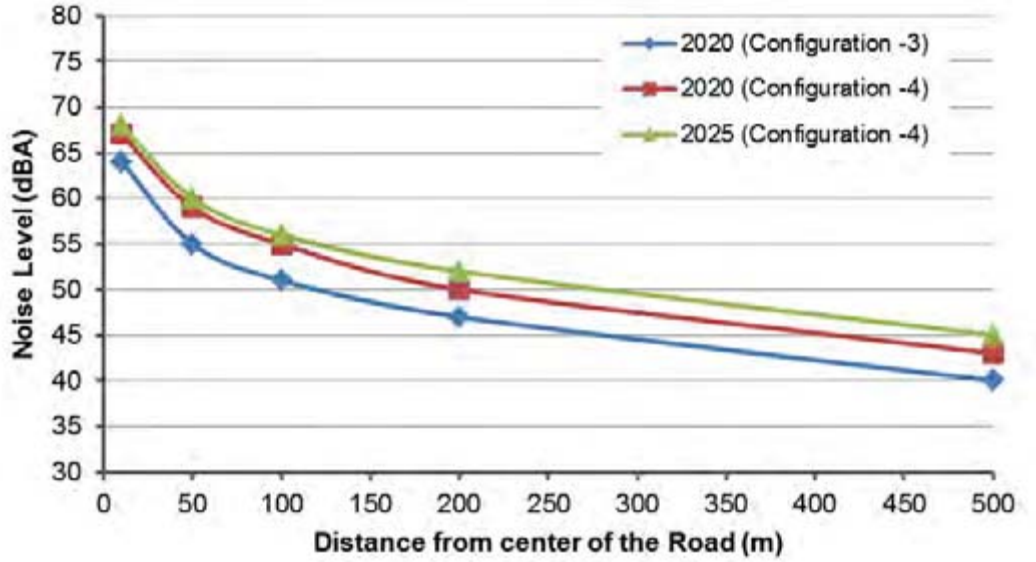
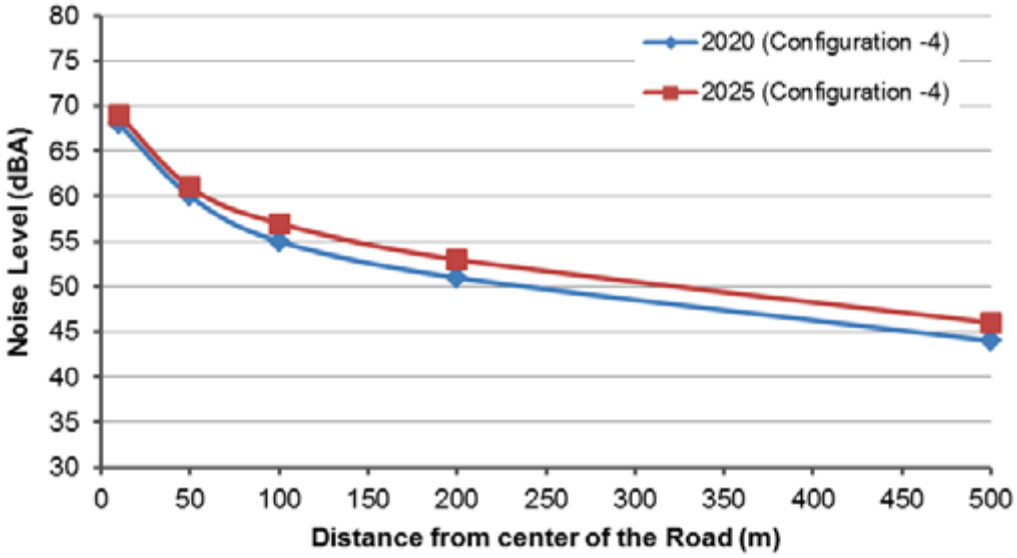


Exhibit 7.12: Calculated Night Time Noise Levels (Leq) for Section–3 of M–4



The noise modeling results show that:

Configuration–2 in 2015: M-3, Section–1 of M-4, Extension of M-4

The predicted night time noise levels associated with the projected traffic flows exceed NEQS in residential areas at a distance of 100 m from the motorways, and comply with NEQS at distance of 200 m an above with exception of a slight exceedence at M-3. The 24 hour noise levels when compared with the assumed standard of 55 dBA Leq also follow a similar pattern.

Configuration–3 in 2020: M-3, Section–1 and Section -2 of M-4, Extension of M-4

Night time noise levels comply with NEQS at a distance of 100 m and slightly exceed the standard at 200 m. The 24 hour noise levels when compared with the assumed standard of 55 dBA Leq also follow a similar pattern.

Configuration-4 in 2020 and 2025: M-4 Fully Operational

The night time noise levels associated with the projected flows with M-4 fully operational in 2020 and 2025 exceed NEQS at the distance of 200 m, but meet NEQS at a distance of 500 m from the motorway.

On the basis of the above, a noise impact zone of 500 m along the alignment of M-3 and M-4 motorways is marked. These noise impact zones (zone in which noise level exceeds night time NEQS of 45 dBA in residential areas) are shown on maps provided in **Exhibit 7.13** to **Exhibit 7.17**.

Exhibit 7.13: Noise Impact Zone for M-3

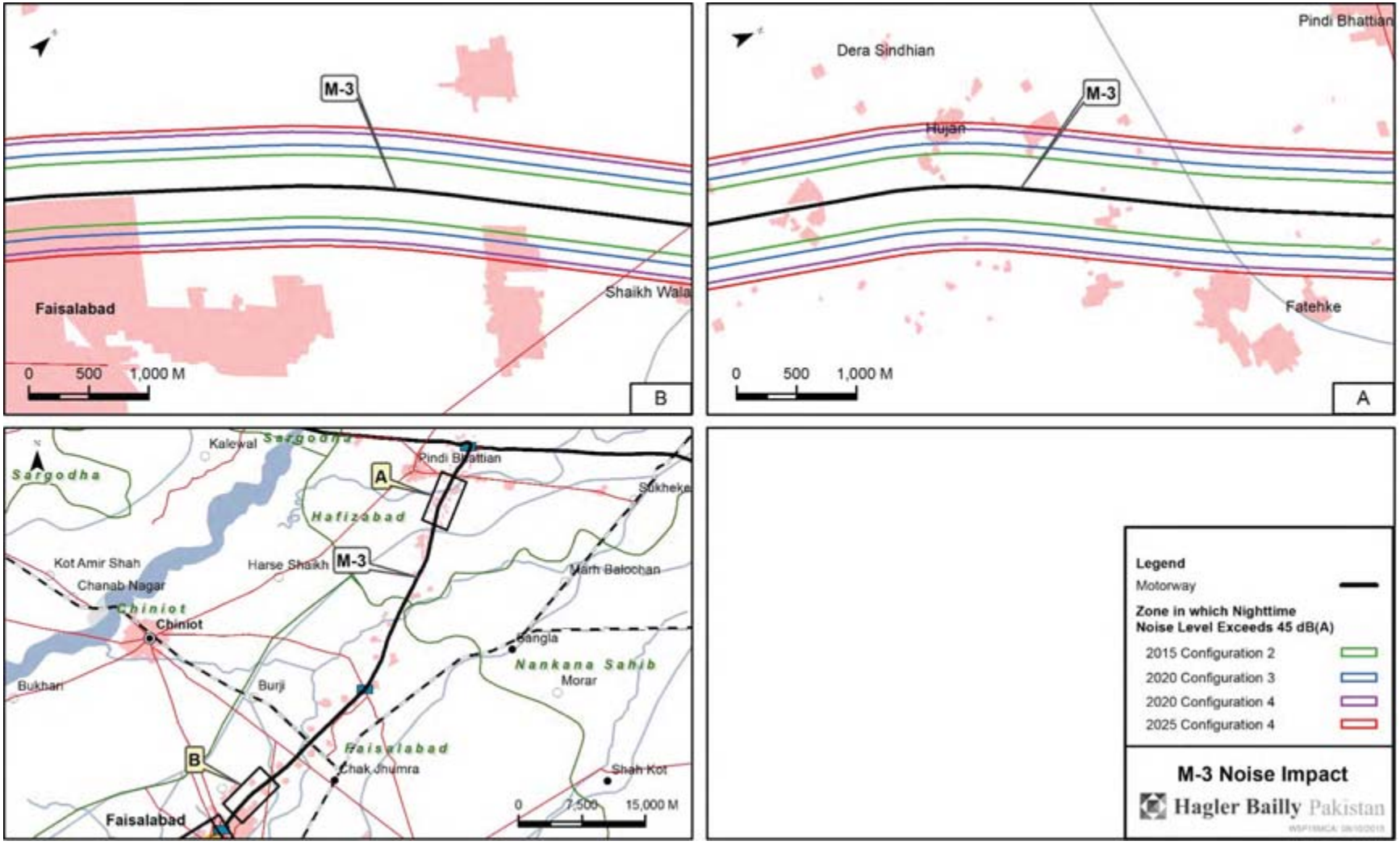


Exhibit 7.14: Noise Impact Zone for Section–1 of M-4

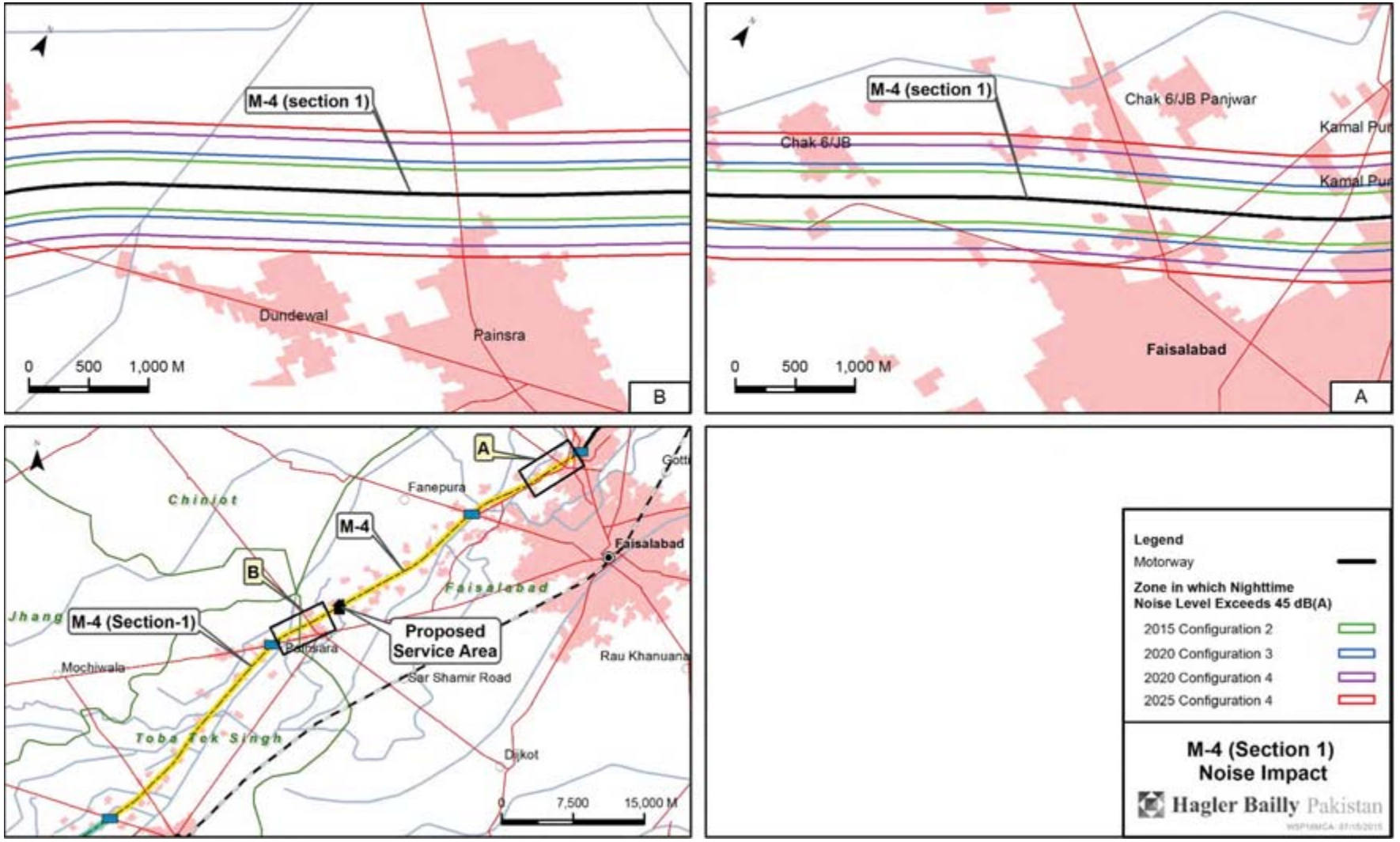


Exhibit 7.15: Noise Impact Zone for Section–2 of M-4

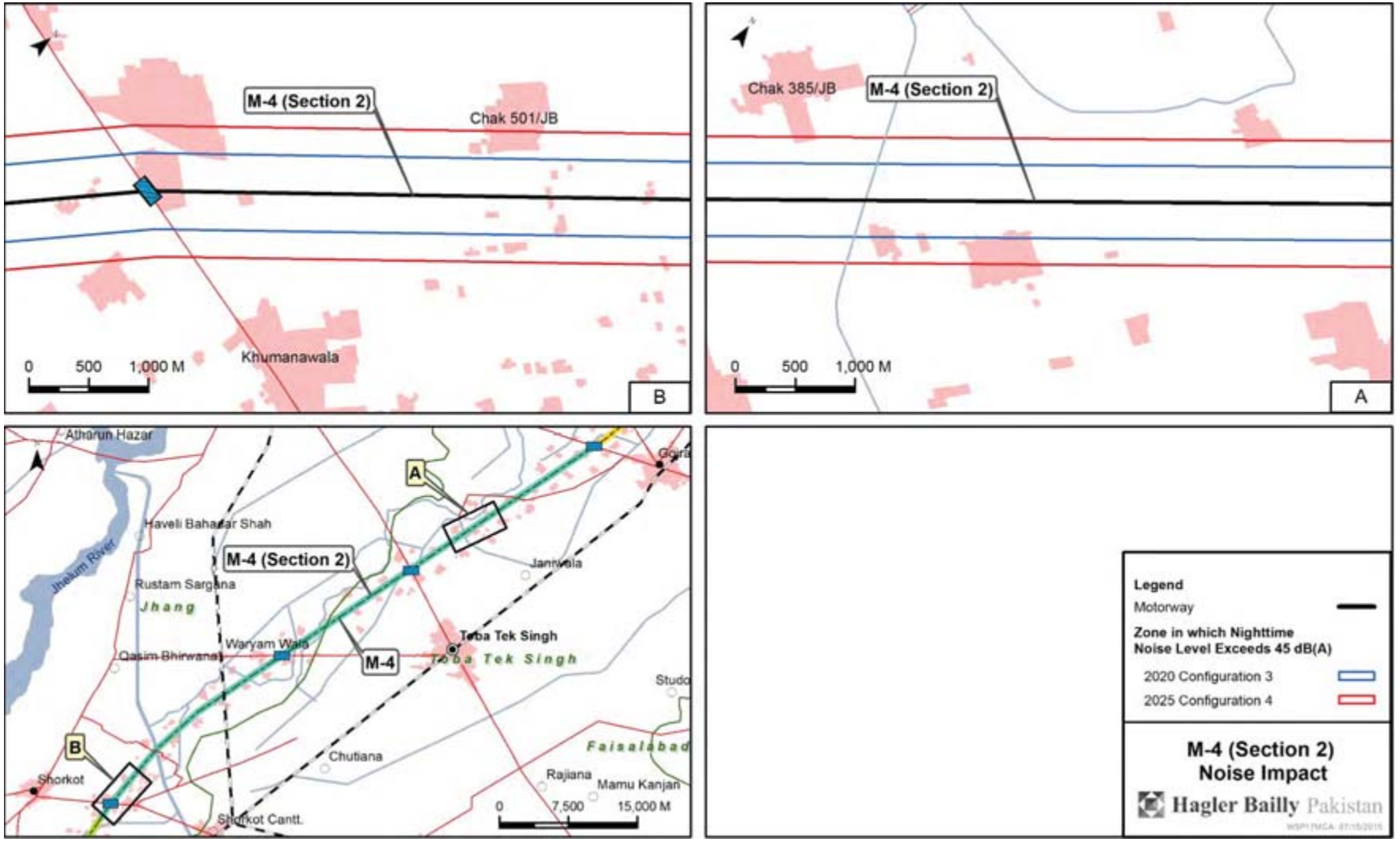


Exhibit 7.16: Noise Impact Zone for Section–3 of M-4

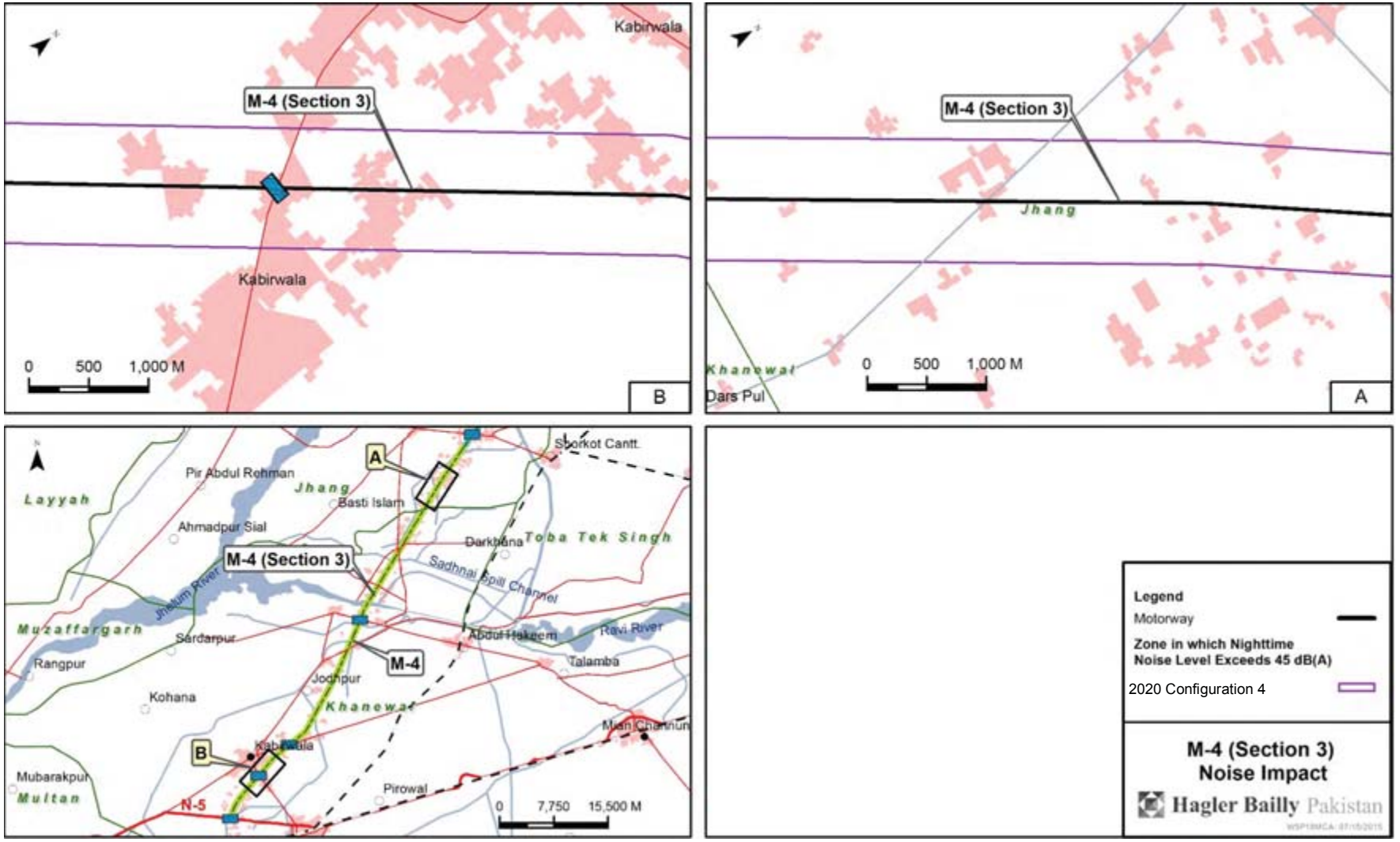
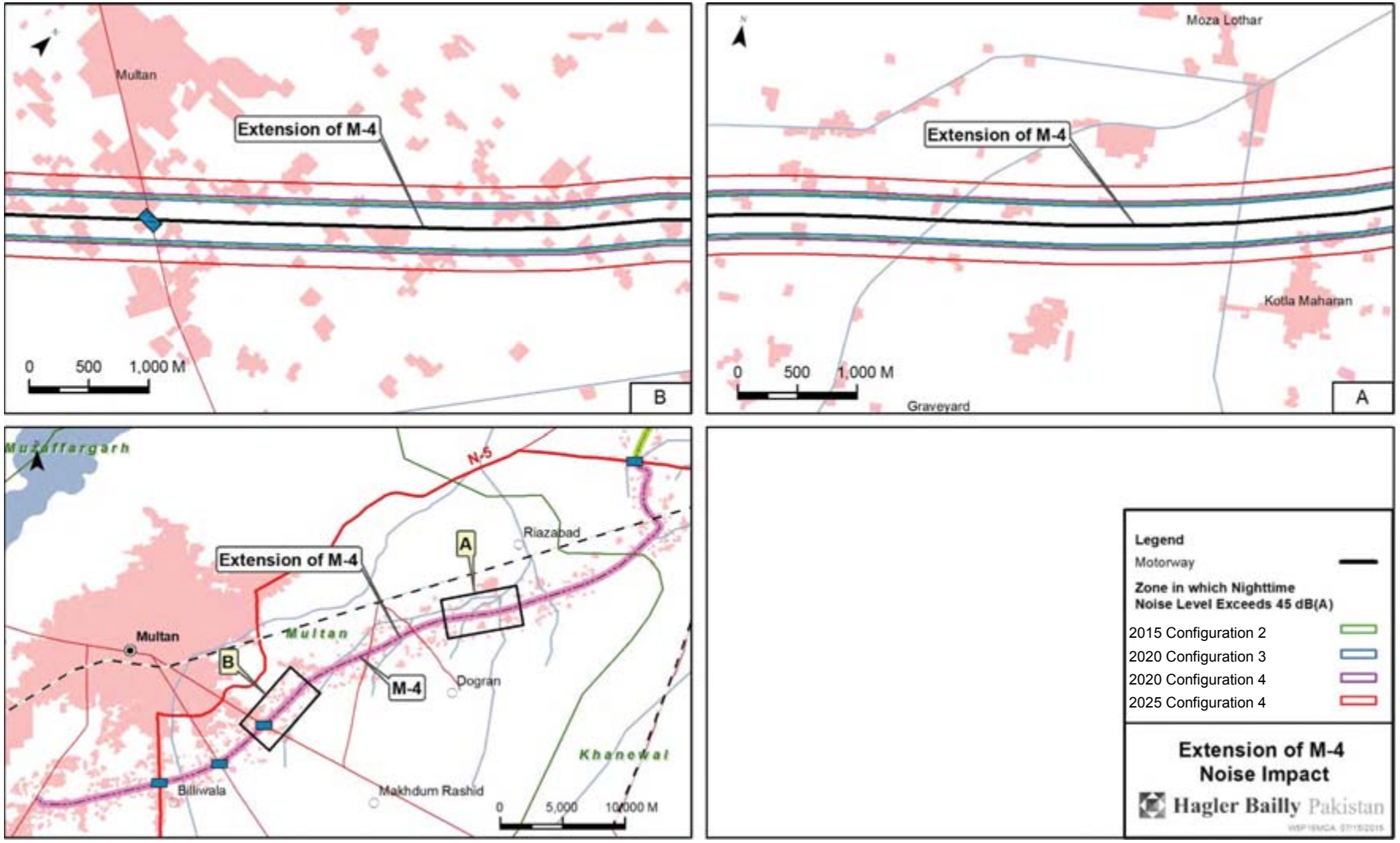


Exhibit 7.17: Noise Impact Zone for Extension of M-4



7.2 Air Quality Assessment

7.2.1 Baseline Air Quality

The air quality in the Project Area is mostly free from pollutants except dust on the roads where interchanges and flyovers are proposed. The M-4 passes through the agricultural fields with no industrial developments along its alignment. The only industrial development found in the Study Area is the M-3 Faisalabad Industrial Estate (FIE) which is currently under development. Therefore, the industrial emissions are expected to be minimal along the alignment of M-4.

The ambient air quality of the Study Area is provided in **Exhibit 7.18**[59].

Exhibit 7.18: Ambient Air Quality Sampling Results

Parameters	*Average Test Results*					*NEQS for Ambient Air Quality*
	L1	*L2*	*L3*	*L4*	*L5*	
CO	1.20	0.33	0.70	0.48	1.40	5 mg/m^3 (8 hours)
NO_2	0.02	<0.01	0.02	0.01	0.02	40 µg/m^3 (annual)
SO_2	0.02	<0.01	0.01	0.01	0.01	80 µg/m^3 (annual)
PM_{10}	266.3	142.6	228.5	135.2	287.28	120 µg/m^3 (annual)

Location L1: Faisalabad-Sargodha Road, **Location L2**: Painsara-Bhawana Road, **Location L3**: Gojra-Jhang Road. **Location L4**: Shorkot Cantt Road, **Location L5**: Khanewal Multan Road

Source: SGS Pakistan

The results show that the particulate matter (PM_{10}) of the Study Area is significantly high as compared to the NEQS. This is mainly due to the agricultural practices, unpaved roads and dry climate of the area (see **Section 1.1.2** for details on climate).

7.2.2 Meteorology

The climate of the area areas from which the M-4 passes has two extremes – hot summer and mild winters. The summer season starts from April and continues till October. After that the temperature starts to fall with cooler nights. June and July are the hottest months in the year. The onset of winter is in November which continues till March. The coldest months are December, January and February.

The maximum and minimum temperatures in summer are 41 °C and 27 °C respectively and in winters 19 °C and 4 °C respectively[60].

The mean monthly temperature, precipitation and humidity data are provided in **Exhibit 7.19** (Faisalabad, Toba Tek Singh and Jhang) and **Exhibit 7.20** (Khanewal)[61].

[59] Lamia Islam Khan, "Environmental Impact Assessment of M–4 Motorway", Lahore School of economics, Lahore, Pakistan, 2014.

[60] Lamia Islam Khan, "Environmental Impact Assessment of Faisalabad–Khanewal Motorway, (M-4)" Lahore School of Economic, Lahore, Pakistan, 2014.

[61] Mean climatic data is taken from Environmental Impact Assessment Report of M-4 Motorway conducted by NHA in 2007 and updated in 2014.

Exhibit 7.19: Mean Climatic Data (Faisalabad, Toba Tek Singh, Jhang)

Month	*Monthly Temperature (°C)*		*Precipitation (mm)*	*Relative Humidity (%)*
	Maximum	*Minimum*		
January	19.4	4.1	11.5	66.0
February	21.9	7.1	20.1	61.2
March	26.7	12.3	25.7	58.2
April	33.5	18.0	16.9	46.5
May	38.4	22.7	16.1	37.5
June	41.5	31.8	27.9	41.7
July	40.1	32.4	115.0	61.5
August	38.1	26.6	89.8	65.9
September	35.7	23.7	28.6	59.9
October	33.0	17.1	3.8	54.7
November	27.2	10.3	3.0	62.7
December	21.4	5.1	8.6	66.5
Annual Average	**31.2**	**17.6**	**372.3**	**56.6**

The Project area has low rainfall. The bulk of monsoon precipitation occurs in July and August, with monthly averages of 115.0 mm and 89.8 mm respectively. Minimum rainfall occurs in the month of November which is 3.0 mm.

Exhibit 7.20: Mean Climatic Data (Khanewal)

Month	*Monthly Temperature (°C)*		*Precipitation (mm)*	*Relative Humidity (%)*
	Maximum	*Minimum*		
January	21.0	4.5	7.2	62.3
February	23.2	7.6	9.5	56.4
March	28.5	13.4	19.5	51.6
April	35.5	19.5	12.2	40.1
May	40.4	26.4	3.7	33.2
June	43.7	30.6	12.3	39.9
July	41.1	28.0	61.3	56.0
August	38.6	24.9	32.6	59.7
September	37.2	18.2	10.6	56.3
October	34.6	10.9	1.6	51.6
November	28.5	5.5	2.4	51.4
December	22.5	17.8	6.9	66.6
Annual Average	**35.1**	**18.9**	**186.8**	**5.9**

7.2.3 Air Quality Modeling

The air quality of the Study Area was modeled to assess the cumulative impacts of increased traffic flow associated with the combined operations of M–3 and M–4 motorways.

Air Quality Assessment Study Area

The study area for the assessment of air quality is stretched to a buffer of 5 km on both sides of the road. The vehicular traffic of 5 road sections was used to assess the air quality impacts. These include M-3 Motorway and all sections of M-4 Motorway (see **Section 1** for details). These 5 sections of roads were further divided into 15 smaller segments, dividing the portions of the roads in straight lines to understand the behavior of dispersion of air emissions associated with the vehicles by using AERMOD.

AERMOD Modeling System

AERMOD provides predicted pollutant concentrations for hourly, daily, monthly, and yearly averaging periods, and complies with the USEPA's guidelines on air quality models. The model also accounts for varying wind speeds and directions (sectors), and has the ability to model seasonal or monthly variations in emissions characteristics. It is capable of taking into account building downwash, meteorological, and surface data in its calculations. While AERMOD does not have the built-in capacity to directly process this data, it is provided with three stand-alone pre-processors to do so: BPIPPRM for building downwash, AERMET for meteorological data, and AERMAP to calculate surface characteristics. The salient features of the model are described in **Exhibit 7.21**.

These pre-processors are discussed below;

AERMET

AERMET requires the user to input hourly surface observation data and twice-daily upper air sounding data. The program uses this data to develop the necessary boundary layer parameters for dispersion calculation by AERMOD.

AERMAP

The AERMAP's pre-processor processes terrain data and prepares a grid of receptors to be used in the AERMOD program. Since the terrain in the vicinity is not much elevated and considered as flat, so the AERMAP was not used.

BPIPPRM

The building profile input program for PRIME algorithm (BPIPPRM) requires the user to input the physical characteristics (height, length, width etc.) of buildings and stacks in the modeled area. The program then determines the emission plume disturbance due to building downwash but this pre-processor was not used as there was not disturbance from buildings.

Exhibit 7.21: Salient Features of AERMOD Air Dispersion Model

Model name	AERMOD Modeling System
Release date	On April 21, 2000, the USEPA proposed that AERMOD to be adopted as the EPA's preferred regulatory model for both simple and complex terrain.[62] On November 9, 2005, AERMOD was adopted by the EPA and promulgated as their preferred regulatory model, effective as of December 9, 2005.[63]
Current version	Version 13350
Model source	http://www.epa.gov/scram001/dispersion_prefrec.htm
Model type	Gaussian Plume Model Gaussian plume treatment in horizontal and vertical directions for stable atmospheres. Non-Gaussian treatment in vertical for unstable atmospheres
Type of Source	*Point* such as stacks (allows multiple stacks) *Area* such as villages *Volume* such as stock piles *Line* such as roads
Source locations	Urban or rural. Urban effects are scaled by population.
Plume deposition	Dry or wet deposition of particulates and/or gases
Terrain types	Simple or complex terrain Requires digital elevation model for complex terrain
Building effects	Includes algorithms for building downwash
Meteorological data	Requires minimum one-year (preferably 3-year) hourly meteorological data for the site or nearby weather station
Output options	Calculates averages for specified periods (for example, annual or monthly), maximum or given percentile during the specified period, and concentration at specific locations

7.2.4 Model Grid

A polar grid receptor network was used to simulate the model. The receptor locations were plotted in 36 radial directions; beginning with 10 degrees with commanded increment of 20 degrees in a clockwise fashion up to a radius of 145 km , with an interval of 5000 m. The origin for grid was taken at 247,800.00 E and 3,433,400.00 N in the UTM coordinate system.

7.2.5 Meteorological data

Hourly climatic data of Sahiwal weather station for the year 2013, located at a geodesic distance of 84 km from the air quality assessment study area was utilized for the air quality modeling. The data was used as both these areas share similar climatic conditions.

[62] Federal Register: April 21, 2000 (Volume 65, Number 78) Proposed Rule

[63] Federal Register: November 9, 2006 (Volume 70, Number 216) Final Rule

The key parameters included in the data are wind speed, wind direction, pressure, and temperature.

7.2.6 Traffic analysis

The daily number of vehicles going through the routes M-3 (Pindi Bhattian – Faisalabad), Section–I (Faisalabad – Gojra), Section–II (Gojra – Shorkot), Section–III (Shorkot – Khanewal) and Extension of M-4 (Khanewal – Multan) were calculated from the Traffic data provided by ADB[64]. Daily number of vehicles was calculated by dividing Average Daily Traffic in PCUby PCU factor[65] of each category of vehicle. PCU's factor used and the traffic count along each route is given in **Appendix C**.

7.2.7 Definition of Scenarios

The cumulative and environmental impact assessment was carried out by making five scenarios that consists of alternative options and years.

Scenario 1: Represents the whole M-3 Motorway, Section 1(Faisalabad – Gojra) and Section 4 (Khanewal – Multan) of Motorway M-4 for the year 2015 which is our present situation.

Scenario 2: Represents the whole M-3 Motorway, Section 1 (Faisalabad – Gojra), Section 4 (Khanewal – Multan) and Section 2 (Gojra – Shorkot) of Motorway M-4 for the year 2020 which is our forecasted situation. 50% of the area of Phase 1 of Faisalabad Industrial Estate and Management Company was also taken for assessing cumulative impacts of both the traffic and industries.

Scenario 3: Represents the whole M-3 Motorway, Section 1 (Faisalabad – Gojra), Section 4 (Khanewal – Multan) and Section 2 (Gojra – Shorkot) of Motorway M-4 for the year 2020 which is our forecasted situation. 50% of the area of Phase 1 of Faisalabad Industrial Estate and Management Company along with the proposed coal fired Power Plant was also taken for assessing cumulative impacts of the traffic, industries and power plant.

Scenario 4: Represents the whole M-3 Motorway, Section 1 (Faisalabad – Gojra), Section 4 (Khanewal – Multan) and Section 2 (Gojra – Shorkot) of Motorway M-4 for the year 2020 which is our forecasted situation. 75% of the area of Phase 1 and 25% area of Phase 2of Faisalabad Industrial Estate and Management Company along with the proposed coal fired Power Plant was also taken for assessing cumulative impacts of the traffic, industries and power plant.

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[64] J M Duggan Consulting, "M-4 Pakistan Traffic Model Forecasting Report – V2", Asian Development Bank, Manila, Philippines, July 15, 2015.

[65] PCU is the passenger car unit

7.2.8 Results

The worst case scenarios were modeled, counting traffic on M-3 and M-4 motorways and predicted industrial emissions, including proposed 110 MW coal-fired power plant in FIE. The cumulative impacts of these emissions were assessed for the sensitive receptors located along the alignment of these motorways.

The modeling results show that predicted concentrations of SO_2 and NO_X are within NEQS. The background concentration level of $PM_{2.5}$ is not available, therefore only incremental results are provided. The modeling results show that the concentration of $PM_{2.5}$ also falls within NEQS.

The air quality modeling results are provided in **Exhibit 7.22**[66], while graphical representation of these are provided in **Exhibit 7.23**.

Exhibit 7.24 to **Exhibit 7.47** provides the pollutant dispersion maps of only vehicular emissions to a distance of 5 km, on both sides, from the centerline of the motorways.

For this assessment, PM_{10} was not modeled. In the context of vehicular emission $PM_{2.5}$ is much more important than PM_{10}. For example, according to a World Bank technical paper,[67] "Nearly all PM emitted by motor vehicles consists of fine particles and a large portion of these fine particles has an aerodynamic diameter less than 1 micron." Similarly, Gillies (2001)[68] found that 74% of the emission is PM2.5. Thus the ambient PM10 concentration will be about 35% higher than the modeled PM2.5 concentration but still significantly less than the standards.

[66] The results in the **Exhibit 7.27** provides incremental and predicted concentration of pollutants in the Study Area. The incremental are the modeling results, while predicted results include combined concentration of incremental and background levels of pollutants. The background concentrations of SO_2 and NO_X are only available for 24 hours monitoring period.

[67] Vehicular Air Pollution: Experience from Seven Latin American Urban Centers, World Bank Technical Paper No 373, World Bank 1997

[68] Gillies, JA et al. On-Road Particulate Matter (PM2.5 and PM10) Emissions in the Sepulveda Tunnel, Los Angeles, California. Environ. Sci. Technol., 2001, 35 (6), pp 1054–1063. (http://pubs.acs.org/doi/abs/10.1021/es991320p?journalCode=esthag)

Exhibit 7.22: Air Quality Modeling Results

Pollutants	*Averaging time*	*Units*	*Background Concentration*	*Incremental Concentration*				*Predicted Concentration*				*NEQS*	*Comment*
				Scenario 1	*Scenario 2*	*Scenario 3*	*Scenario 4*	*Scenario 1*	*Scenario 2*	*Scenario 3*	*Scenario 4*		
SO_2	Annual Average - Max	$\mu g/m^3$		0.06	0.69	1.49	2.17					80	After adding background concentration of the NO_X and SO_2 to the incremental concentration due to roads, M–3 Industrial area and its Power Plant, the predicted concentration levels still comply with NEQS.
	24 hours - 98th percentile	$\mu g/m^3$	0.06	0.24	1.94	7.42	10.28	0.3	2	7.48	10.34	120	
NO_X	Annual Average - Max	$\mu g/m^3$		0.23	1.75	2.68	3.91					100	
	24 hours - 98th percentile	$\mu g/m^3$	0.08	1.2	6.69	13.79	17.21	1.28	6.77	13.87	17.29	140	
$PM_{2.5}$	Annual Average - Max	$\mu g/m^3$		0.07	0.26	0.51	0.74					15	
	24 hours - 98th percentile	$\mu g/m^3$		0.21	0.73	2.19	3.24					35	

Exhibit 7.23: Pollutant Concentration vs Scenarios

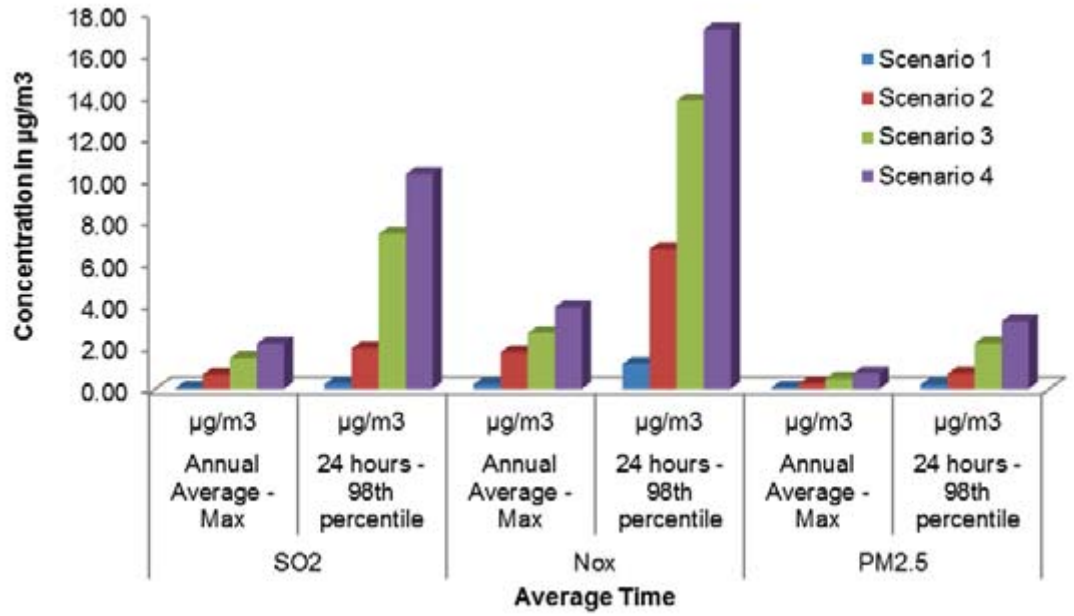


Exhibit 7.24: Predicted 24 Hours Increment in $PM_{2.5}$ in Scenario 1

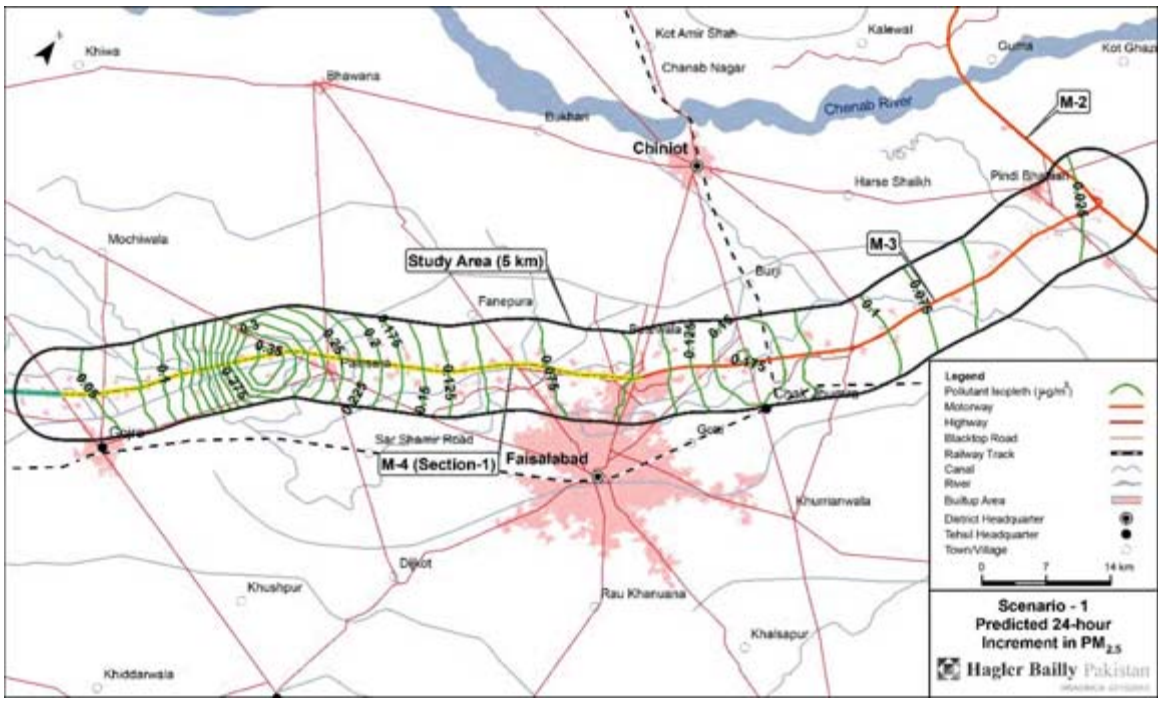


Exhibit 7.25: Predicted Annual Increment in $PM_{2.5}$ in Scenario 1

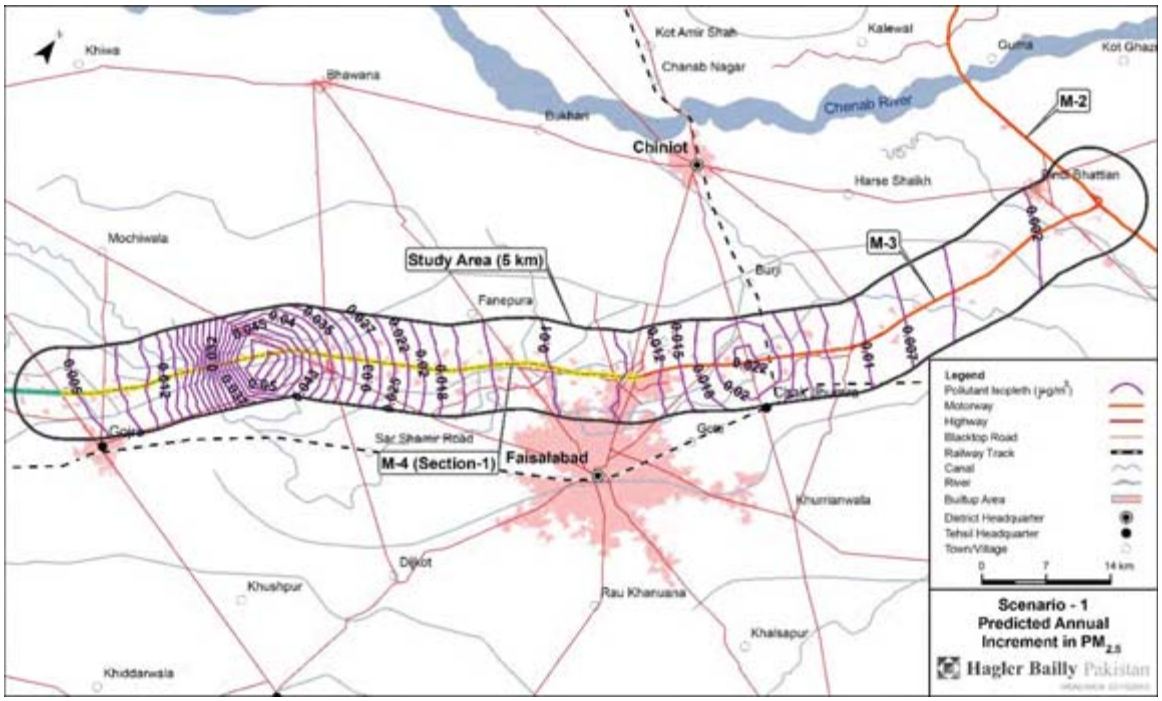


Exhibit 7.26: Predicted 24 Hours Increment in SO_2 in Scenario 1

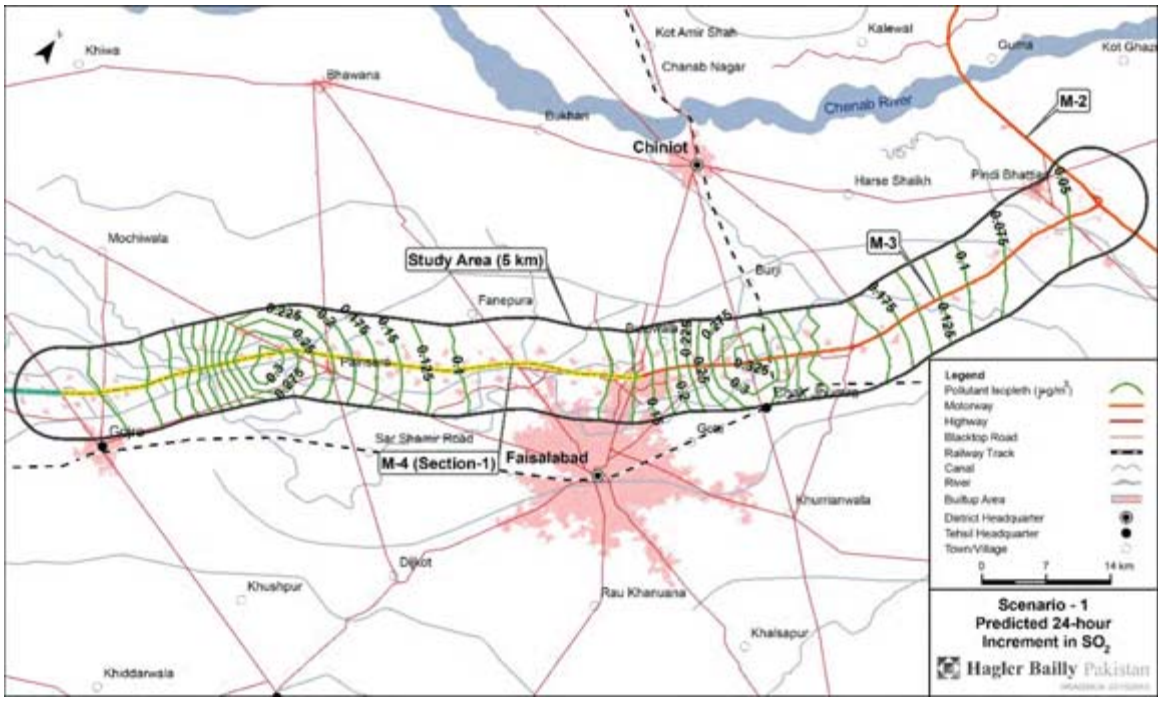


Exhibit 7.27: Predicted Annual Increment in SO_2 in Scenario 1

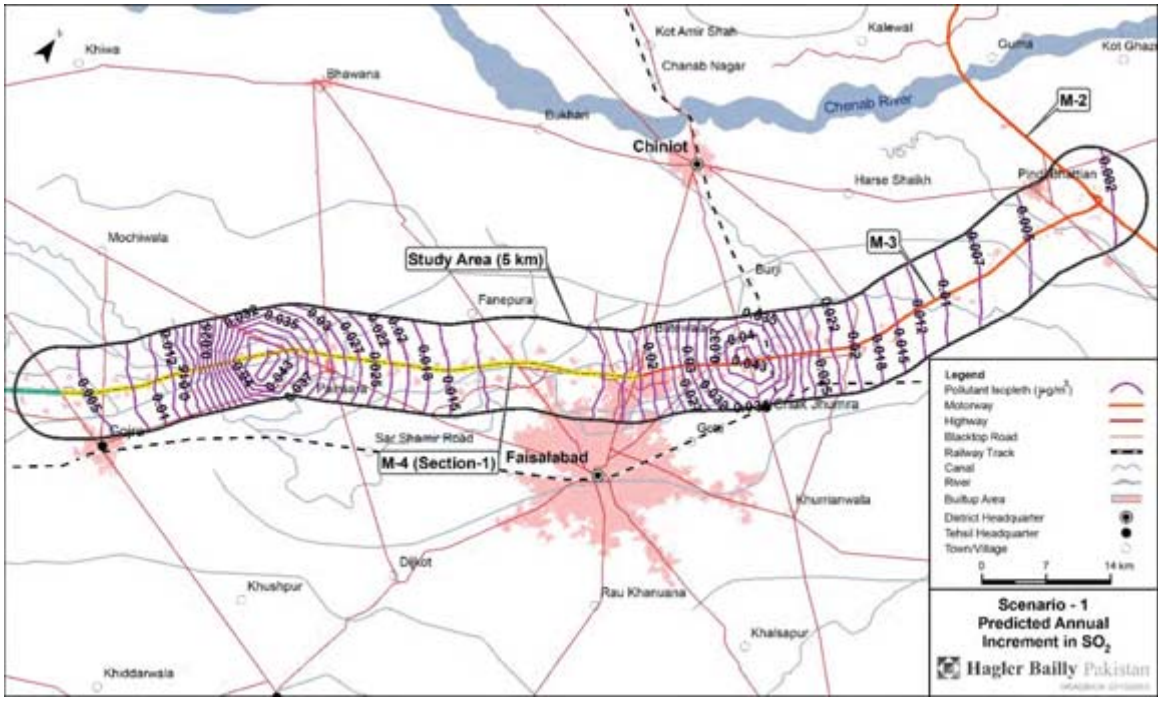


Exhibit 7.28: Predicted 24 Hours Increment in NO_X in Scenario 1

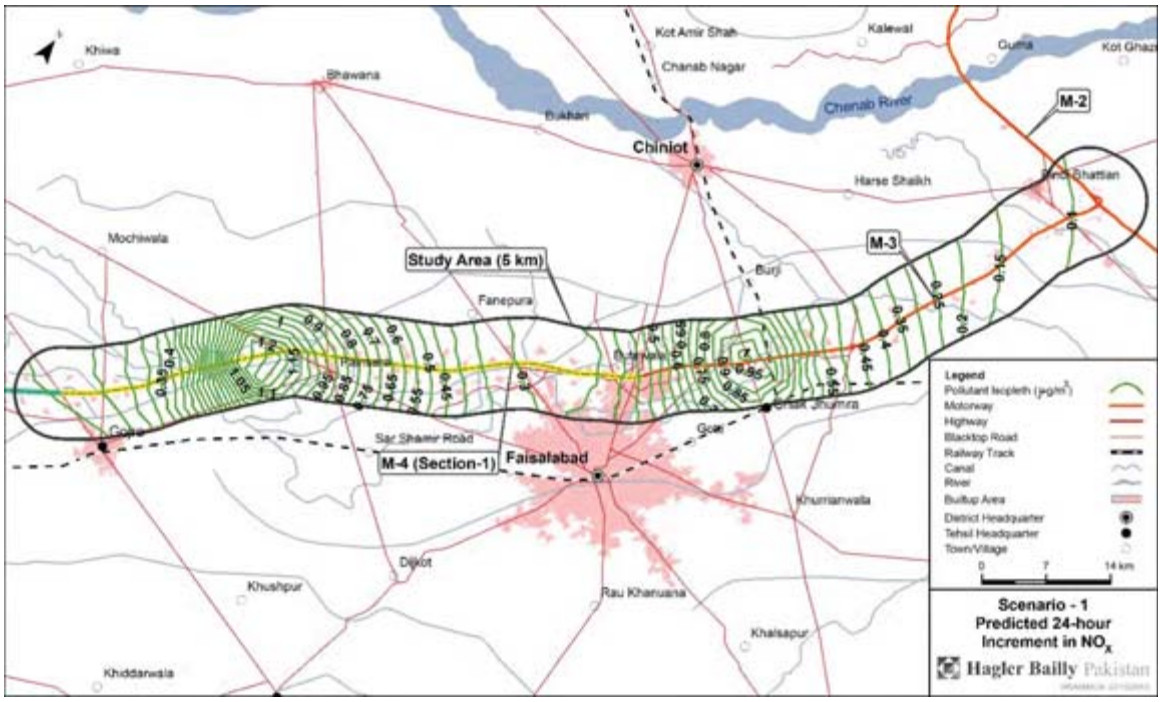


Exhibit 7.29: Predicted Annual Increment in NO_X in Scenario 1

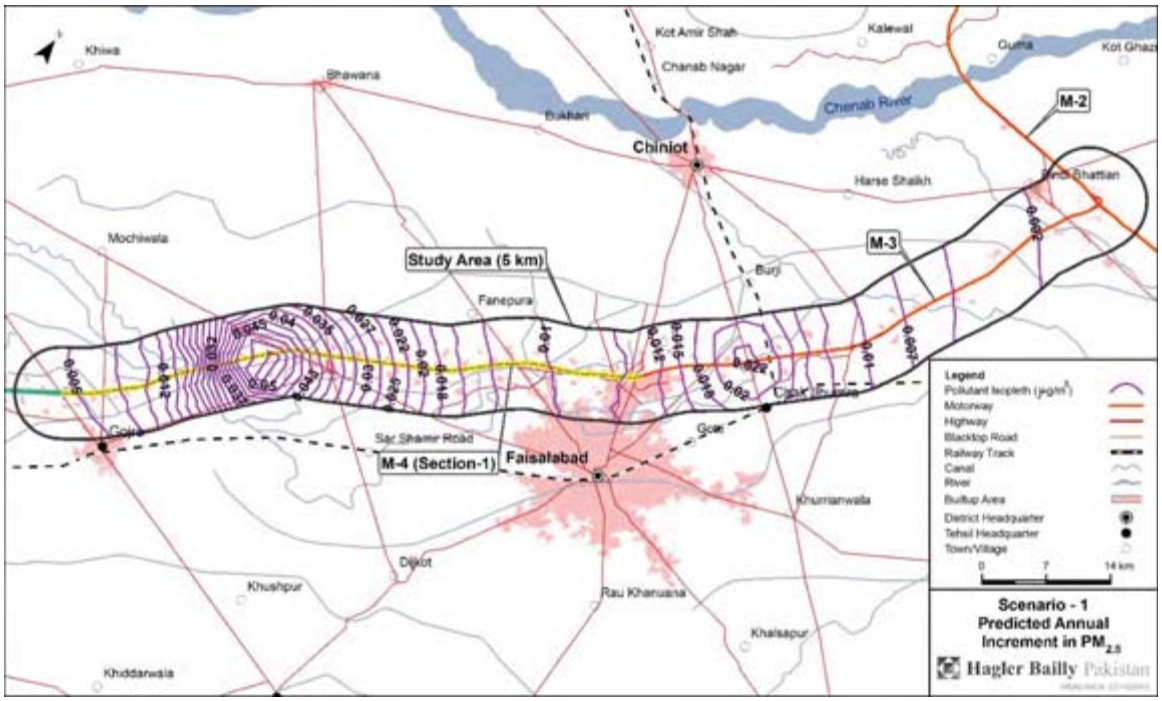


Exhibit 7.30: Predicted 24 Hours Increment in $PM_{2.5}$ in Scenario 2

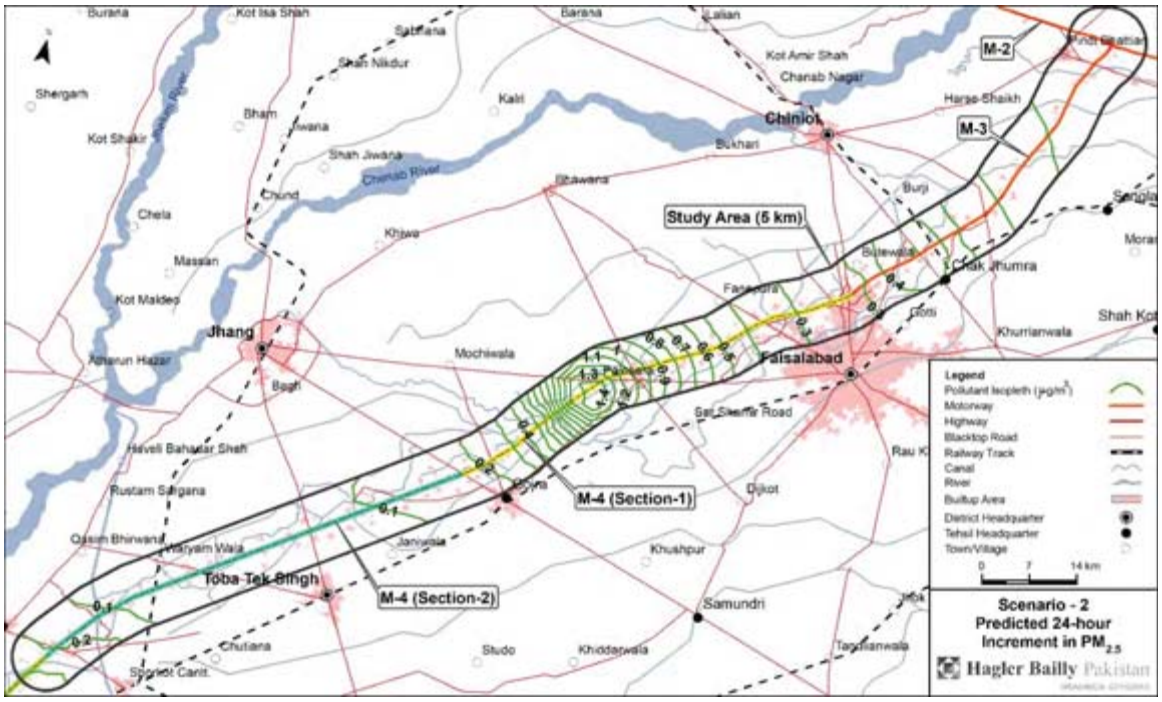


Exhibit 7.31: Predicted Annual Increment in $PM_{2.5}$ in Scenario 2

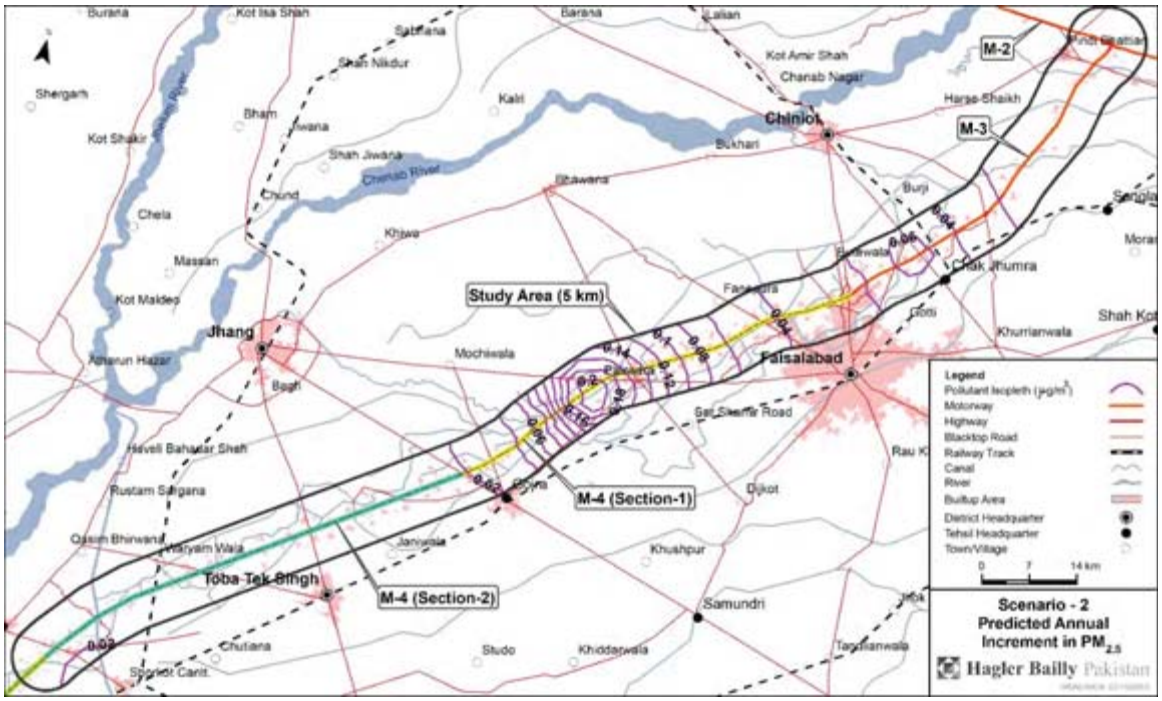


Exhibit 7.32: Predicted 24 Hours Increment in SO_2 in Scenario 2

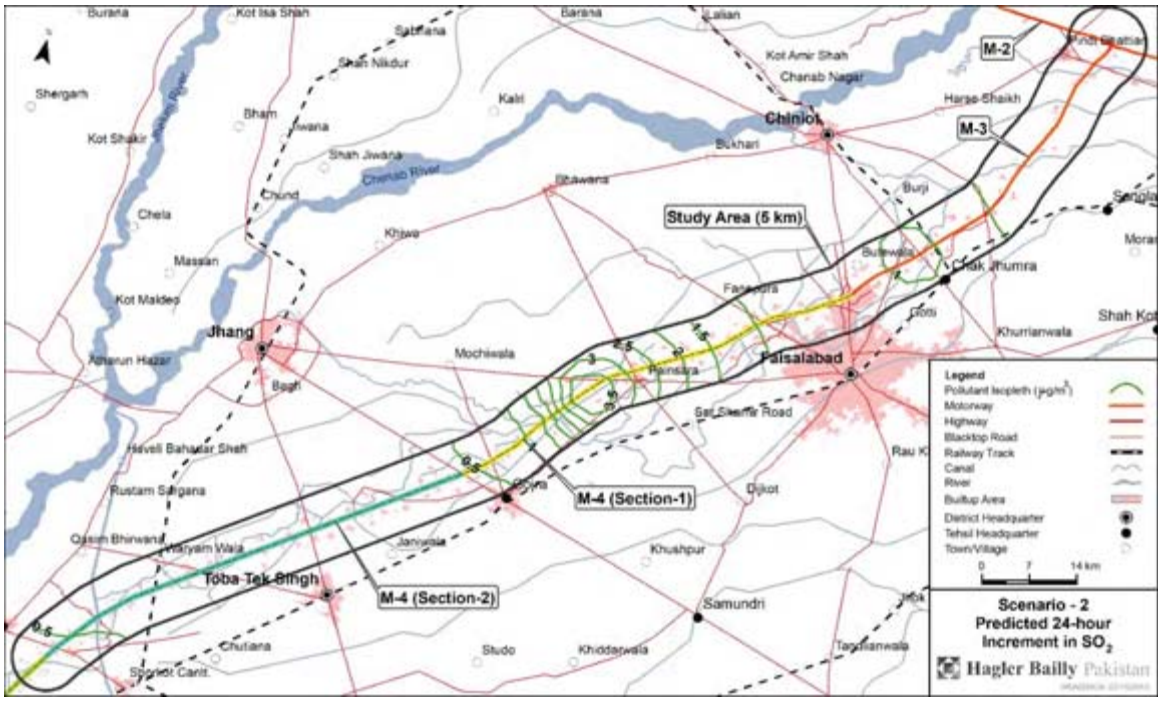


Exhibit 7.33: Predicted Annual Increment in SO_2 in Scenario 2

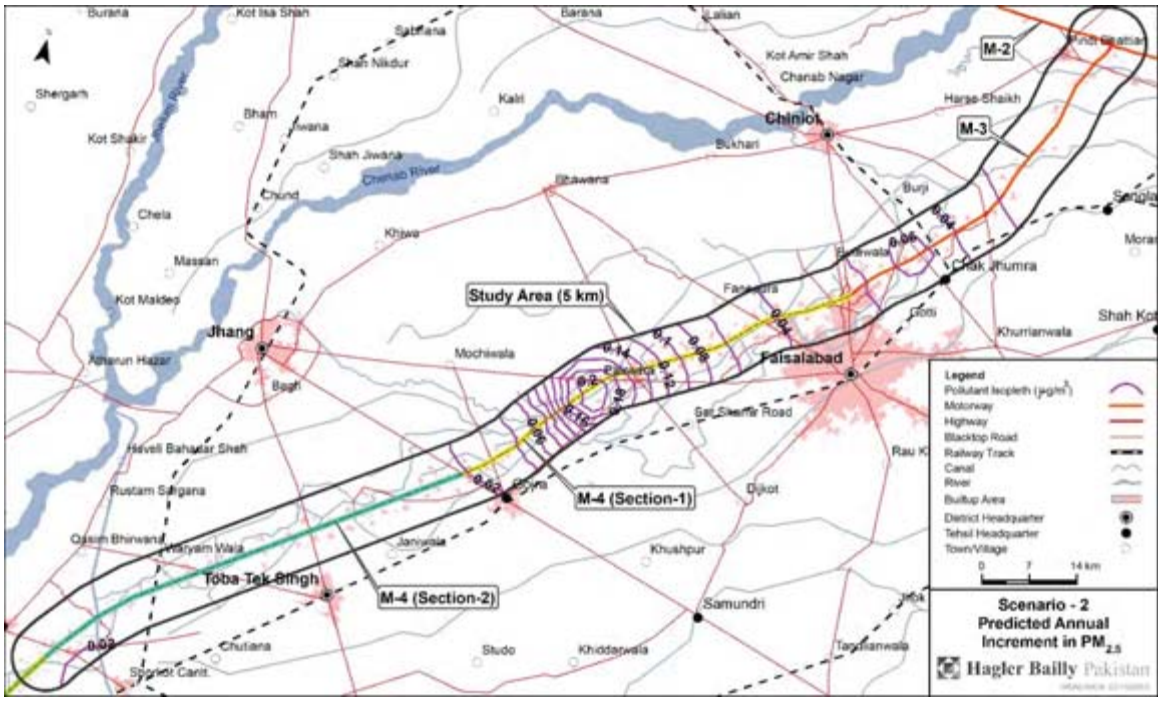


Exhibit 7.34: Predicted 24 Hours Increment in NO_X in Scenario 2

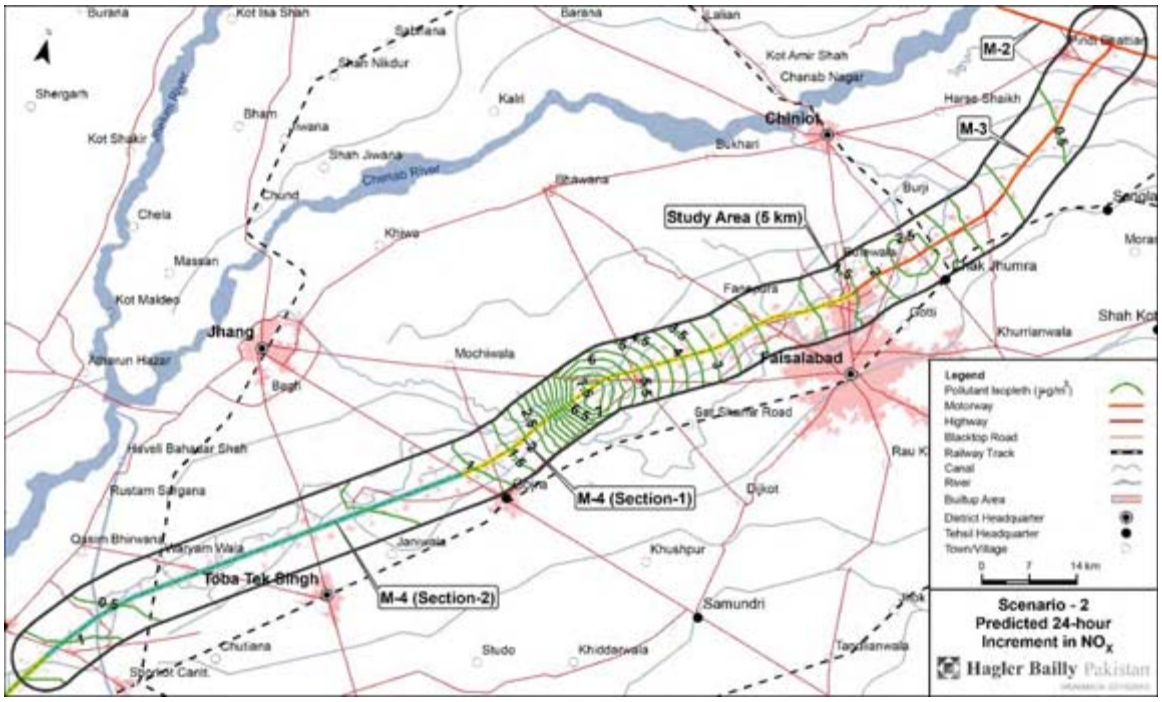


Exhibit 7.35: Predicted Annual Increment in NO_X in Scenario 2

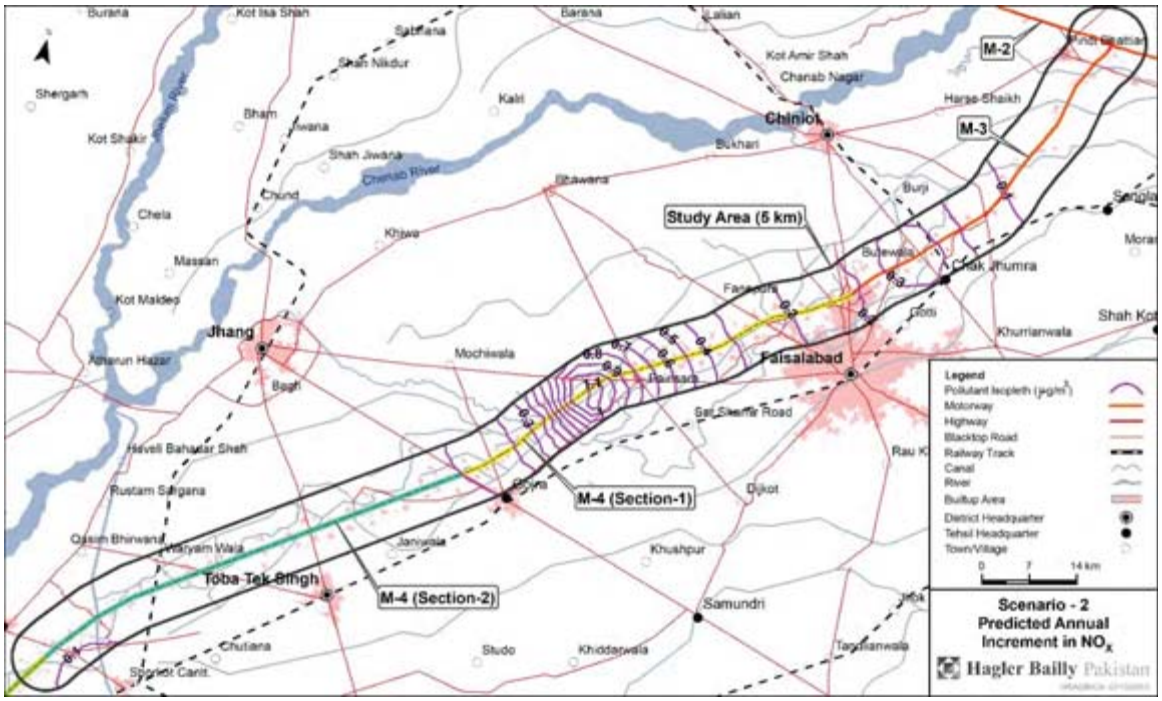


Exhibit 7.36: Predicted 24 Hoursl Increment in $PM_{2\,5}$ in Scenario 3

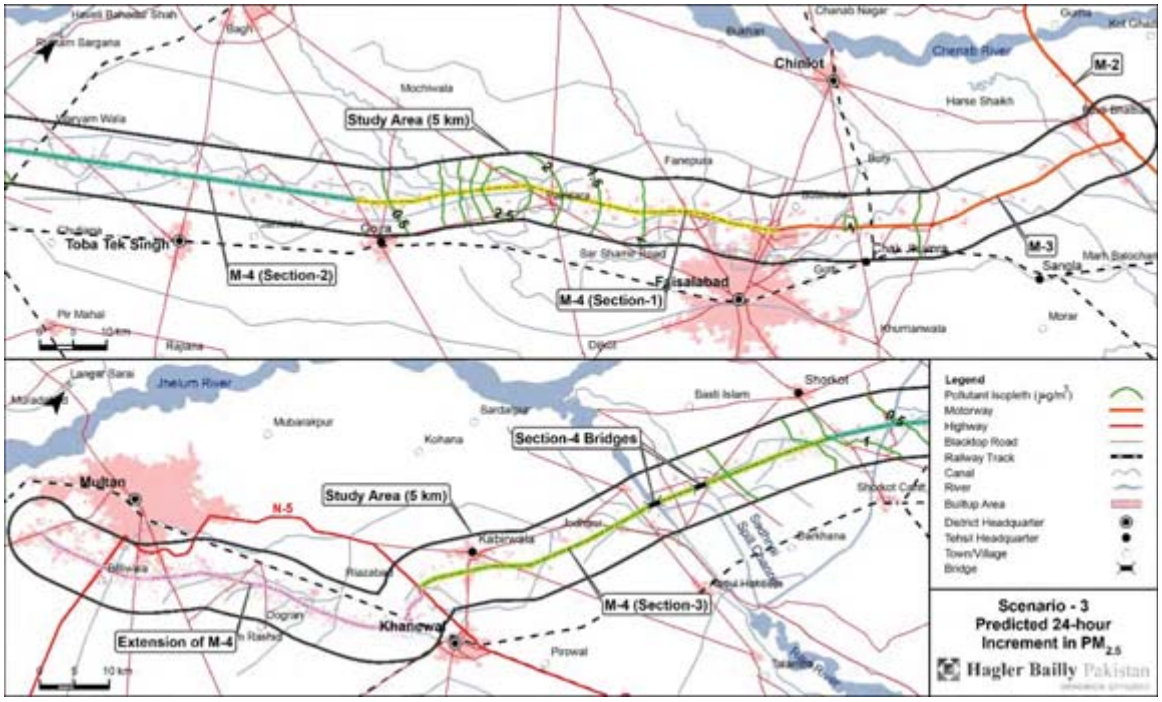


Exhibit 7.37: Predicted Annual Increment in $PM_{2.5}$ in Scenario 3

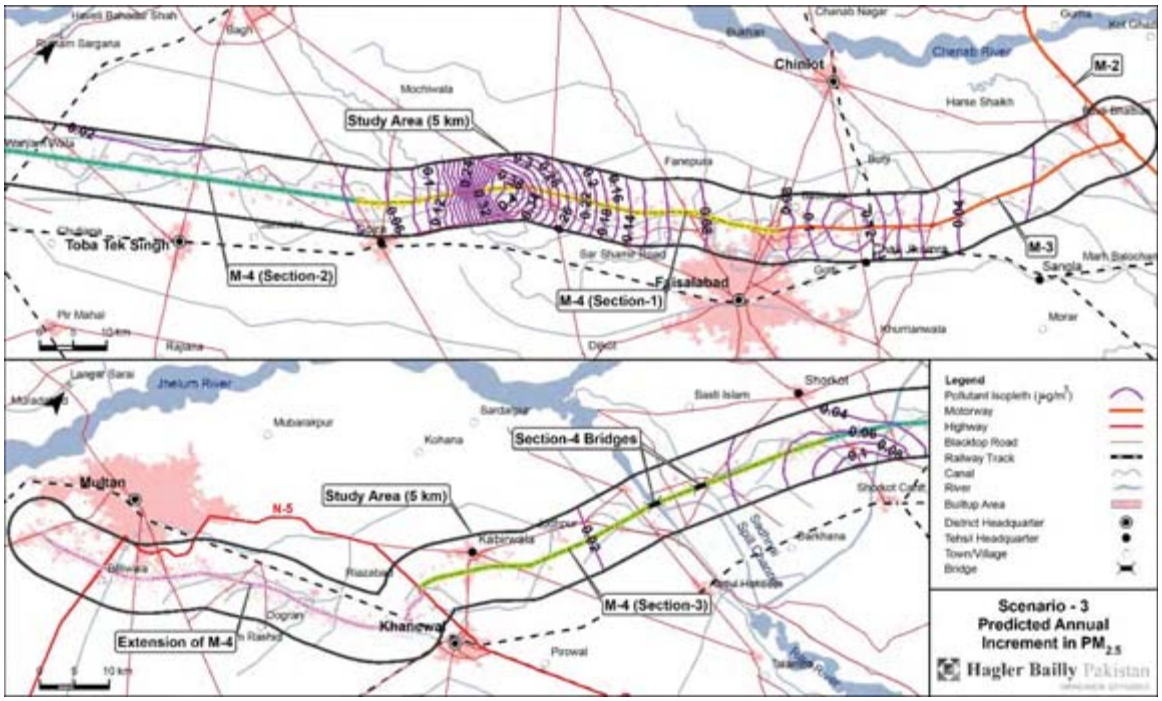


Exhibit 7.38: Predicted 24 Hours Increment in SO_2 in Scenario 3

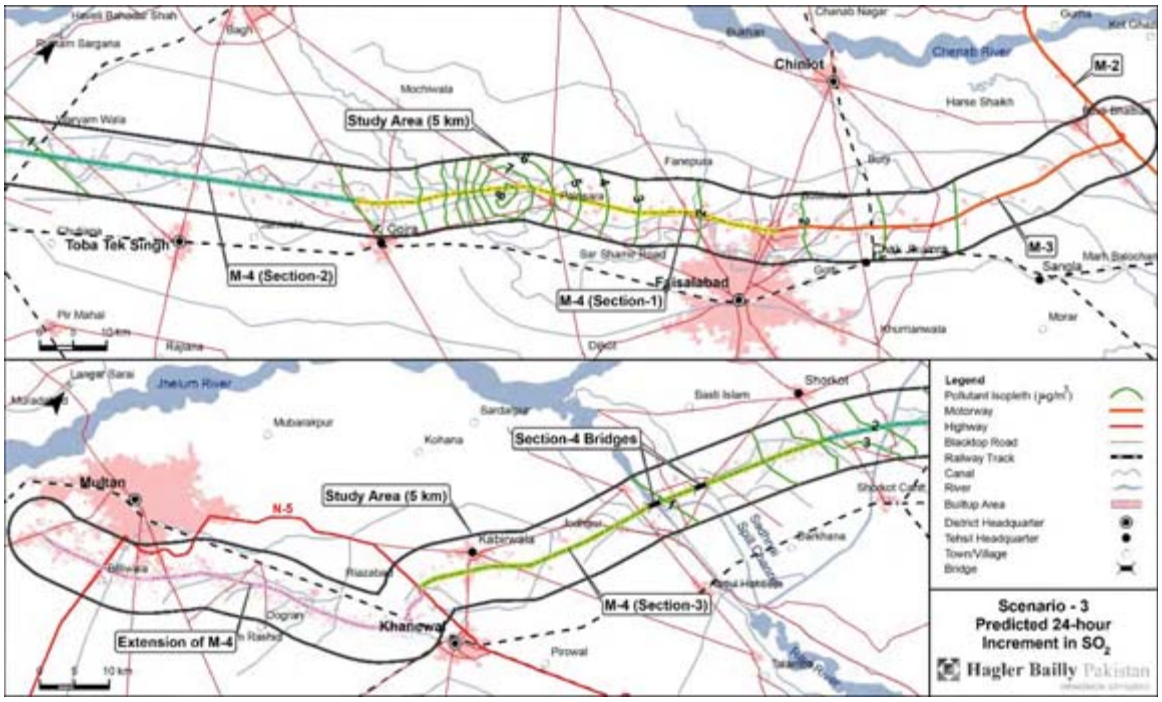


Exhibit 7.39: Predicted Annual Increment in SO_2 in Scenario 3

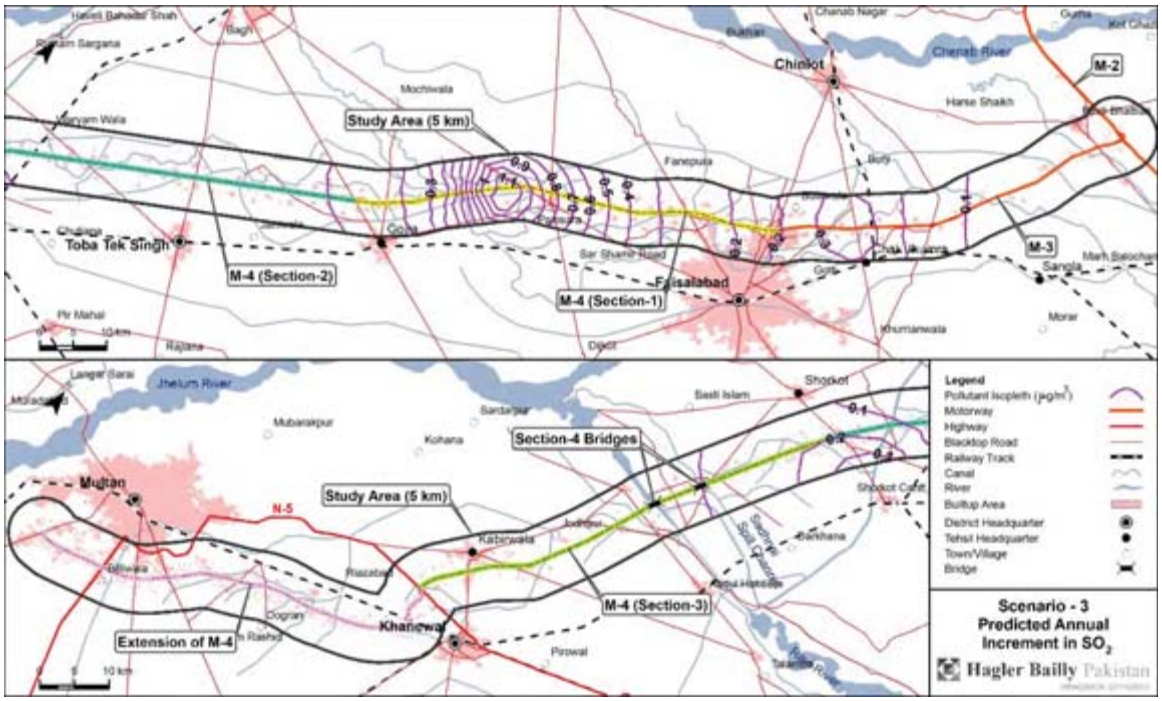


Exhibit 7.40: Predicted 24 Hours Increment in NO_X in Scenario 3

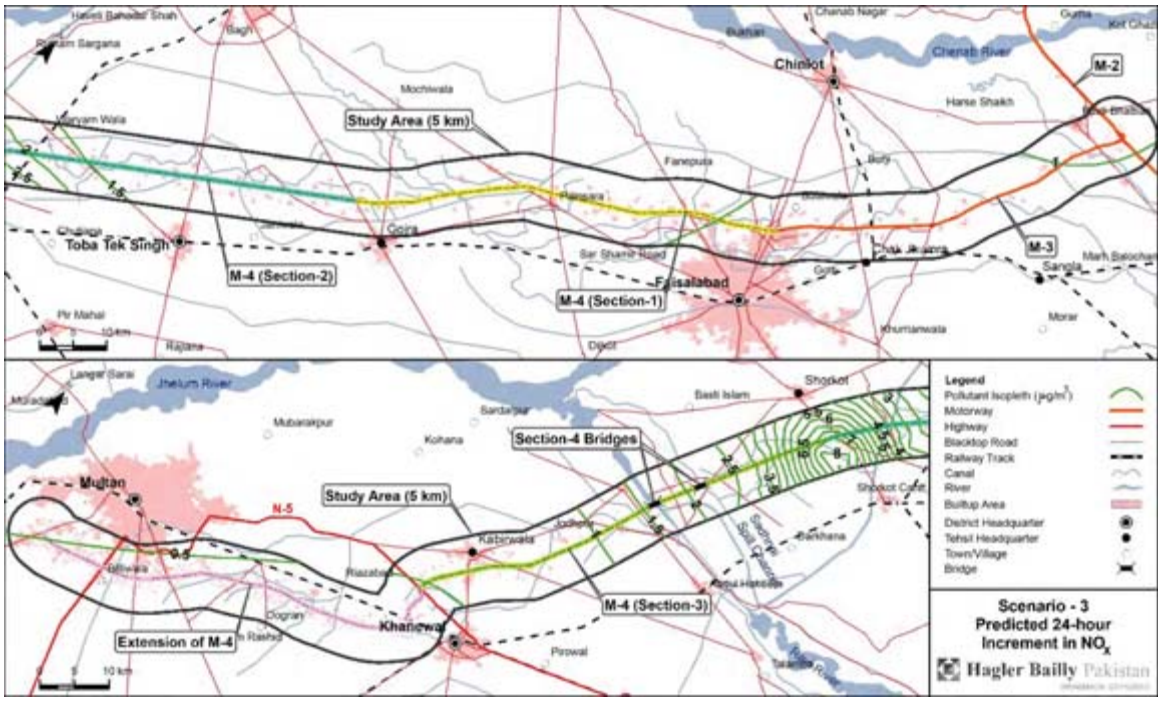


Exhibit 7.41: Predicted Annual Increment in NO_X in Scenario 3

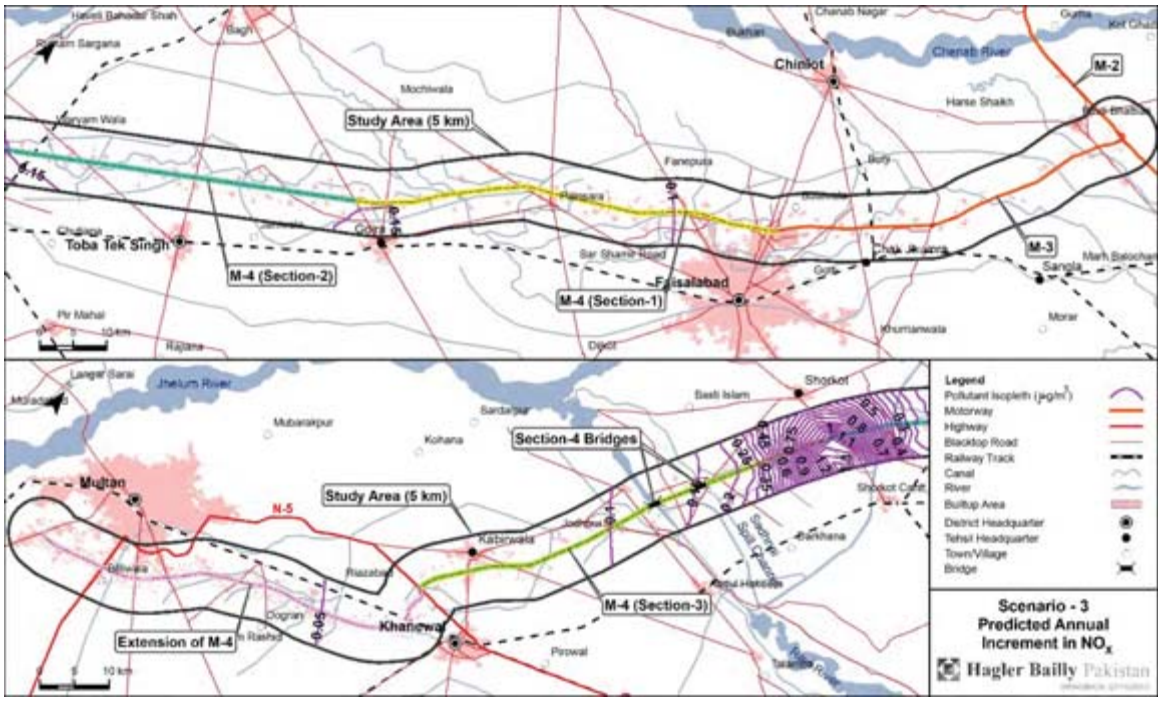


Exhibit 7.42: Predicted 24 Hours Increment in $PM_{2.5}$ in Scenario 4

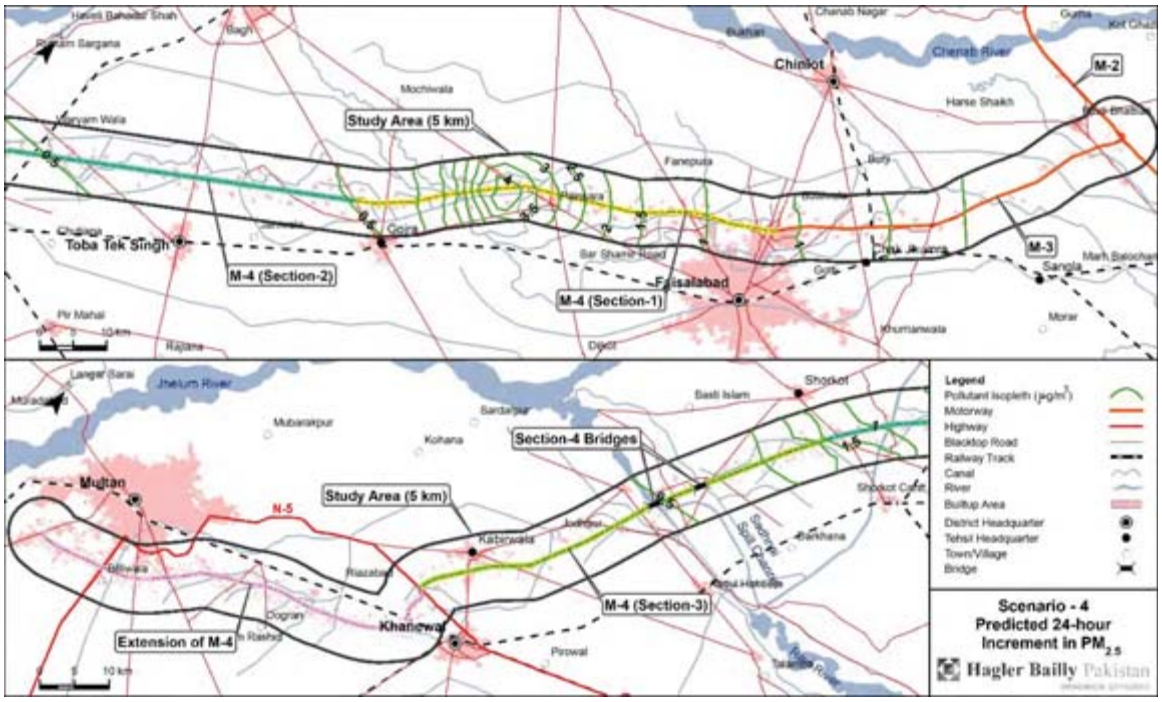


Exhibit 7.43: Predicted Annual Increment in $PM_{2.5}$ in Scenario 4

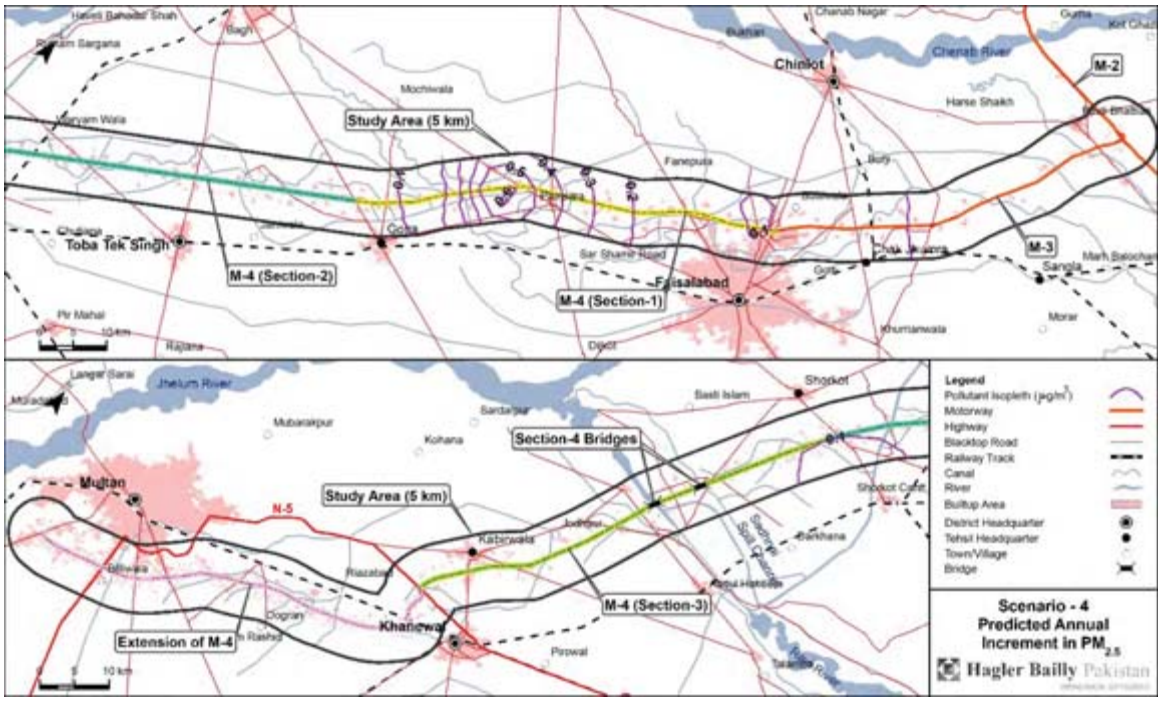


Exhibit 7.44: Predicted 24 Hours Increment in SO_2 in Scenario 4

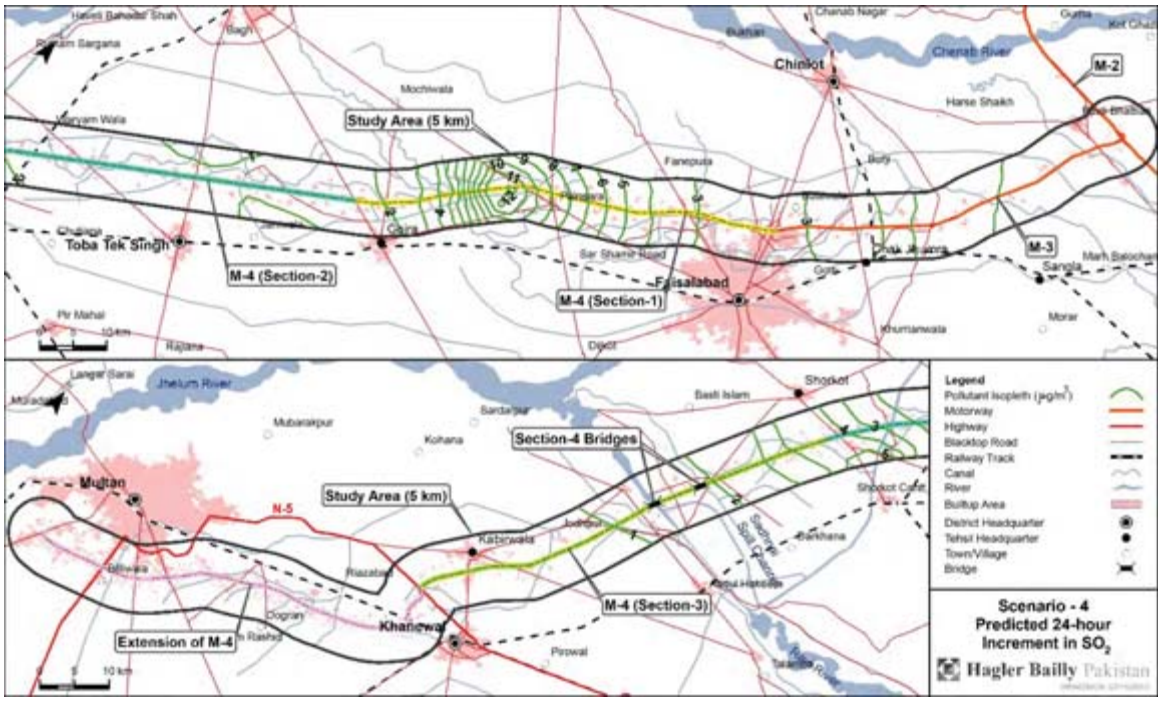


Exhibit 7.45: Predicted 24 Hours Increment in SO_2 in Scenario 4

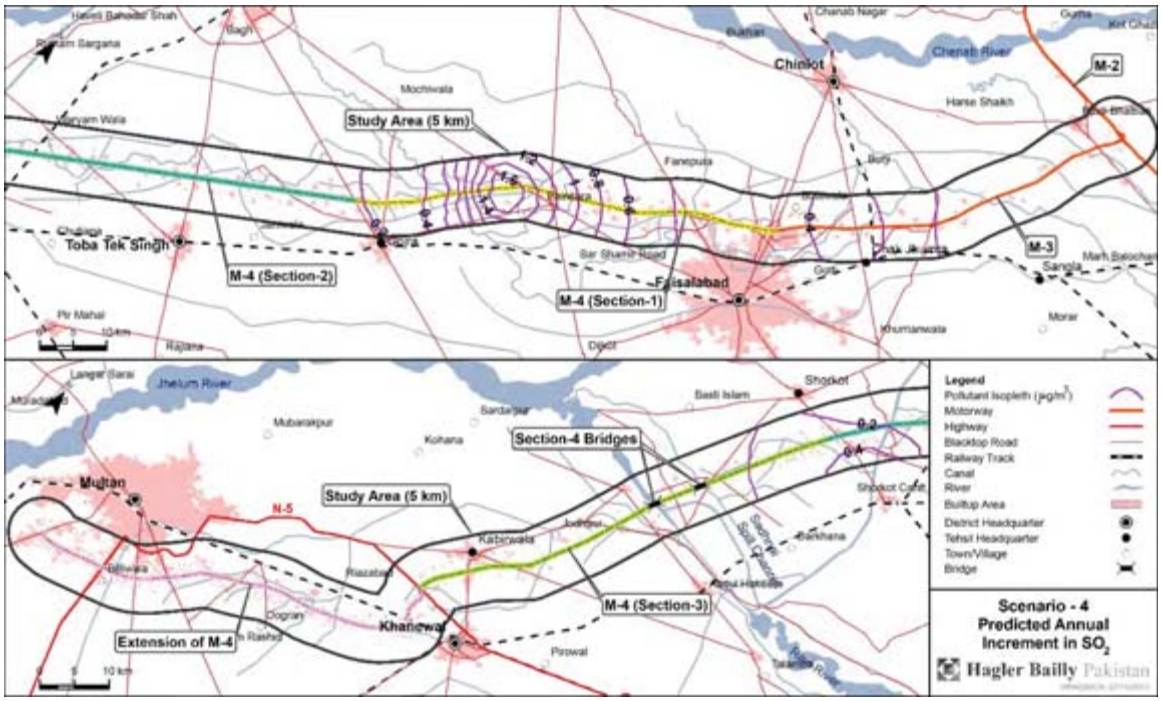


Exhibit 7.46: Predicted 24 Hours Increment in NO_X in Scenario 4

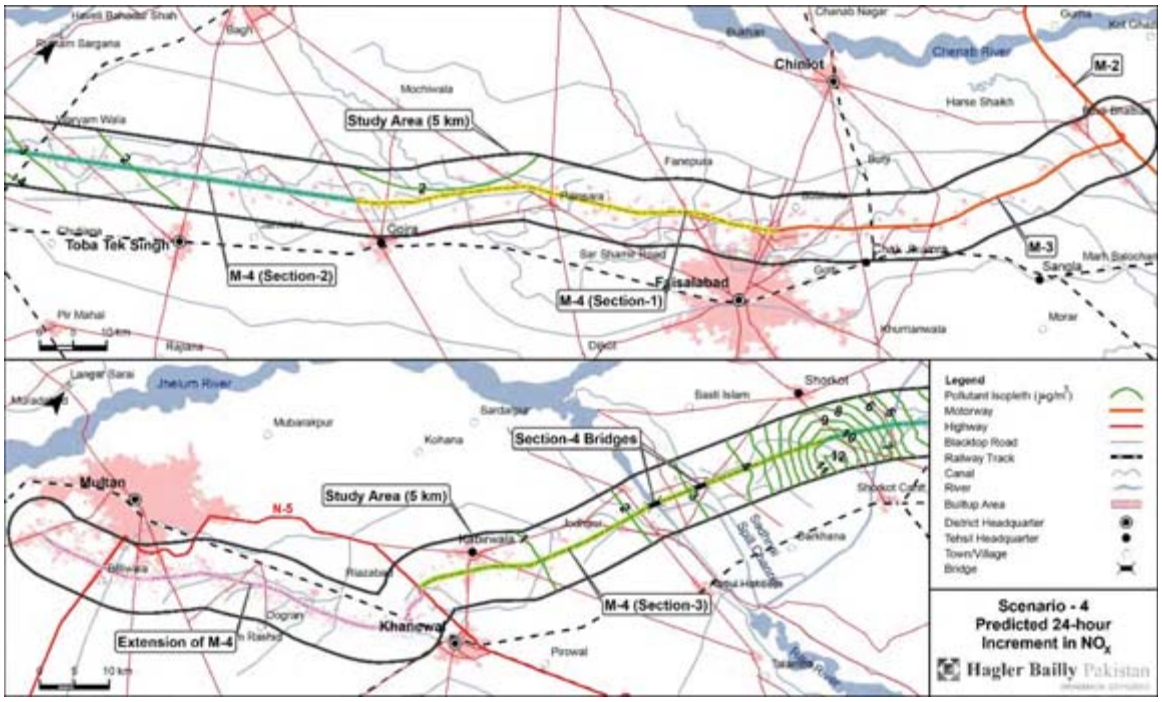
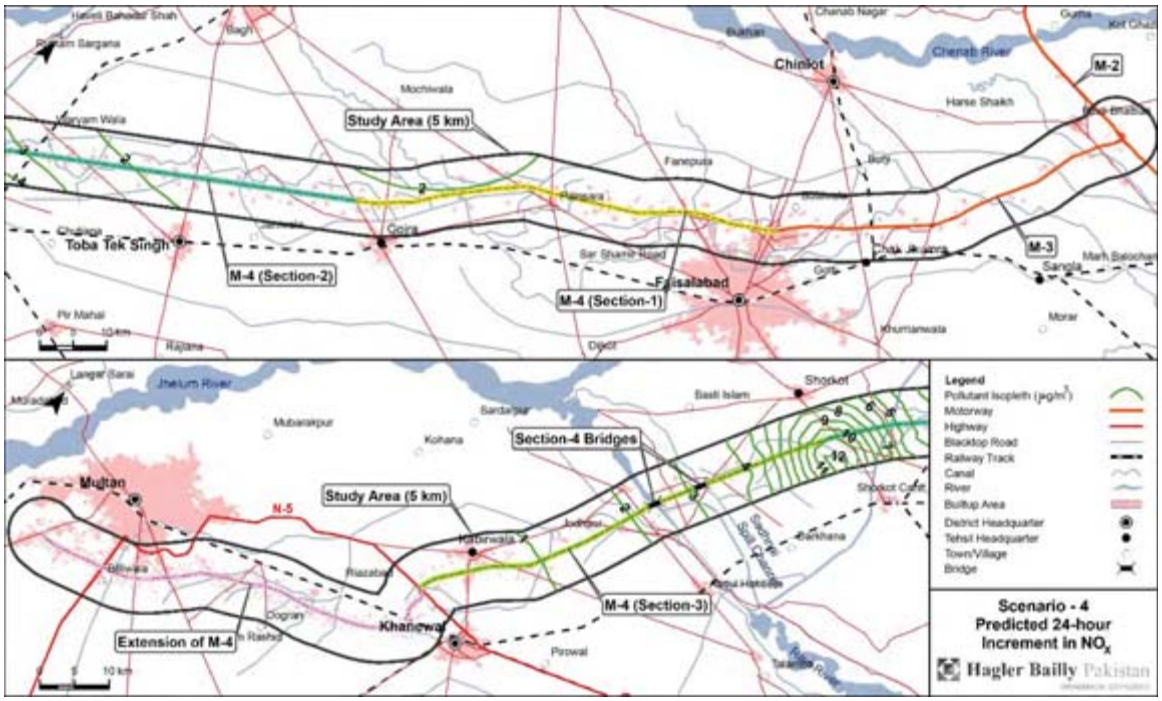


Exhibit 7.47: Predicted Annual Increment in NO_X in Scenario 4



7.3 Land Use and Right of Way Acquisitions

The proposed Section 2 of M-4 will require acquisition of about 608 ha of land. Combined with other sections of M-4, the total land requirement is nearly 2,500 ha. The total cropped are of Punjab is about 16.6 million ha.[69] Thus the M-4 Project will be less than 0.02% of the total cropped area.

Although, land has been acquired for past projects for transportation and industrial development, and this trend is likely to continue in future, current and reasonably foreseeable actions, including this project, the land requirement is insignificant to the total area and hence will have insignificant impact on the agricultural economy.

7.4 Global Climate Change

Global climate change is an important concern. The Government of Pakistan is party to international treaties on climate change and is participating in various measures at internationals and local level to reduce climate change impact and undertake adaptive measures to mitigate climate change effects.

The construction of the M-4 will result in emission of greenhouse gas (GHG) in two ways:

1. The construction activity itself will cause emission of GHG. Release of GHG may result from site clearing, preparation of the sub-grade, production of construction materials, transportation of material, and the construction works itself.

[69] Agricultural Department, Government of Punjab. http://www.agripunjab.gov.pk/overview%20new, Accessed July 2015.

2. The second source of GHG release is due to change in traffic pattern. The road will result in diverting traffic from other roads. The emissions will be the net result of:
    a. change in route length—longer route means more fuel consumption; and
    b. speed—fuel consumption is maximum at the speed of about 90 km per hour (km/h)[70], fuel consumption will increase both for higher and lower speeds.

The estimate for GHG emission from construction is provided in **Exhibit 7.48**.

Exhibit 7.48: GHG Emission from M-4 Construction

Activity	Emission Factor[71] (t CO_2eq/km)	Emissions (tCO2eq.)				
		Section 1 (59 km)	*Section 2 (61 km)*	*Section 3 (64 km)*	*Section 4 (63 km)*	*Total*
Earthworks	161.40	9,523	9,845	10,330	10,168	39,866
Pavement	1333.86	78,698	81,365	85,367	84,033	329,463
Culverts	238.48	14,070	14,547	15,263	15,024	58,904
Structures	1067.99	63,011	65,147	68,351	67,283	263,792
Road Furniture	432.40	25,512	26,376	27,674	27,241	106,803
Total		**190,814**	**197,280**	**206,985**	**203,749**	**798,828**

To assess the change in GHG emission the results of traffic model[72] were used. Currently, there are two possible routes between Multan and Pindi Bhattian (on M-2). Construction of M-4 will result in diverting the traffic from these two roads to the M-4. The characteristics of the route are shown in **Exhibit 7.49**.

Exhibit 7.49: Characteristics of the Routes

Route	Segment	Category	Length (km)	Avg. Speed (km/h)
Via M-2 and N-5	Pindi Bhattian–Lahore (via M-2)	Motorway	118.5	LTV: 120 HTV: 110
	Lahore–Multan (via N-5)	National Highway	319.9	LTV: 75 HTV: 75
Via District Road	Pindi Bhattian–Chiniot–Jhang–Shorkot–Multan	District Road	240.3	LTV: 40 HTV: 40
Via M-3 and M-4	Pindi Bhattian–Faisalabad–Golra–Shorkot–Multan	Motorway	298.6	LTV: 120 HTV: 110

In **Exhibit 7.50** and **Exhibit 7.51**, the projected traffic for 2025 under two different scenarios are shown.

Exhibit 7.50: Projected Traffic in 2025—under "No-Project" Condition

		LTV (ADT)	Buses (ADT)	Truck (ADT)s

[70] See for example, http://www.mpgforspeed.com, Accessed August 2015.

[71] Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation: A Toolkit for Developing Countries. The World Bank. November 2010

[72] M-4 Pakistan Traffic Forecasting Report. JM Duggan Consulting. 2015

District Roads				
Kabirwala_Shorkot	55.0	2,640	560	1,618
Shorkot_Jhang	60.0	2,247	477	1,378
Jhang_Chinot	87.2	1,060	224	650
Chinot_Pindibhattian	38.1	877	186	537
M-2 and N-5				
M-2 PindiBhattan_Lahore	118.5	19,928	133	1,560
Lahore_N5Pattoki	66.7	20,726	1,127	8,792
N5_Pattoki_Sahiwal	89.3	15,484	445	6,894
N5_Sahiwal_Khanewal	126.6	13,422	1,098	6,672
N5_Khanewal_Multan	37.3	19,066	2,018	3,885
M-3-M-4 Motorway				
M-3_Motorway_PindiBhattan_Fasailabad	52.2	5,754	215	842
M-4_Motorway_Fasailabad_Gojra	58.8			
M-4_Motorway_Gojra_Shorkot	61.0			
M-4_Motorway_Shorkot_Khanewal	64.5			
M-4_Motorway_Khanewal_Multan	62.1			

Source: M-4 Pakistan Traffic Forecasting Report. JM Duggan Consulting. 2015

Note: 1. ADT = Average Daily Traffic

2. For District Roads, the traffic mix has been calculated from total traffic. The ratio that has been used is 32%, 11%, and 57% for LTV, buses, and trucks, respectively.

3. The ADT is calculated from the reported PCU traffic. Factor of 1.0, 1.6218, and 2.9064 has been used for LTV, buses, and trucks, respectively.

Exhibit 7.51: Projected Traffic in 2025—under M-4 Completed and Operational

		LTV (ADT)	Buses (ADT)	Trucks (ADT))
District Roads				
Kabirwala_Shorkot	55.0	1,054	223	646
Shorkot_Jhang	60.0	1,441	305	883
Jhang_Chinot	87.2	964	205	591
Chinot_Pindibhattian	38.1	974	207	597
M-2 and N-5				
M-2PindiBhattan_Lahore	118.5	19,887	134	1,642
Lahore_N5Pattoki	66.7	20,887	1,134	8,272
N5_Pattoki_Sahiwal	89.3	15,559	455	6,275
N5_Sahiwal_Khanewal	126.6	13,631	948	5,166
N5_Khanewal_Multan	37.3	19,863	2,026	3,873
M-3-M-4 Motorway				
M-3_Motorway_PindiBhattan_Fasailabad	52.2	5,759	209	3,457
M-4_Motorway_Fasailabad_Gojra	58.8	3,737	1	4,496
M-4_Motorway_Gojra_Shorkot	61.0	1,328	1	5,826
M-4_Motorway_Shorkot_Khanewal	64.5	2,370	93	6,702
M-4_Motorway_Khanewal_Multan	62.1	1,466	24	1,815

For Source and Notes see **Exhibit 7.50**.

The fuel consumption rate varies with speed. The rates are shown in **Exhibit 7.52**.

Exhibit 7.52: Fuel Consumption Rate for Vehicle Type and Speed

Vehicle Type	Fuel	Fuel Consumption Rate (km/l)			
		At Optimum Speed	*On Motorway*	*On National Highway*	*On District Roads*
Light Vehicles	Gasoline	12.5	11.0	12.5	8.0
Buses	Diesel	3.5	3.1	3.5	2.2
Trucks	Diesel	3.0	2.6	3.0	1.9

Notes: 1. Optimum Speed is 90 km/h.

2. Fuel consumption rate is taken from Pakistan Country Report on Male Declaration.[73].

3. Fuel consumption on Motorway, national Highway, and District Roads, are assumed to be in the ratio of 88%, 100%, and 64%, respectively of that consumption at 90 km/h. These ratios are based on the results reported on the blog Automatic[74]

[73] Malé Declaration on Control and Prevention of Air Pollution and its Likely Trans boundary Effects for South Asia. Pakistan Country Report: baseline Report, National Action Plan, and Databases. Report prepared for Pakistan Environmental Protection Agency by Hagler Bailly Pakistan. December 2000.

[74] http://blog.automatic.com/cost-speeding-save-little-time-spend-lot-money/. Accessed August 2015

Using the above data the fuel consumption on the three routes for the projected traffic of 2025 was calculated as shown in **Exhibit 7.53**.

Exhibit 7.53: Total Fuel Consumption Per Day—With and Without the Project

	LTV(petrol)	Buses(diesel)	Trucks(Diesel)
Without Project			
District Roads	50,733	38,418	129,581
M-2 and N-5	602,963	98,556	792,176
M-3-M-4 Motorway	27,305	3,645	16,651
	681,001	**140,619**	**938,407**
With Project			
District Roads	33,200	25,138	84,798
M-2 and N-5	608,461	93,610	701,685
M-3-M-4 Motorway	76,844	6,008	509,557
	718,505	**124,757**	**1,296,040**

The GHG Emission Factors were obtained from the IPCC.[75] . The calculations of emission factor used in the assessment are shown in **Exhibit 7.54**. Finally, the change in emission due to the project is shown in **Exhibit 7.55**.

Exhibit 7.54: Emission Factors for Diesel and Gasoline Consumption in Transport Sector

		Diesel	*Gasoline*	*Global Warming Potential*
CO_2 EF	kg/TJ	741,00	69,300	1
CH_4	kg/TJ	3.9	33	25
N_2O	kg/TJ	3.9	3.2	298
Calorific Value of Fuel	Tj/Gg	43	44.3	
Density of Fuel	kg/l	0.837	0.707	
Equivalent CO_2	kg/TJ	75,360	71,079	
Emission Factor	$kgCO_2/l$	2.71	2.23	

Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Exhibit 7.55: Calculation of GHG Emission

		Diesel	*Gasoline*
Without Project	l/d	1,079,026	681,001
With Project	l/d	1,420,797	718,505
Difference	l/d	341,772	37,504
GHG Emission	kg CO2 Eq/d	926,977	83,490

[75] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Inter-governmental Panel on Climate Change. http://www.ipcc-nggip.iges.or.jp/public/2006gl/, Accessed August 2015.

This analysis evaluates the change in GHG emission for traffic between Pindi Bhattian and Multan as a result of construction of M-4. The modeled year is 2025. The comparison of the predicted traffic volume for "with-Project" and "without-Project" conditions on the three routes indicates that the commission of M-4 will result in diversion of significant volume of traffic from district roads to the M-4. This will result in a decrease of GHG emission as the speed of the traffic will increase resulting in fuel efficiency. The decrease will be despite that fact that the M-3 and M-4 route will be slightly longer. Some diversion of traffic from N-5 to M-4 is also likely to take place. Here again the GHG emission will reduce. However, a net increase of traffic, particularly of the truck is expected on the M-4. The reason for this is not very clear from the transport model results. This may indicate a modal shift from other forms. It is also possible that traffic between nodes other than Pindi Bhattian and Multan are diverted to M-4. The net result of, decrease due to higher speeds and increase in truck traffic on M-4, is that the GHG emission after complete commissioning of M-4 will increase by about 1,010 tonne CO2 equivalent per day. It may be noted that in this analysis only a part of the model result is analyzed. It is possible that

7.5 Health and Safety Issues

The M–4 passes through the agricultural fields where locals will require to cross the highway in order to access their fields located across the road. In addition, the local farmers will also require to take their livestock across the alignment of M–4 for grazing purposes. This may result in safety issues for the locals due to fast moving traffic on the road.

To avoid any safety related incidences and ensure well-being of the local residents, the whole alignment of the M–4 Motorway will be fenced at the edge of the RoW to prevent any pedestrian and animal crossings through the highway. To facilitate the movement of locals across the road, adequate number of underpasses at appropriate distances will be provided.

7.6 Access Issues

During the stakeholder consultations, the locals reported access issues across the alignment of M–4 (see **Section 4.2** for details). These were mostly related to the location and distance of the underpasses provided on Section-I of M–4 to facilitate movement across the highway. To avoid such issues in the planned sections of M–4, the major settlements along the route of the M–4 should be identified and underpasses or overhead pedestrian crossings should be provided to enable easy access of the locals across the highway.

8. Environmental Management and Monitoring

This section provides the management measures as well as the monitoring that shall be carried out to address the significant cumulative impacts.

8.1 Mitigation Measures

Managing cumulative impacts requires similar mitigation measures to that of the EIA. If appropriate mitigation measure are identified and implemented at the EIA level, no local level measures would be required to mitigate cumulative impacts.

Mitigation measures for cumulative impacts are identified in this section.

8.1.1 Noise

To mitigate the noise impacts, following mitigation measures will be undertaken by NHA to ensure welfare and well-being of the communities residing within these zones along the alignment of M-3 and M-4 motorways.

- Provision of boundary walls/fencing facing the highway for sensitive receptors such as schools, residential area, places of worships etc. along the alignment of motorways.
- Under highway regulations, the construction of building is not allowed within 34 m from the centerline of the highway. Pertaining to this regulation and findings of the noise modeling, construction of schools and hospitals should be discouraged within 500 m from the centerline of the motorways, and prohibited within 34 m form the centerline of the highway. This distance could be reduced subject to on-site measurements and modeling based on actual traffic counts and predictions in future.
- Tree plantations, under the technical assistance of Forest Department, should be carried out to reduce the propagation of noise from the motorways.
- Focused group consultations should be held on periodic bases to record the issues of the communities associated with the increased noise levels and measures, for e.g. provision of a sound barrier, should be taken to resolve the issues.
- Construction of noise barriers between source and receptor as described below to block the direct path of noise to the receiver noise reduction at path. This barrier will reduce the impact of noise both at night and during day time for sensitive receptors that are located beyond 50 m from the center of the road by absorbing and reflecting the sound energy, transmitting it and forcing it to take a longer path to reach the receptor.

Noise Barriers

The effectiveness of noise barriers depends on:

- Barrier Location – Noise barriers work efficiently when they are located as close to the noise source as possible because they will reduce the noise level for all the receptors rather than reducing it for an individual receptor if the barrier is built close to it. For the present study the barrier is placed at a distance of 30 m from the center of the road within RoW of 50 m on both sides of the road.
- Barrier Height – The height of the barrier is an important parameter that should be considered. It should be high enough to block the line of sight from the receptor to the engines of the vehicles on the road which will result in the reduction of noise level of 5 dBA. Theoretically attenuation can be of 20 dBA which is impossible to achieve so the practical limit is about 15 dBA. In this study the barrier height is 3 m which blocks the line of sight and the attenuation limit is 12 dBA which is easily achievable.
- Barrier Material – When the barrier height is over 2 m and the reduction of 10 dBA or more is required, then the material to be used plays an important role.[76] The material to be used as noise barrier must have a surface mass of at least 10kg/m^2. In the present study we are using concrete as our barrier material.

Exhibit 8.1 to **Exhibit 8.4** show noise attenuation at distances of 50 m to 500 m from the center of the road. The noise levels at 10 m can be ignored as there no residential construction will take place within RoW. Regulations also prohibit constructions within 34 m form the center of the motorway.

Exhibit 8.1: Noise Levels after Attenuation of 12 dBA in Configuration–2 in 2015

Modeled Route	*At 50 m from the center of the Motorway*		*At 100 m from the center of the Motorway*		*At 200 m from the center of the Motorway*		*At 500 m from the center of the Motorway*	
	Ldn	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*
M-3	50	43	46	39	42	34	35	27
Section–1 of M-4	49	42	45	38	40	33	34	26
Extension of M-4	48	40	44	36	39	32	32	25

Exhibit 8.2: Noise Levels after Attenuation of 12 dBA in Configuration–3 in 2020

Modeled Route	*At 50 m from the center of the Motorway*		*At 100 m from the center of the Motorway*		*At 200 m from the center of the Motorway*		*At 500 m from the center of the Motorway*	
	Ldn	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*
M-3	52	44	47	40	43	35	36	29
Section–1 of M-4	51	44	47	40	43	35	36	28
Extension of M-4	47	40	43	35	38	31	31	24
Section–2 of M-4	51	43	47	39	42	35	35	28

[76] https://www.nzta.govt.nz/assets/resources/state-highway-noise-barrier-design-guide/docs/noise-barriers-version-1.0.pdf

Exhibit 8.3: Noise Levels after Attenuation of 12 dBA with M-4 Fully Operational in 2020

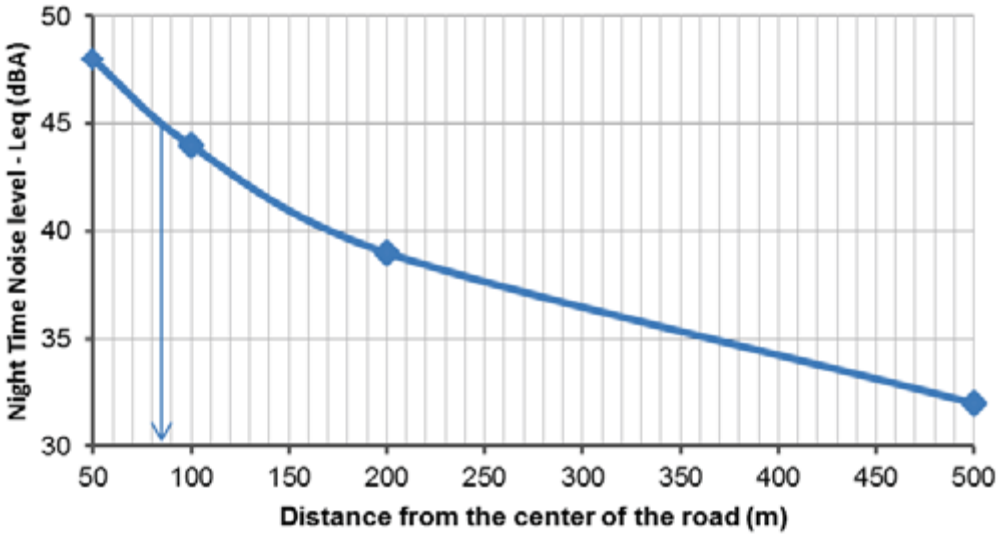
Modeled Route	*At 50 m from the center of the Motorway*		*At 100 m from the center of the Motorway*		*At 200 m from the center of the Motorway*		*At 500 m from the center of the Motorway*	
	Ldn	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*
M-3	54	46	50	42	45	38	38	31
Section–1 of M-4	54	46	50	42	45	38	38	31
Extension of M-4	49	42	45	37	40	33	33	26
Section–2 of M-4	54	47	50	43	46	38	39	31
Section–3 of M-4	55	48	51	43	46	39	39	32

Exhibit 8.4: Noise Levels after Attenuation of 12 dBA with M-4 Fully Operational in 2025

Modeled Route	*At 50 m from the center of the Motorway*		*At 100 m from the center of the Motorway*		*At 200 m from the center of the Motorway*		*At 500 m from the center of the Motorway*	
	Ldn	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*	*Ldn*	*Leq*
M-3	55	48	51	43	46	39	40	32
Section–1 of M-4	55	48	51	44	47	39	40	32
Extension of M-4	51	44	47	40	43	35	36	28
Section–2 of M-4	56	48	52	44	47	40	40	33
Section–3 of M-4	57	49	53	45	48	41	41	34

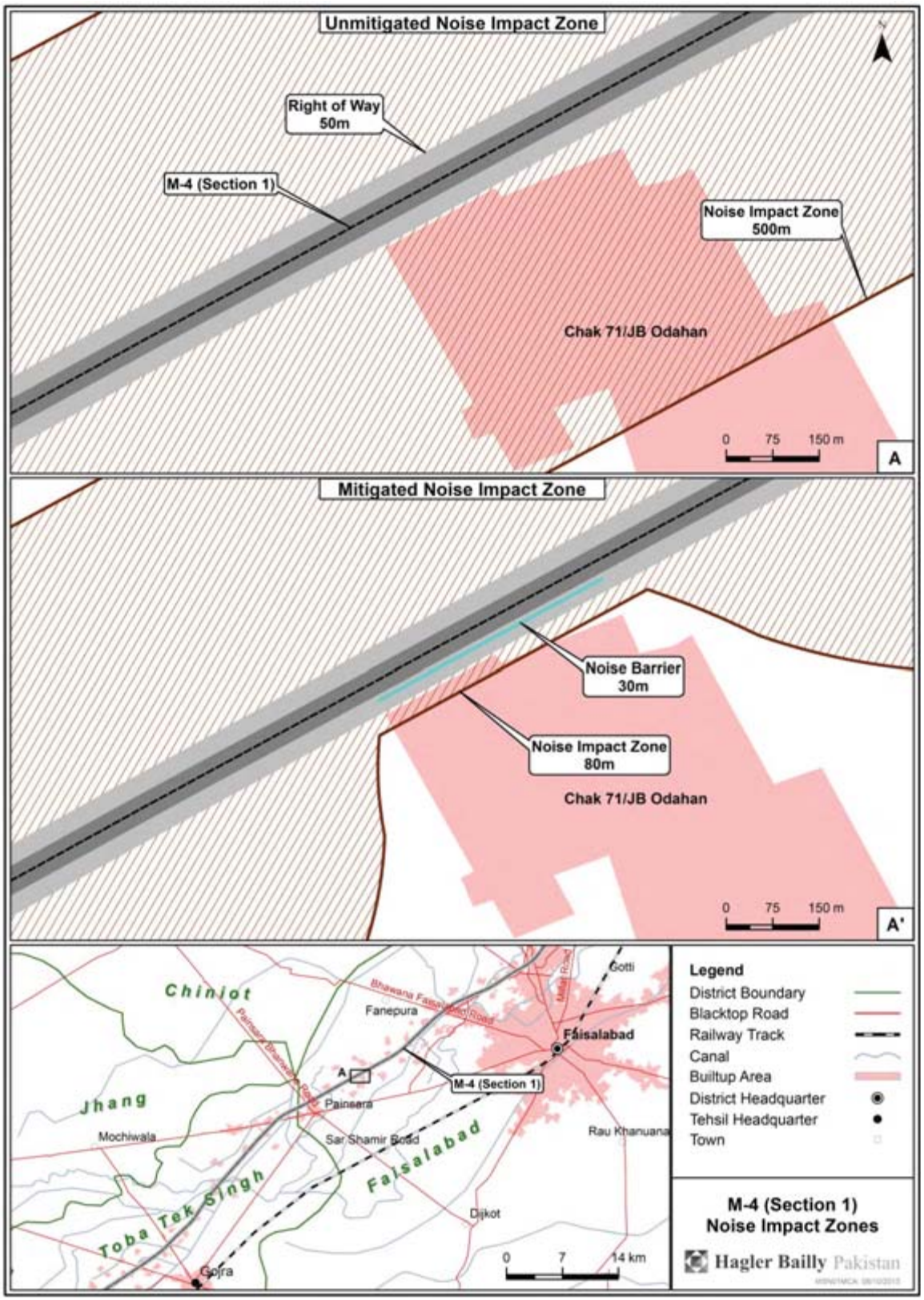
The above results show that Configuration–2 in 2015 and Configuration –3 in 2020 comply with NEQS for both 24 hour Ldn of 55 dBA and night time Leq of 45 dBA at a distance of 50 m from the center of motorway. However, as the M-4 Motorway becomes fully operational the day time noise levels exceed the NEQS limit by 1 to 2 dBA in 2025, whereas the night time noise level exceeds the NEQS limit by 1 to 4 dBA in 2020 and 2025 at a distance of 50 m from the center of the road. Relationship between night time noise level and distance from the centre of the motorway for Section–1 in 2025 which is the worst case is shown in **Exhibit 8.5**.

Exhibit 8.5: Noise level at Varying Distances for Section–1 (M-4 Motorway) Reflecting the Worst Case



The above graph shows that after attenuation of 12 dBA due to the noise barrier the night time NEQS for noise is met at a distance of 80 m from the centre of the motorway. One village along Section–1 of the M-4 Motorway was taken as an example to illustrate the noise impact on this village before and after the construction of noise barrier as shown in **Exhibit 8.6**.

Exhibit 8.6: Unmitigated and Mitigated Noise Levels along Section–1 of M-4 Motorway



The village without noise barrier was originally in the noise impact zone of 500 m but as the noise barrier was introduced the noise impact zone reduced to a distance of 80 m.

There are an estimated 125 villages along the whole length of M-4 Motorway that fall in the 500 m noise impact zone. After the provision of noise barrier of length of approximately 400 m to 600 m at the edge of the carriageway (depending on the size of the village), along these villages only about 10 of them will be subjected to noise level exceeding NEQS by 1 dBA to 4 dBA which could be considered acceptable given the cost of construction of noise barriers and will reflect a significant improvement over prevailing practices for noise attenuation along highways in the country.

The following measures are proposed course of action:

- All receptors falling within 500 m of all the sections of the M-4 will be identified and categorized by distance and size.
- For each receptor, an initial noise assessment will be carried out during which 24-hour noise data shall be collected at the nearest residential unit within the receptor. Hourly traffic count shall also be undertaken simultaneously.
- A risk assessment shall be undertaken for all the receptors. The result of the risk assessment will be categorization of the receptors into, say, the following categories:
    A. Receptors where noise level is already above the NEQS;
    B. Receptors where NEQS is likely to be exceeded in the next 3 years; and
    C. Receptors where there is no immediate risk of non-compliance.
- Measures shall be undertaken to construct noise walls in receptors falling in Category A.
- An annual noise monitoring program shall be initiated. In this noise levels in all receptors falling in Category A and B will be monitored once a year. Similar assessment will be carried out for Category C receptors once every three years.

In addition to the above, NHA will initiate a research program in collaboration with the EPAs to determine a risk based standards for traffic noise.

8.1.2 Air Quality

In general, the impact on air quality is not significant. However, there is opportunity to improve the air quality of the CoI by taking certain measures. These are as follows:

- A program shall be launched to test emission from motor vehicles entering the motorway. Vehicles with excessive emission shall be warned and, in association with the Punjab EPD, a system of fine could be initiated.
- Use of M-4 for vehicles emitting excessive smoke shall be made prohibited. If the problem is with engine tuning, tuning centers may be set-up at the motorway where such vehicles may be tuned before allowing them on the motorway. The cost of tuning shall be borne by the vehicle owners.

- Thick avenue of trees shall be planted in areas where there is a dust problem.

8.2 Environmental Monitoring

Similar to the mitigation measures, monitoring at the local level is the most effective way of monitoring environmental impacts. No new monitoring measure are being proposed for the CEIA.

8.3 Adaptive Management and Evaluation

This section outlines the framework for adaptive management that needs to be applied to respond to changing pressures in the Project area, and unforeseen or unexpected outcomes of the management and mitigation measures applied.

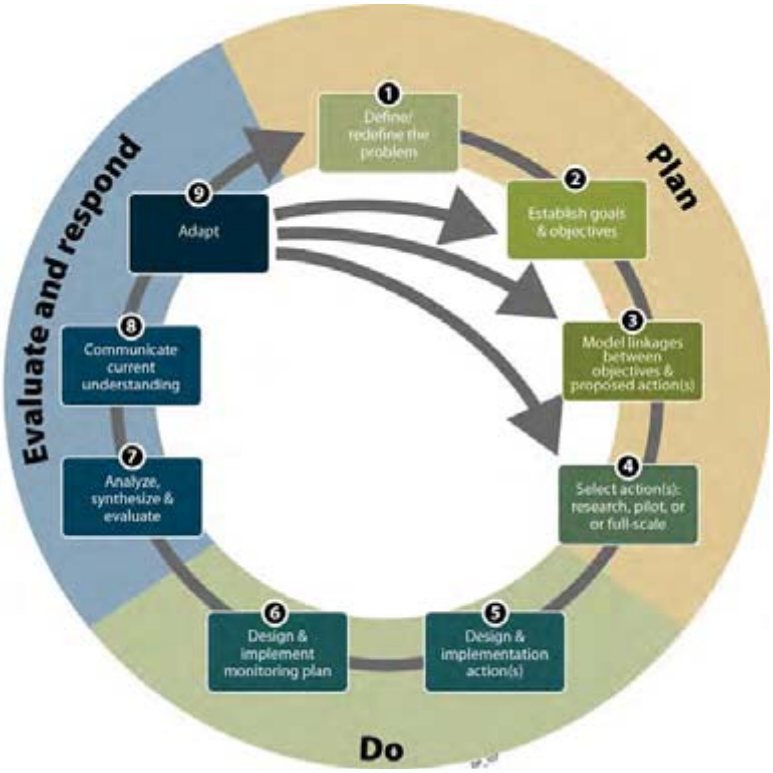
8.3.1 Adaptive Management Framework

Adaptive management defined as *a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs*. An adaptive management approach provides a structured process that allows for taking action under uncertain conditions based on the best available science, closely monitoring and evaluating outcomes, and re-evaluating and adjusting as more information is obtained.

This section outlines potential adaptive management requirements that need to be applied to respond to changing circumstances. This shall include adaptive management and changes to the monitoring and mitigation requirements.

The framework for adaptive management is outlined in **Exhibit 8.7.**

Exhibit 8.7: Adaptive Management Framework



8.3.2 Revision of Monitoring and Management Plan

The management and monitoring outlined in this section and in the EIA may need revision, as new information is obtained and due to changing circumstances. This section includes the requirements for evaluation of the monitoring and mitigation plan, and its on-going applicability.

The National Highway Authority shall commission studies to evaluate the mitigation and monitoring which may include:

- review of records and monitoring data
- review of annual monitoring reports
- review of operational changes needed
- carrying out evaluation of the monitoring and management and providing recommendations.

The mitigation and monitoring should be evaluated every 3 years following start of operation, taking into account the results of monitoring and reporting. The evaluation should include recommendations on whether the mitigations and monitoring need revision.

Evaluation should include assessment of the following (but not limited to):

- Consideration of any unavoidable digression from management measures

- Results of monitoring and reporting, and monitoring reports.
- Opportunities identified by constructors, operators, and the National Highway Authority.
- Any additional risks identified during the course of operations and from examination of monitoring results.
- Changes in community concerns and pressures, and other unanticipated stakeholder concerns identified during the course of construction or operation by the National Highway Authority.

Following an evaluation and review of changes recommended by the National Highway Authority, an updated mitigation and monitoring plan shall be formulated in consultation with ADB and the community stakeholders. All revisions to mitigation and monitoring shall be documented with a clear decision making trail and included as an appendix to the revised mitigation and monitoring plan.

8.4 Responsibility

The National Highway Authority will be responsible for making adaptive management decisions after consultation with relevant parties and stakeholders, including the Project lenders, and any Project implementation organizations, monitoring and evaluation consultants and community stakeholders.

9. Conclusions

ADB is financing the construction of Motorway M-4 Gojra–Shorkot Section for the National Trade Corridor Highway Investment Program (NTCHIP) of the Government of Pakistan. The National Highway Authority is the implementing agency for the project. The Cumulative Environmental Impact Assessment (CEIA) of the project was carried out in compliance with the ADB SPS 2009. Literature research and consultations were conducted with the community and institutional stakeholders within the corridor of impact of the project to identify Valued Environmental and Social Components (VECs) considered as significant in assessing risk associated with the cumulative impacts. The CEIA covered the proposed project for which an EIA was conducted earlier by NHA, as well as other reasonably forseeable developments in and around the project area that could affect the VECs.

Key VECs identified included air quality and noise that can impact public health, access to livelihood opportunities, and availability of land for agriculture. The overall perception of stakeholders in the long term perspective was highly positive and they considered it as an important development for the local economy. Modeling studies were conducted to predict the cumulative long term impacts of operation of the project on noise and air quality in the corridor of impact extending to 500 m form the center of the carriageway on each side. While the project will meet the National Environmental Quality Standards (NEQS) for air quality, mitigation of noise will be required to meet the night-time NEQS for noise in the corridor of impact. Feasible mitigation measures may be required in future are evaluated and discussed in the report.

An environmental management and a monitoring plan was included to provide guidelines to NHA for management of the impacts, including a framework for adaptive management to respond to concerns of the community during project operation.

The plan included measures for initiating a program to test emission from motor vehicles entering the motorway. Vehicles with excessive emission will be warned and, in association with the Punjab EPD, a system of fine could be initiated. It also planned that thick avenues of trees will be planted in areas where there is dust problem.

The proposed mitigation measure for noise included initiating a risk-based monitoring program for all receptors falling within 500 m of M-4 and, as a result construction of noise walls at appropriate places. In addition, NHA will initiate a research program in collaboration with the EPAs to determine a risk based standards for traffic noise.

Appendix A: Stakeholder Consultation Plan

See following pages

Hagler Bailly Pakistan

National Motorway M-4 Gojra–Shorkot Section Project Cumulative Environmental Impact Assessment (CEIA)

Stakeholder Engagement Plan

HBP Ref.: D5SP1MCA

July 20, 2015

Asian Development Bank

Philippines

Contents

10. Introduction

The Asian Development Bank (ADB) under the National Trade Corridor Highway Investment Program (NTCHIP) aims to assist Government of Pakistan (GoP) in improving road connectivity along the main North-South National Highway Corridor (NHC) that will support the National Trade Corridor (NTC)[77]. The NTCHIP was approved by the government in 2005. The NTCHIP Program is financed by ADB through a Multi-tranche Financing Facility (MFF-0016) which was approved in 2007. The MFF consists of several tranches, each covering several subprojects.

The Tranche–1 of NTCHIP includes construction of a two lane, 184 km long dual carriageway by the National Highway Authority (NHA) connecting Faisalabad to Khanewal (M4 Motorway or M4 Project, see **Exhibit 1.1**), including full depth asphalt pavement, bridges, flyovers, underpasses and interchanges. The Motorway has been designed to provide a safe, congestion free and high speed corridor for the traffic expected on the route that is an important part of the projected transportation network in the country. This Motorway will also improve the communication network within Punjab.

The M4 Project was divided into three sections for implementation; **Section–I:** (Faisalabad–Gojra), **Section–II** (Gojra–Shorkot), and **Section–III** (Shorkot–Khanewal). The **Section–IV** of the project includes construction of two bridges, one over Sadhnai Spill Channel and the other on River Ravi. The motorway connecting Khanewal to Multan is known as Extension of M–4. The road is in its finishing stage and is expected to open for traffic in 2015.

The Section–I of M4 (Faisalabad–Gojra) has been completed and opened for traffic on March 16, 2015. Whereas, the construction of Section–II of the M4 (Gojra–Shorkot) is expected to start shortly. Section–II of M-4 will be implemented under Tranche–4 of NTCHIP. In addition to these, M4 Extension Project with total length of 63 km connecting Khanewal to Multan is currently in its completion stage. The Section–III of the M–4 will be connected to this extension to extend M4 Motorway to Multan city.

This report documents the Cumulative Environmental Impact Assessment (CEIA) of the Section–II (Gojra–Shorkot) of M–4 in combination with the past, present and reasonably foreseeable future development along the alignment of existing M–3 and Section–I of M4 motorways (the 'Project') to comply with the requirements of ADB Safeguards Policy Statement 2009[78] (ADB SPS 2009) with respect to cumulative and induced impacts of the Project. For this purpose, ADB made available the services of Mr Vaqar Zakaria, Environmental Specialist, through Hagler Bailly Pakistan (Pvt.) Ltd. (HBP) to NHA.

[77] 40075–023: National Trade Corridor Highway Investment Program, Tranche–1 Project Data Sheet. Asian Development Bank, (source: http://adb.org/projects)

[78] Asian Development Bank, "ADB Policy Paper; Safeguard Policy Statement" Manila, June 2009.

Terminologies

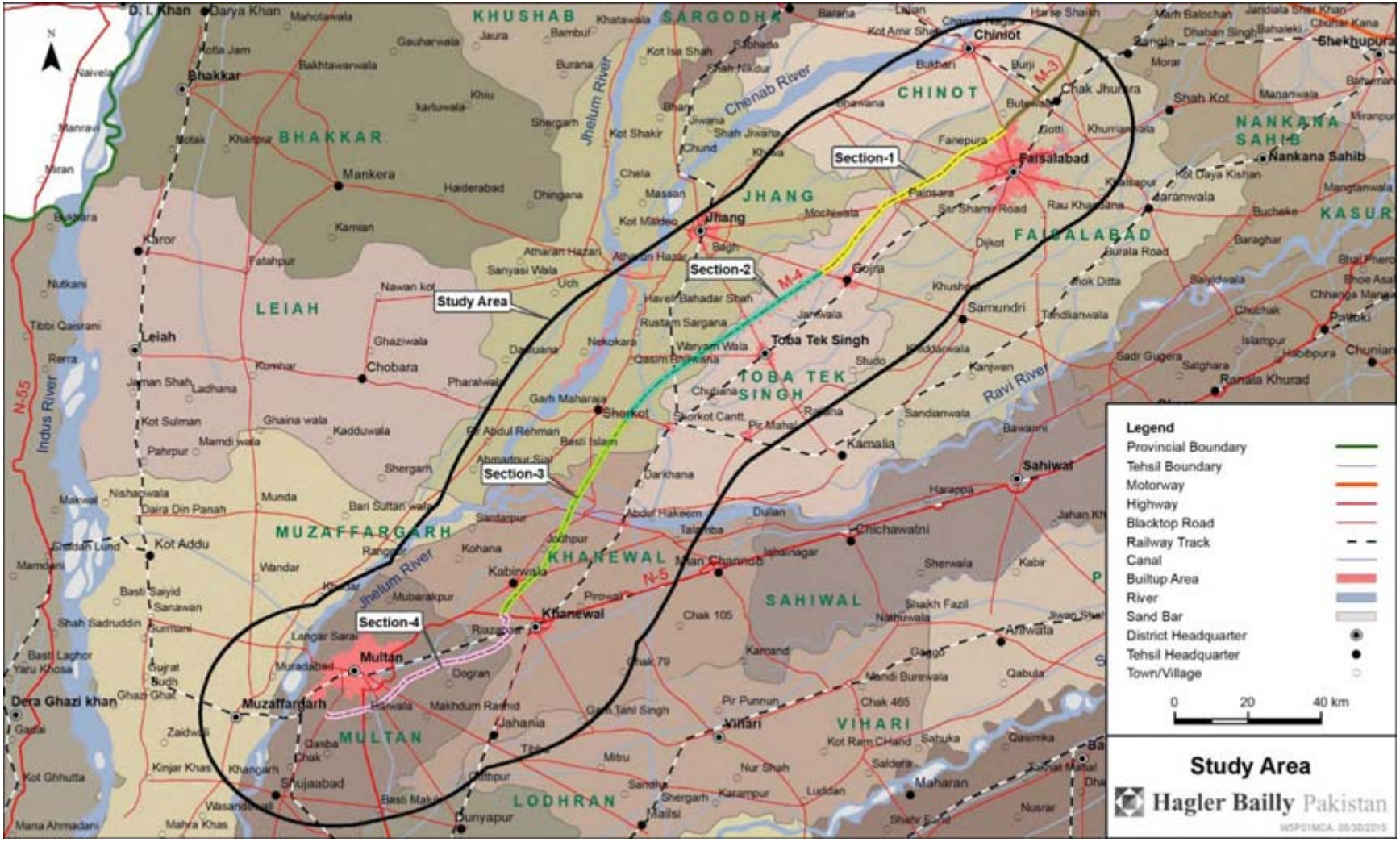
Following terminologies are used in this document:

Project	Section–II of M4, connecting Gojra to Shorkot with the total length of 62 km
Study Area[79]	The area where Developments are planned or are anticipated; or where the environmental or social impacts of the Developments are likely to take place; or where the development activities are likely to impact the VECs. The map of the Study Area is provided as **Exhibit 1.1.**
Study	Collectively, the identification of VECs and CEIA of the current and planned developments of the Study Area on VECs.
Developments:	M–3 and M–4 motorways and all the past, present and reasonably foreseeable industrial and residential developments in the Study Area
Stakeholders	Persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community or other businesses.[80]

[79] For the initial scoping, a 30 km Study Area is marked on both sides of the M3 and M4 motorways.

[80] International Finance Corporation "*Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets"* World Bank Group, Washington, D.C. United States of America, May 2007. http://www1.ifc.org/wps/wcm/connect/938f1a0048855805beacfe6a6515bb18/IFC_StakeholderEngagement.pdf?MOD=AJPERES

Exhibit 1.1: Study Area



10.1 Objectives of SEP

The objectives of stakeholder engagement plan are to:

- Ensure involvement of the stakeholders in decision-making of the study;
- Identify, assess and inform stakeholders of the future developments and their consequences;
- Aid in identification of VECs that the Developments may impact;
- Seek input from key stakeholders on planned development (Section–II of M–4) to increase its positive outcomes and avoid or mitigate negative impacts, and
- Specifically for the VECs:
  - Identify how the VECs have been affected by the existing developments and hence are likely to affected by the Project and Developments; and
  - Gather data and information from the stakeholders' perspective on the VECs, as well as about their relations/dependence on them.
- Identification of appropriate mechanism for grievance mechanism and involvement of the stakeholders in the monitoring of environmental and social impacts of the Project and Development.

10.2 Good Practice Principles

The consultations will be undertaken in good faith, while remaining impartial. The good practice principles which will be observed during the consultations are:

- *Cultural sensitivity* – this requires understanding and appreciation of the social institutions, values, and culture of the communities in the project area and respect for the historical, cultural, environmental, political and social backgrounds of the communities which are affected by a project;
- *Interactive approach* – stakeholders' engagement should not be limited to one-way dissemination of information. Stakeholder comments should be fed into the decision making processes for the proposed project design;
- *Open, transparent and informative* – government, institutions, industries and communities who are interested or can be affected by the proposed developments should have access to relevant information, in a simple and understandable format;
- *Inclusive and equitable* – Ensure that all stakeholder groups are represented, including less represented groups such as women, children, elderly and poor people;
- *Appropriateness and flexibility* – stakeholder engagement methodologies (meetings, workshops etc.) must be appropriate to the specific phase of the PESR and CIA process and the stakeholder groups identified. The consultation should also be adjusted according to the resources available;

- *Capacity building* – capacity building should be a part of interaction with stakeholders, wherever appropriate and practicable.

10.3 ADB Stakeholder Participation Guidelines

Asian Development Bank considers stakeholder participation as a tool to support good governance, citizenship, and accountability and promotes innovation, responsiveness, and sustainability, linked directly to development effectiveness. ADB in its stakeholder engagement guidelines provided in ADB–Guide to Participation, emphasis on following best practices to be adopted while involving stakeholders in decision making process.[81]

10.3.1 Core Principles of Stakeholder Participation

The stakeholder engagement ensures participation of affected and interested groups in development activities. The depth of the involvement of the stakeholders vary depending upon developmental context, however, several principles remain constant.[82] They include:

- **Promote accountability and transparency**: Participatory mechanisms hold decision makers accountable to their stakeholders. They promote communication and openness about activities, and transparency in the objectives of participation and degree of stakeholder influence.
- **Allow for participation at all levels**: People participate at any and all levels of decision making (policy, program, and project) through timely, flexible activities that suit their skills, abilities, and interests.
- **Make participation accessible to all**: All people are valued equally, opportunities for participation are adequately communicated and offered fairly, and barriers that stop particular groups getting involved are challenged.
- **Value diversity**: The diversity of people's experiences, backgrounds, beliefs, and skills offer a unique resource for society. Celebrating and capitalizing on this is key to participation.
- **Ensure participation is voluntary**: People involve themselves in decision making because they believe in the importance of issues at stake and that their participation will make a difference. Avoid coercion.
- **Encourage stakeholders to create their own ideas and solutions**: In community-led participatory approaches people take action themselves in ways they choose.

To ensure adequate participation, following steps will be coursed to achieve measurable results[83]:

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[81] Asian Development Bank, "*Strengthening participation for development results: An Asian Development Bank guide to participation*" Mandaluyong City, Philippines: Asian Development Bank, 2012

[82] Ibid

[83] Asian Development Bank, "*Strengthening participation for development results: An Asian Development Bank guide to participation*" Mandaluyong City, Philippines: Asian Development Bank, 2012

5. analyze stakeholders to understand who is interested in development activities and their relationships;
6. consulting with stakeholder groups in reviewing a policy or strategy or in designing a project to understand their views
7. engaging stakeholders systematically through an agreed Participation Plan; and
8. informing stakeholders of the accountability mechanism.

10.4 Engagement Activities and Steps

On the basis of both ADB and World Bank Group stakeholder participation guidelines, various steps involved in stakeholder engagement are identified, starting from stakeholder identification to management functions adopted to address the concerns and incorporate the suggestions of the stakeholders in decision making processes pertaining to Developments.

The key steps to be followed in this stakeholder engagement are provided in **Exhibit 1.2**.

Exhibit 1.2: Summary of Stakeholder Engagement Activities and Steps

Steps	*Description*
Stakeholder identification and analysis	► Identification of government bodies, regulatory agencies, industries and communities which are associated or have a stake in VECs in the Study Area.
Information disclosure	► The purpose and details of the CEIA study will be shared with the stakeholders. A map of the Study Area showing the alignment of the M3 and M4 motorways will be shared with the stakeholders during the meeting to record their concerns related to the Project, identify VECs of the Study Area and share knowledge about reasonable foreseeable developments in the Study Area.
Stakeholder consultation	► Stakeholders will be informed prior to the consultations. The time and venue for the consultations will be shared and agreed with the stakeholders. ► Consultations with the communities will be held within the settlements, to extent possible. Where due to logistic or security concerns, it is not possible to hold consultations with the community, a nearby community or location will be selected, to ensure maximum participation. Separate consultations with the female members of the community will be held. ► The consultations will be targeted and meaningful i.e. directly related to the Developments ► The consultation mechanism will include unstructured interviews and discussions directly following the structured discussions focusing on the Project, Developments and existing VECs ► The proceedings of the consultation meetings will be recorded. The findings of the consultations will be shared with ADB and NHA.
Reporting to Stakeholders	► Feedback consultations will be held to inform the stakeholders about the results of the Study and the recommendations for corrective actions to address their concerns and mitigate the impacts associated with the existing and proposed Developments

10.5 Grievance Redress Mechanism

Timely and effective redress of stakeholder grievances contribute to bringing sustainability in the developments in an area. In this context, the SEP will help advocate the process of forming and strengthening relationships between M4 management and the stakeholder community groups and bridge any gaps to create a common understanding, providing the NHA management the 'social license' to operate in the area. The grievance redress mechanism Project and other Developments will help achieve the objectives of sustainability and cooperation by dealing with the environmental and social issues of the Project.

The purpose of the complaints procedure will be to ensure all complaints from local communities are dealt with appropriately, with corrective actions being implemented and the complainants being informed of the outcome. The SEP will aim to ensure that grievances are treated without prejudice. The grievance mechanism to be included in the SEP will possess the following salient features:

- Designated contact points and/or personnel to receive and register complaints,
- All grievances (verbal and written) will be registered in a Complain Log and a generic report will be generated on a quarterly basis,
- NHA and other decision makers will respond to all grievances within 30 days of submission – and more quickly in cases where there is specific urgency,
- NHA and other decision makers will screen and assess the severity of the complaint,
- NHA and other decision makers may reject a complaint with justifications provided to the complainant or refer the matter to other authorities as appropriate,
- If accepted, NHA and other decision makers will define an approach to resolve it, implement the approach, communicate approach to the complainant and keep track of the measures included in approach,
- NHA and other decision makers will conduct feedback consultations to determine the effectiveness of the approach taken to resolve issues and record community perception on the grievance resolution mechanism, and
- Communicate with relevant authorities regarding outcomes and any further actions to be taken.

11. Identified Stakeholders

The stakeholders in the Study Area are identified through:

- review of existing developments within the Study Area;
- review of existing land-use to identify additional developments in the region (e.g. Faisalabad Industrial Estate on M–3).
- review of previous consultations carried out as part of M–4 update EIA; and
- review of ecological and socioeconomic profile of the Project area developed for the updated EIA of the Project.

On the basis of the above, the following stakeholders are identified that may be affected or hold an interest in the Project and Developments.

- Communities within the Study Area along the alignment of M–4 motorway; and
- Government and regulatory authorities directly or indirectly connected to or overseeing, the Project and Developments.

The list of identified stakeholders along with the consultation schedule is provided in **Exhibit 2.1**.

11.1 Consultation Plan

To identify those VECs that the Project and other existing and proposed Developments in the Study Area may impact, and to identify the vulnerability of these VECs in relation to development activities.

Focus will be key industry groups within Study Area, agriculture dependent communities, their dependence on water and soil and status of both, and other communities that may be affected by the Project and Developments in the Study Area (due to increased noise, emissions, traffic etc.)

The list of identified stakeholders, along with their address and consultation schedule is provided in **Exhibit 2.1.**

11.2 Consultation Mechanism

The consultation mechanism to engage institutional and community stakeholders is as follows.

11.2.1 Consultations with Institutional Stakeholders

The identified key institutional stakeholders will be informed in advance about the consultations through telephone. During the consultations, HBP's consultation team will present information related to Project and the stakeholder engagement process, and respond to and record any comments and queries from the participants.

The institutional stakeholder consultations will focus on identifying any planned, or reasonably foreseeable future development in the Study Area which will aid in CEIA of the Project and Developments.

11.2.2 Consultations with Communities

The community groups in the surroundings of the M4 that are most likely to be impacted, both negatively and positively, by the Project and Developments will be consulted within their settlements and combined consultation sessions will be arranged where possible.

The HBP consultation team, comprising of both male and female consultation specialists will visit these communities to conduct consultations. Separate consultations will be conducted with male and female members of the communities keeping in mind cultural sensitivity within Pakistan and Punjab province.

Representatives, notables, educated personnel, government and private employees and other interested groups (on the basis of difference in ethnicities and culture) from the potentially affected communities will be invited. The Project related information and Study Area map will be shared with the attendants. The discussions will focus on identifying the VECs and their current status.

11.3 Tentative Schedule

The tentative schedule for the ESR consultations is the first week of July, 2015 and will be completed in about 5 to 6 days.

The consultation schedule along with stakeholders is provided in **Exhibit 2.1**.

Exhibit 2.1: List of Identified Stakeholders and Meeting Schedule

Day	*Stakeholder*	*Meeting Time*
Institutional Stakeholders		
Day 1 (July 01, 2015)	Pakistan Industrial Development Corporation	9:30 am
	Punjab Small Industries Corporation	11:00 am
	Directorate of Industries, Punjab	12:30 pm
	Punjab highway department	2:00 pm
Day 2 (July 02, 2015)	Multan Chamber of Commerce and Industry	10:00 am
	Transporters Association, Multan	12:00 pm
Day 3 (July 03, 2015)	Faisalabad Industrial Estate Development and Management Company (FIEDMC)	9:30 am
	Faisalabad Chamber of Commerce and Industry	11:00 pm
	Trasporters Association, Faisalabad	12:30 pm
Community Stakeholders		
Day 4 and 5 (July 04 and 05, 2015)	Communities residing in the Study Area along the alignment of Seciton 2 (Gojra–Shorkot) of M4 and near the interchanges	
Day 6 (July 06, 2015)	Contigency day; any institution(s) left due to availability issues will be consulted	

Appendix A: Institutional Stakeholder Consultation Logs

See following pages.

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	Punjab Small Industries Corporation (PSIC)		
Date:	July 01, 2015		
Time:	9:15 am		
Meeting Venue:	PSIC office, Al-Falah Building, Shahrah-e-Quaid-e-Azam, Lahore		
Attended by:	*Name*	*Designation*	*Contact*
	Mr Khalid Iqbal (KI)	Director, Planning	92 334 4118520
	Mr Sabih Zaka (SZ)	Cirector, Commercial	92 300 9419942
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities. At the end of the informative session, MA invited the KI and SZ to express and share their views related to the development of M3 and M4 motorways and identify any present and reasonably foreseeable future developments planned by PSIC along or near the alignment of these motorways.		

Meeting Minutes

Views on the existing M3 and M4 motorways: Both the attendees appreciated the development of motorways in the country considering them as a major step towards economic development of Pakistan. KI, comparing the motorways with the recently announced China-Pakistan economic corridor, recognized the route of the motorways as more important connecting north with the south of the country touching major industrial cities like Faisalabad and Multan. The participants called the spread effects of motorways as “unprecedented” providing opportunities for investment to the industrialists due to easy access to north and south of the country and employment for communities residing along the route of these motorways.

PSIC current developments in the Study Area: Currently PSIC is managing two industrial estates in the Study Area, one on KhanewalJhanian link road called Small Industrial Estate, Khanewal and, second on LahoreFaisalabadJhang road known as Faisalabad Small Industrial Estate. The attendees recognized the route of the M3 and M4 motorways as a major breakthrough in proffering easy access to these industrial estates to the other parts of the country.

Future/Planned projects: PSIC has planned and proposed a mini industrial estate in Shorkot Cannt to the government of Punjab and is currently involved in the planning of artesian villages along the main highways of Punjab, the project initiated by Chief Minister Punjab under the name of “Retail Parks cum Outlets of Handicrafts on Main Highways of Punjab”. The first park of its kind will be developed on MultanKhanewal road, 25 km from Multan towards Lahore.

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	Pakistan Industrial Development Corporation (PIDC)		
Date:	July 01, 2015		
Time:	10:30 am		
Meeting Venue:	PIDC office, Shahrah-e-Quaid-e-Azam, Lahore		
Attended by:	*Name*	*Designation*	*Contact*
	Mr Javed Iqbal (JI)	Economic Advisor	92 42 99210541
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities to JI. At the end of the informative session, MA invited JI to express and share his views related to the development of M3 and M4 motorways and identify any present and reasonably foreseeable future developments planned by PIDC along or near the alignment of these motorways.		

Meeting Minutes

Mr Javed Iqbal told that currently PIDC does not have any plan to develop an industry or industrial estate along the alignment of M3 and M4 motorways. Currently PIDC is only engaged in the management and development of Sargodha Industrial Park (SIP) which is an agro based industrial development.

In addition, Mr Iqbal shared his views about the importance of the route of the motorways in relation to the location of SIP stating that these future infrastructure developments will provide easy and economically efficient access to the products of SIP to the south Punjab increasing the business market for the industries of SIP.

Mr Iqbal shared contacts of PIDC's subsidiary companies, Furniture Pakistan, Technology Up-gradation and Skill Development Company and National Industrial Park. Due to shortage of time and limited office working hours in Ramadan, telephonic consultations were held with the representatives of these organizations. None of the representatives from these identified any plans to develop an industry or facilitate developing one along the alignment of M3 and M4 motorways.

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	Directorate of Industries, Punjab (DoIP)		
Date:	July 01, 2015		
Time:	12:30 pm		
Meeting Venue:	Directorate of Industries, Ponch House, Chobarji, Lahore		
Attended by:	*Name*	*Designation*	*Contact*
	Mr Khalid Saeed (KS)	Deputy Director, Planning	
	Amjad Afzal (AA)	Assistant Director Planning	92 333 4244720
	Akbar Shah (AS)	Officer, Planning	92 301 4145859
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities to the attendees. At the end of the informative session, MA invited attendees to express and share their views related to the development of M3 and M4 motorways and identify any present and reasonably foreseeable future developments planned by the Directorate of Industries, Punjab along or near the alignment of these motorways.		

Meeting Minutes

Mr Saeed told that DoIP is no more engaged in industrial development in the province. The government of Punjab has formulated a new company for the development and management of industrial estates in the Punjab province with the name Punjab Industrial Estates Development and Management Company (PIEDMC). PIEDMC is an independent body with a head office in Sundar Industrial Estate, located to the east of the Riwind Road, Lahore. Mr Saeed shared the number of Mr Wajeeh Nadeem Iqbal, Manager Engineering and Planning Department, PIEDMC. Telephonic consultation was held with Mr Nadeem in which he told that currently PIEDMC is not planning to develop any industrial estate along the M3 and M4 motorways and that PIEDMC, as a company has no concern/issues associated with the development of these motorways.

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	Punjab Highway Department (PHD)		
Date:	July 01, 2015		
Time:	1:45 pm		
Meeting Venue:	PHD, 2 Lake Road, Chobarji, Lahore		
Attended by:	*Name*	*Designation*	*Contact*
	Mr Imtiaz Ahmed	Deputy Director Planning	92 423 99212655
	Mr Pervez Iqbal	Chief Draftsman	92 423 99212648
	Mr Ghazanfar Abbas	Sub-Engineer	92 320 4431250
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities to the attendees. At the end of the informative session, MA invited attendees to express and share their views related to the development of M3 and M4 motorways and identify any present and reasonably foreseeable future developments of road networks in the province of Punjab to facilitate and provide easy access to the communities living in the areas along and around the alignment of these motorways.		

Meeting Minutes

Mr Imtiaz told that PHD does not plan development of the road, in fact the PHD is only limited to upgrade, repair and develop road networks planned by the Planning Division of the Punjab government. The initiative for the development of roads is taken by the community putting up their need to either their local member of National Assembly (MNA) or District Coordination Officer (DCO). The plan after the approval of MNA or DCO is put up to the Planning Division of the Punjab government which takes a decision and if required, mobilize PHD to construct the roads.

In addition, the PHD through its surveys and complaints registered by the local community, repairs and widens the existing roads which has either become insufficient to cater the needs of increased traffic flows over time or are damaged by floods of 2010-11 in the southern Punjab.

Mr Imtiaz further told that development of any road to facilitate access to motorways is planned and developed by National Highway Authority alone, and PHD, to date, has received any plan or directives from the Punjab government to develop any road with a key objective to link some specific area with motorways.

PHD shared the list of their current projects in the Study Area which includes repair and widening of existing roads in the south Punjab. These roads are not repaired or widened with an objective to facilitate access to motorways, however, development of these will surely provide easy and efficient access to the communities residing along their routes to different parts of the province including cities/towns with motorway interchanges. Therefore, these development, are expected to play an important role in offering an easy access to the residents of these area to different parts of the country by reaching motorways.

The list of the under-repair roads in south Punjab, falling within the Study Area is provided below:

- Rehabilitation of Pir MahalKamalia Road (total length 17.42 km)
- Widening of Satiana Road to village 258/RB Dijkot Morr (total length 20.20 km)
- Improvement of Pir MahalDarkhanaShorkotToba Road (length 20.00 km)
- Conversion of single to dual carriageway of SumundariRajanaToba Tek Singh Road (total length 45.00 km)
- Construction of bridge and road to connect JhangShorkotKabirwala road to Meerak Sial (length 430 m)
- Construction of expressway from Shujabad to Nag Shah (length 26.15 km)

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	General Bus Stand, Multan		
Date:	July 02, 2015		
Time:	10:15 am		
Meeting Venue:	Office of the Supridendent, General Bus and Truck Stand, Multan		
Attended by:	*Name*	*Designation*	*Contact*
	Mian Wali Muhammad	General Secreatry, Bus Stand	92 313 8730896
	Ejjaz Hussain Bhutta	Supridendent, Multan Bus and Truck Stand	92 300 8739867
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities to the attendees. At the end of the informative session, MA invited Mr Ali and Mr Bhutta to express and share their views related to the developmental plan and route of M3 and M4 motorways and their concerns/suggestions related to these.		

Meeting Minutes

Views on the development of M4: B**o**th the attendees appreciated the development of motorways in the country considering them as an opportunity for the transporters to start providing services between Peshawar and Multan. Currently the passenger carrying heavy traffic vehicles commute through, N5 to reach Lahore, MuzaffargarhLayyahMianwali Road to reach Peshawar and KabirwalaShorkotjhang to reach Rawalpindi/Islamabad.

The attendees told that the construction of M4 connecting Multan to M2 will be a major breakthrough in improving the transportation between northern and southern parts of the country. In addition, they communicated that better roads result in less wearing and tearing of vehicle and fuel efficient commute between areas. Therefore, transporters will prefer using M4 rather than other routes which they are currently using.

Mr Wali shared his future plans including introduction of new buses providing state of the art travelling facilities to the travellers to reach Rawalpindi, Islamabad and Peshawar via Shorkot as soon as the Section 2 of the M4 is completed.

In general, both the participants valued the developments of road infrastructure in the country, especially the route and development of M4 in the south Punjab in relation to their business interest and easy and comfortable access for the passengers.

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	General Truck Stand, Multan		
Date:	July 02, 2015		
Time:	11:30 am		
Meeting Venue:	Office of the Operation Manager, General Truck Stand, Multan		
Attended by:	*Name*	*Designation*	*Contact*
	Malik Imdad Hussain	Manager Operations	92 300 9635035
	Malik Fazal Hussain	Deptuy Secretary	92 300 8734886
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities to the attendees. At the end of the informative session, MA invited both the attendees to express and share their views related to the developmental plan and route of M3 and M4 motorways and their role in relation to the transportation of goods on large cargo carrying trollers from Multan to the northern parts of the country.		

Meeting Minutes

Views on the development of M4: Both the attendees think highly of the development of M4 motorway connecting Multan to the northern parts of the country due to efficient transportation minimizing the events of truck break downs mostly associated with the compromised conditions of the road infrastructure of the country.

The attendees reported that currently the trucks commute through N5 highway to reach Lahore, where upon arrival before 10:00 pm, they are stopped at the entrance of the city and are allowed to enter city after 10:00 pm. This result in loss of time putting an extra cost on the transporter. On the other hand, it is not possible to manage truck traffic in a way to avoid a truck reaching Lahore before 10:00 pm because the delay in the departure of the truck sometimes result in many losses which include rotting of fruits, overcrowded truck stand causing mismanagement and additional cost of delayed delivery.

The attendees recognized the development of M4 as a major benefit for their business to access M2 to reach the north of the country avoiding delays resulting from various hurdles like bad condition of highways in Punjab and delays at the entrance of Lahore.

In addition, when they were asked about their views on the load/weight limits of motorways, the attendees told that the limitations should not only be applied to the motorways, but shall be applicable to all the highways in the country. This will not only reduce the damage of the roads caused by the movement of the heavy trucks but will also reduce the wearing and tearing of the goods carrying vehicles. When inquired about the reasons behind carrying extra load, the attendees identified the pressure of the clients as the major reason forcing them to carry more load then the capacity of the trucks.

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	Multan Chamber of Commerce and Industry (MCCI)		
Date:	July 02, 2015		
Time:	1:30 pm		
Meeting Venue:	Office of Mr Mian Iqbal Hussan, President of MCCI		
Attended by:	*Name*	*Designation*	*Contact*
	Mian Iqbal Hassan	President, MCCI	92 302 8631940
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities to Mr Hassan. At the end of the informative session, MA invited Mr Hassan to express and share his views related to the developmental and route of M3 and M4 motorways and their role in industrial development and share information on any plans of MCCI to develop industries along the alignment of these motorways.		

Meeting Minutes

Mr Hassan, the existing president of MCCI has also served as Chairman Punjab Industrial Estate Development and Management Company (PIEDMC) from 2009 to 2013. During the consultation meeting, questions were asked to inquire about the plans of both MCCI and of PIEDMC which were sketched during his chairmanship.

Mr Hassan told that MCCI is a trading body and is not independently involved in development of industries. The body acts to protect and promote the interests and rights of its member industrialists/businessmen and serve as a platform to communicate the concerns and reservations of its members at various national and international forums.

In addition, if any member(s) of the body wishes to develop industry, the chamber facilitates the plan by discussing and putting it forward at various platforms for approvals and sanctions.

When inquired about any plans shared by its members or PIEDMC during his tenure, to develop and promote industrial development along or near the alignment of M4, Mr Hassan told that currently, other than announced M3 Industrial Estate, Faisalabad, there is no any such plan to develop industry along the route of the M3 or Motorways.

Mr Hassan recognised M4 as an important economic corridor and has also informed about various communications between Government of Pakistan and China to develop industrial cities and parks along the whole alignment of motorways in Pakistan due to easy access to Karachi Port Terminal and Port Qasim. He, however, told that there is no such plan on grounds or under development to promote this industrial development along this key economic corridor connecting major industrial estates of Pakistan located in Hatter, Faisalabad, Multan and Karachi.

At the end of the meeting Mr Hassan shared his concerns related to the expected epidemic growth of the industries along the motorways compromising the biophysical environment of the area, marginalizing the already vulnerable communities. He emphasised on the sustainable development of socially and environmentally compliant industries along the motorways to ensure sustainable development of road networks as economic corridors in Pakistan.

CEIA of Section 2 (GojraShorkit) of M4, Punjab, Pakistan

Record of the Consultation Meeting

Stakeholder:	Faisalabad Industrial Estate Development and Management Company (FIEDMC)		
Date:	July 03, 2015		
Time:	10:30 am		
Meeting Venue:	Office of Chief Operating Officer, FIEDMC, First Floor, FCCI Complex, Canal Road, Faisalabad		
Attended by:	*Name*	*Designation*	*Contact*
	M Aaamer Saleemi	Chief Operating Officer	92 300 8652229
	Iran Shahzadi	Assistant Manager Marketing	92 335 9230235
Conducted by:	M Salman Ahmed (MA), Hagler Bailly Pakistan		
Recorded by:	MA		
Language:	English/Urdu		
Preamble:	The meeting started with the exchange of introduction between the participants. After the introduction, MA briefed the objective of the stakeholder consulation and gave a description of the CEIA study and the related activities to the attendees. At the end of the informative session, MA invited the attendees to express and share their views related to the development and route of M3 and M4 motorways in relation to the existing and planned motorways network connecting M3 Industrial Estate to the south Punjab facilitating the transport of material and products to and from the estate. At the end MA asked the participants to share the details of the existing, developing and planned industrial units in the M3 Industrial Estate.		

Meeting Minutes

The consultation meeting focused on identifying the future plans of the FIEDMC to develop M3 Faisalabad Industrial Estate (FIE). The respondents told that currently FIE is stretched over an area of 4,500 acres, divided into two phases; Phase I and Phase II. Phase I is further divided into Phase IA and Phase IB. Phase I is comprised of 1,565.95 acres, while Phase II has an area of 2934.05 acres.

FIEDMC is currently working on their vision 2020 plan with an aim to extend the FIE to an area of 10,000 acres in the same vicinity.

The FIEDMC has proposed their own 110 MW coal-fired power plant, which has been approved by Energy Board of Punjab, to meet the energy requirements of the future industries in the Estate. In addition, the respondents told that 777 acres of Phase I has been sold to various proponents from textile, chemical and food processing sector. The FIEDMC, after achieving goals set in their vision 2020, will be largest industrial estate in the country.

Appendix B: Traffic Counts for Air Quality Modeling

Exhibit C.1: PCU factor for each vehicle category

User Class	*Demand Segmentation*	*Matrix Level*	*Matrix Proportion*	*PCU Factor*
1	Motorcycle/Two Wheeler	1	93%	0.5
2	Auto Rickshaw/Three Wheeler	1	7%	0.75
3	Car/SUV/Taxi	2	100%	1
4	Station Wagon/ Jeeps/ 4WD	3	100%	1.25
5	Mini Bus	4	100%	1.5
6	Bus	5	100%	2
7	Truck - 2axle	6	21%	2.5
8	Truck - 3axle	6	21%	3
9	Truck - 4axle	7	58%	3.5
10	Truck - 5+axle	7	7%	4
11	Truck - 2axle (overloaded)	6	30%	2.5
12	Truck - 3axle (overloaded)	6	28%	3
13	Truck - 4axle (overloaded)	7	31%	3.5
14	Truck - 5+axle (overloaded)	7	4%	4

Exhibit C.2: Traffic Count for Scenario 1

Category	*Route*	*Type of Vehicle*	*Traffic Flow (PCU/ADT) - Northbound*	*Traffic Flow (PCU/ADT) - Southbound*	*Total Traffic Flow (PCU/ADT)*	*Sub-Category*	*PCU Factor*	*Percentage by sub-category*	*Total Traffic Flow by sub-category (PCU/ADT)*	*Daily No of vehicles*
A	M3 - Motorway - PindiBhattian - Faisalabad	Light Vehicles	2,331.20	2,148.50	4,479.70	Cars/Taxi/SUVs	1	84%	3779.30	3779
						Jeeps/Station Wagons/ 4WD	1.25	16%	700.40	560
B		Bus	220.8	221.1	441.90	Minibus	1.5	76%	334.24	223
						Bus	2	24%	107.66	54
C		Truck	558.7	501	1,059.70	Light Truck	2.745	80%	848.53	309
						Heavy Truck	3.555	20%	211.17	59
A	M4 - Motorway - Faisalabad - Gojra	Light Vehicles	2,278.10	2,254.30	4,532.40	Cars/Taxi/SUVs	1	84%	3823.76	3824
						Jeeps/Station Wagons/ 4WD	1.25	16%	708.64	567
B		Bus	0	0	0.00	Minibus	1.5	76%	0.00	0
						Bus	2	24%	0.00	0
C		Truck	192.2	154	346.20	Light Truck	2.745	80%	277.21	101
						Heavy Truck	3.555	20%	68.99	19
A	M4 - Motorway - Khanewal - Multan	Light Vehicles	737.80	736.40	1,474.20	Cars/Taxi/SUVs	1	84%	1243.71	1244
						Jeeps/Station Wagons/ 4WD	1.25	16%	230.49	184
B		Bus	39.4	32	71.40	Minibus	1.5	76%	54.00	36
						Bus	2	24%	17.40	9
C		Truck	772.7	883.2	1,655.90	Light Truck	2.745	80%	1325.93	483
						Heavy Truck	3.555	20%	329.97	93

Exhibit C.3: Traffic Count for Scenario 2

Category	*Route*	*Type of Vehicle*	*Traffic Flow (PCU/ADT) - Northbound*	*Traffic Flow (PCU/ADT) - Southbound*	*Total Traffic Flow (PCU/ ADT)*	*Sub-Category*	*PCU Factor*	*Percentage by sub-category*	*Total Traffic Flow by sub-category (PCU/ADT)*	*Daily No of vehicles*
A	M3 - Motorway - PindiBhattian - Faisalabad	Light Vehicles	2,420.50	2,238.00	4,658.50	Cars/Taxi/ SUVs	1	84%	3930.15	3930
						Jeeps/Station Wagons/ 4WD	1.25	16%	728.35	583
B		Bus	145.5	151.5	297.00	Minibus	1.5	76%	224.64	150
						Bus	2	24%	72.36	36
C		Truck	1469.8	1250.2	2,720.00	Light Truck	2.745	80%	2177.98	793
						Heavy Truck	3.555	20%	542.02	152
A	M4 - Motorway - Faisalabad - Gojra	Light Vehicles	1,474.60	1,481.60	2,956.20	Cars/Taxi/ SUVs	1	84%	2494.00	2494
						Jeeps/Station Wagons/ 4WD	1.25	16%	462.20	370
B		Bus	0.6	0.6	1.20	Minibus	1.5	76%	0.91	1
						Bus	2	24%	0.29	0
C		Truck	2397.2	1921.9	4,319.10	Light Truck	2.745	80%	3458.42	1260
						Heavy Truck	3.555	20%	860.68	242

Category	*Route*	*Type of Vehicle*	*Traffic Flow (PCU/ADT) - Northbound*	*Traffic Flow (PCU/ADT) - Southbound*	*Total Traffic Flow (PCU/ADT)*	*Sub-Category*	*PCU Factor*	*Percentage by sub-category*	*Total Traffic Flow by sub-category (PCU/ADT)*	*Daily No of vehicles*
A	M4 - Motorway - Khanewal - Multan	Light Vehicles	513.00	518.10	1,031.10	Cars/Taxi/ SUVs	1	84%	869.89	870
						Jeeps/Station Wagons/ 4WD	1.25	16%	161.21	129
B		Bus	14.5	17.7	32.20	Minibus	1.5	76%	24.36	16
						Bus	2	24%	7.84	4
C		Truck	745.2	828.4	1,573.60	Light Truck	2.745	80%	1260.03	459
						Heavy Truck	3.555	20%	313.57	88
A	M4 - Motorway - Gojra - Shorkot	Light Vehicles	495.60	498.60	994.20	Cars/Taxi/ SUVs	1	84%	838.76	839
						Jeeps/Station Wagons/ 4WD	1.25	16%	155.44	124
B		Bus	0.5	0.5	1.00	Minibus	1.5	76%	0.76	1
						Bus	2	24%	0.24	0
C		Truck	2798.1	2250.6	5,048.70	Light Truck	2.745	80%	4042.64	1473
						Heavy Truck	3.555	20%	1006.06	283

Exhibit C.4: Traffic Count for Scenario 3

Category	*Route*	*Type of Vehicle*	*Traffic Flow (PCU/ADT) - Northbound*	*Traffic Flow (PCU/ADT) - Southbound*	*Total Traffic Flow (PCU/ADT)*	*Sub-Category*	*PCU Factor*	*Percentage by sub-category*	*Total Traffic Flow by sub-category (PCU/ADT)*	*Daily No of vehicles*
A	M3 - Motorway - PindiBhattian - Faisalabad	Light Vehicles	2,406.90	2,235.10	4,642.00	Cars/Taxi /SUVs	1	84%	3916.23	3916
						Jeeps/Station Wagons/ 4WD	1.25	16%	725.77	581
B		Bus	145.5	151.5	297.00	Minibus	1.5	76%	224.64	150
						Bus	2	24%	72.36	36
C		Truck	3641.2	3191.9	6,833.10	Light Truck	2.745	80%	5471.46	1993
						Heavy Truck	3.555	20%	1361.64	383
A	M4 - Motorway - Faisalabad - Gojra	Light Vehicles	1,479.50	1,483.10	2,962.60	Cars/Taxi /SUVs	1	84%	2499.40	2499
						Jeeps/Station Wagons/ 4WD	1.25	16%	463.20	371
B		Bus	0.6	0.6	1.20	Minibus	1.5	76%	0.91	1
						Bus	2	24%	0.29	0
C		Truck	4753.3	4055.6	8,808.90	Light Truck	2.745	80%	7053.53	2570
						Heavy Truck	3.555	20%	1755.37	494
A	M4 - Motorway - Khanewal - Multan	Light Vehicles	529.70	530.50	1,060.20	Cars/Taxi /SUVs	1	84%	894.44	894
						Jeeps/Station Wagons/ 4WD	1.25	16%	165.76	133
B		Bus	14.6	17.8	32.40	Minibus	1.5	76%	24.51	16
						Bus	2	24%	7.89	4
C		Truck	1379.1	1452.7	2,831.80	Light Truck	2.745	80%	2267.50	826
						Heavy Truck	3.555	20%	564.30	159
A	y - G	Light	549.90	542.50	1,092.4	Cars/Taxi	1	84%	921.60	922

Category	*Route*	*Type of Vehicle*	*Traffic Flow (PCU/ADT) - Northbound*	*Traffic Flow (PCU/ADT) - Southbound*	*Total Traffic Flow (PCU/ADT)*	*Sub-Category*	*PCU Factor*	*Percentage by sub-category*	*Total Traffic Flow by sub-category (PCU/ADT)*	*Daily No of vehicles*
	M4 - Motorway - Shorkot - Khanewal	Vehicles			0	/SUVs				
						Jeeps/Station Wagons/ 4WD	1.25	16%	170.80	137
B		Bus	0.5	0.5	1.00	Minibus	1.5	76%	0.76	1
						Bus	2	24%	0.24	0
C		Truck	6129.1	5254.2	11,383.30	Light Truck	2.745	80%	9114.93	3321
						Heavy Truck	3.555	20%	2268.37	638
A		Light Vehicles	974.50	957.80	1,932.30	Cars/Taxi /SUVs	1	84%	1630.19	1630
						Jeeps/Station Wagons/ 4WD	1.25	16%	302.11	242
B		Bus	69.3	63.3	132.60	Minibus	1.5	76%	100.29	67
						Bus	2	24%	32.31	16
C		Truck	6882.8	6200.1	13,082.90	Light Truck	2.745	80%	10475.85	3816
						Heavy Truck	3.555	20%	2607.05	733

Exhibit C.5: Traffic Count for Scenario 4

Category	*Route*	*Type of Vehicle*	*Traffic Flow (PCU/ADT) - Northbound*	*Traffic Flow (PCU/ADT) - Southbound*	*Total Traffic Flow (PCU/ADT)*	*Sub-Category*	*PCU Factor*	*Percentage by sub-category*	*Total Traffic Flow by sub-category (PCU/ADT)*	*Daily No of Vehicles*
A	M3 - Motorway - PindiBhattian - Faisalabad	Light Vehicles	2,996.20	2,762.80	5,759.00	Cars/Taxi/SUVs	1	84%	4858.58	4859
						Jeeps/Station Wagons/ 4WD	1.25	16%	900.42	720
B		Bus	166.4	173.2	339.60	Minibus	1.5	76%	256.86	171
						Bus	2	24%	82.74	41
C		Truck	5304	4744.6	10,048.60	Light Truck	2.745	80%	8046.20	2931
						Heavy Truck	3.555	20%	2002.40	563
A	M4 - Motorway - Faisalabad - Gojra	Light Vehicles	1,871.00	1,866.00	3,737.00	Cars/Taxi/SUVs	1	84%	3152.72	3153
						Jeeps/Station Wagons/ 4WD	1.25	16%	584.28	467
B		Bus	0.7	0.7	1.40	Minibus	1.5	76%	1.06	1
						Bus	2	24%	0.34	0
C		Truck	7013.2	6052.7	13,065.90	Light Truck	2.745	80%	10462.23	3811
						Heavy Truck	3.555	20%	2603.67	732
A	M4 - Motorway - Khanewal - Multan	Light Vehicles	733.70	732.70	1,466.40	Cars/Taxi/SUVs	1	84%	1237.13	1237
						Jeeps/Station Wagons/ 4WD	1.25	16%	229.27	183
B		Bus	17.8	21.3	39.10	Minibus	1.5	76%	29.57	20
						Bus	2	24%	9.53	5
C		Truck	2477.9	2796.5	5,274.40	Light Truck	2.745	80%	4223.36	1539
						Heavy Truck	3.555	20%	1051.04	296
A	y - G	Light	662.70	664.90	1,327.6	Cars/Taxi	1	84%	1120.03	1120

Category	*Route*	*Type of Vehicle*	*Traffic Flow (PCU/ADT) - Northbound*	*Traffic Flow (PCU/ADT) - Southbound*	*Total Traffic Flow (PCU/ADT)*	*Sub-Category*	*PCU Factor*	*Percentage by sub-category*	*Total Traffic Flow by sub-category (PCU/ADT)*	*Daily No of Vehicles*
		Vehicles			0	/SUVs				
						Jeeps/Station Wagons/ 4WD	1.25	16%	207.57	166
B		Bus	0.6	0.6	1.20	Minibus	1.5	76%	0.91	1
						Bus	2	24%	0.29	0
C		Truck	9063.4	7870.5	16,933.90	Light Truck	2.745	80%	13559.45	4940
						Heavy Truck	3.555	20%	3374.45	949
A	M4 - Motorway - Shorkot - Khanewal	Light Vehicles	1,201.90	1,168.40	2,370.30	Cars/Taxi /SUVs	1	84%	1999.70	2000
						Jeeps/Station Wagons/ 4WD	1.25	16%	370.60	296
B		Bus	78.4	72	150.40	Minibus	1.5	76%	113.76	76
						Bus	2	24%	36.64	18
C		Truck	10214.1	9266.1	19,480.20	Light Truck	2.745	80%	15598.34	5682
						Heavy Truck	3.555	20%	3881.86	1092

Appendix C: Traffic Counts for Noise Level Modeling

See following pages.

Exhibit D.1: Traffic Counts for Noise Level Modeling 2015

Route		***Total***	*Day (83%)*[84]	*Night (17%)*	*Day Time per hour (7:00 am to 22:00 pm)*	*Night Time per hour (22:00 pm to 7:00 am)*
M3 - Motorway - PindiBhattian - Faisalabad	LTV	**4340**	3601.884 716	737.7354 238	240	82
	Buses	**277**	229.6250 284	47.03163 232	15	5
	Trucks	**369**	305.8710 786	62.64829 322	20	7
M4 - Motorway - Faisalabad - Gojra	LTV	**4391**	3644.257 939	746.4142 766	243	83
	Buses	**–**	–	–	–	–
	Trucks	**120**	99.92692 972	20.46696 151	7	2
M4 - Motorway - Khanewal - Multan	LTV	**1428**	1185.324 564	242.7773 203	79	27
	Buses	**45**	37.10166 786	7.599136 79	2	1
	Trucks	**576**	477.9578 363	97.89497 852	32	11

[84] The day and night percentage distribution of traffic (83% and 17% respectively) is estimated from the trends observed in traffic on N–5 highway near Hyderabad during the Environmental Impact Assessment conducted for Jamshoro Power Generation Project. As N–5 is the longest and the busiest highway in the country, connecting north and south, the trends observed on this highway were considered to be as a sample to estimate the percentage distribution of traffic in day and night time hours.

Siting: Hagler Bailly Pakistan, "Environmental Impact Assessment of Jamshoro Power generation Company, Volume 1: Main Report" Asian Development Bank, Manila, Philippines, October 29, 2013.

Exhibit D.2: Traffic Counts for Noise Level Modeling 2020 Option 3

Route		***Total***	*Day (83%)*	*Night (17%)*	*Day Time per hour (7:00 am to 22:00 pm)*	*Night Time per hour (22:00 pm to 7:00 am)*
M3 - Motorway - PindiBhattian - Faisalabad	LTV	**4513**	3745.648135	767.1809433	250	85
	Buses	**186**	154.3304671	31.60985472	10	4
	Trucks	**946**	785.0989279	160.8033949	52	18
M4 - Motorway - Faisalabad - Gojra	LTV	**2864**	2376.920686	486.8391767	158	54
	Buses	**1**	0.623557443	0.127716585	0	0
	Trucks	**1502**	1246.662051	255.3404201	83	28
M4 - Motorway - Khanewal - Multan	LTV	**999**	829.0517961	169.8057896	55	19
	Buses	**20**	16.73212472	3.42706169	1	0
	Trucks	**547**	454.2028209	93.02949345	30	10
M4 - Motorway - Gojra - Shorkot	LTV	**963**	799.3824999	163.7289458	53	18
	Buses	**1**	0.519631203	0.106430487	0	0
	Trucks	**1756**	1457.253293	298.4735661	97	33

Exhibit D.3: Traffic Counts for Noise Level Modeling Option 4

Route		***Total***	*Day (83%)*	*Night (17%)*	*Day Time per hour (7:00 am to 22:00 pm)*	*NightTime per hour (22:00 pm to 7:00 am)*
M3 - Motorway - PindiBhattian - Faisalabad	LTV	**4497**	3732.381377	764.4636555	249	85
	Buses	**186**	154.3304671	31.60985472	10	4
	Trucks	**2376**	1972.301281	403.9653226	131	45
M4 - Motorway - Faisalabad - Gojra	LTV	**2870**	2382.06658	487.893155	159	54
	Buses	**1**	0.623557443	0.127716585	0	0
	Trucks	**3063**	2542.594833	520.7724357	170	58
M4 - Motorway - Khanewal - Multan	LTV	**1027**	852.4495337	174.5980973	57	19
	Buses	**20**	16.83605096	3.448347787	1	0
	Trucks	**985**	817.368803	167.4128874	54	19
M4 - Motorway - Gojra - Shorkot	LTV	**1058**	878.3398139	179.9009257	59	20
	Buses	**1**	0.519631203	0.106430487	0	0
	Trucks	**3959**	3285.667877	672.9681194	219	75
M4 - Motorway - Shorkot - Khanewal	LTV	**1872**	1553.658021	318.2191128	104	35
	Buses	**83**	68.90309745	14.11268261	5	2
	Trucks	**4550**	3776.239251	773.4465937	252	86

Exhibit D.4: Traffic Counts for Noise Level Modeling 2025

Route		***Total***	*Day (83%)*	*Night (17%)*	*Day Time per hour (7:00 am to 22:00 pm)*	*Night Time per hour (22:00 pm to 7:00 am)*
M3 - Motorway - PindiBhattian - Faisalabad	LTV	**5579**	4630.500721	948.4158104	309	105
	Buses	**213**	176.4667564	36.14379347	12	4
	Trucks	**3494**	2900.420988	594.06213	193	66
M4 - Motorway - Faisalabad - Gojra	LTV	**3620**	3004.719777	615.4245326	200	68
	Buses	**1**	0.727483684	0.149002682	0	0
	Trucks	**4544**	3771.332383	772.4415725	251	86
M4 - Motorway - Khanewal - Multan	LTV	**1421**	1179.053005	241.4927842	79	27
	Buses	**24**	20.31758002	4.161432052	1	0
	Trucks	**1834**	1522.399186	311.8167007	101	35
M4 - Motorway - Gojra - Shorkot	LTV	**1286**	1067.451425	218.6346293	71	24
	Buses	**1**	0.623557443	0.127716585	0	0
	Trucks	**5889**	4887.789241	1001.113459	326	111
M4 - Motorway - Shorkot - Khanewal	LTV	**2296**	1905.830155	390.3507545	127	43
	Buses	**94**	78.15253286	16.00714528	5	2
	Trucks	**6774**	5622.75152	1151.647902	375	128