Initial Environmental Examination

September, 2021

PAK: Central Asia Regional Economic Corridor (CAREC) Program – Tranche 2

Shikarpur - Rajanpur Section of N-55

Final Report

Prepared by National Highways Authority for the Asian Development Bank

CURRENCY EQUIVALENTS

(As of 2 June 2020)

Currency unit	Pakistani Rupees (PRs)
PRs1.00	= $ 0.0061
$1.00	= PRs164.25

UNIT CONVERSIONS

1 gallon	_	3.785 liter
1 gallon/day	_	0.00455 m^3/day
1 m^3/day	_	0.041 m^3/hr
1 Cusec	_	28.31 liters
1km	–	1000m
1ft	–	12 inches
1 acre	–	4,046.8 m^2

LIST OF ABBREVIATIONS

Abbreviation	*Description*
APHA	American Public Health Association
APs	Affected Persons
ASRs	Air Sensitive Receivers
ASTM	American Society of Testing Materials
AKM	Avenue Kilometer
BOD	Bio-chemical Oxygen Demand
BDL	Below Detection Limit
BHU	Basic Health Unit
CAREC	Central Asia Regional Economic Corridor
^{O}C	Degree Centigrade
CC	Construction Contractor
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
dB (A)	Decibel
DCR	District Census Report
DC	Design Consultant
DD	Deputy Director
DO	Dissolved Oxygen
EA	Environmental Assessment
EE	Environmental Engineer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environment Protection Agency
EPD	Environment Protection Department
EPO	Environmental Protection Ordinance

ESR	Environmental Sensitive Receiver
FCC	Forest Conservation Committee
GIS	Geographic Information System
GHG	Green House Gases
GOP	Government of Pakistan
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HSIP	Highway Sector Improvement Program
IEE	Initial Environmental Examination
Km	Kilometer
LAC	Land Acquisition Collector
MVES	Motor Vehicle Examiners
NEQS	National Environmental Quality Standards
NESPAK	National Engineering Services Pakistan
NHA	National Highways Authority
NO_x	Nitrogen Oxides
NGO	Non-Governmental Organization
NOC	No-Objection Certificate
NSR	Noise Sensitive Receiver
NSL	Natural Surface Level
NTC	National Trade Corridor
OSHA	Occupational Safety and Health Administration
PAPs	Project Affected Persons
PEPA	Pakistan Environmental Protection Act
PNCS	Pakistan National Conservation Strategy
PEPC	Pakistan Environmental Protection Council
PM	Particulate Matter

PPC	Pakistan Penal Code
PPAF	Pakistan Poverty Alleviation Fund
REA	Rapid Environmental Assessment
RE	Resident Engineer
RHC	Rural Health Centre
ROW	Right of Way
SC	Supervision Consultant
SO_x	Sulfur Oxides
SSEMP	Site Specific Environmental Management Plan
TA	Technical Assistance
TSS	Total Suspended Solids
UC	Union Council
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
FI	Financial intermediary
CDIP	Corridor Development Investment Program
ADB	Asian Development Bank
BP	Bank Policy
DMC	Developing Member Countries
MFF	Multi Tranche Financing Facility
PRC	People's Republic of China
SPS	Safeguard Policy Statement
OP	Operational Policy
SMART	Self-Monitoring and Reporting Tools
CMS	Convention on Migratory Species of Wild Animals
CITIES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
MGDs	Millennium Development Goals

UNFCCC	United Nations Framework Convention on Climate Change
POPs	Persistent Organic Pollutants
ILO	International Labor Organization
CAREC	Central Asia Regional Economic Corridor
ACW	additional carriageway
TOR	Terms of reference
AASHTO	American association of state highway and transportation
AASHTO ASM	American Association of State Highway and Transportation Officials
UBC	Uniform Building Code
ACWC	Asphaltic Concrete Wearing Course
ACBC	Asphaltic Concrete Base Course
ABC	Aggregate Base Course
CBR	California bearing ratio
AADT	Average Annual Daily Traffic
AAD	Average Annual Daily
CSR	Composite Schedule Rates

WEIGHTS AND MEASURES

ºC	–	Degree Celsius
dB	–	Decibel
Km	–	Kilometer
Kph	–	Kilometer per hour
LAeq	–	Equivalent Continuous Sound Level 'A weighting' – 'A'- weighting = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	–	Meter

NOTES

(i) The fiscal year (FY) of the Government of the Islamic Republic of Pakistan and its agencies ends on 30 June.
(ii) In this report, "$" refers to US dollars.

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TABLE OF CONTENTS

LIST OF ANNEXES ..... **xi**
LIST OF TABLES ..... **xii**
LIST OF FIGURES ..... **xiii**
SECTION 1: EXECUTIVE SUMMARY **1**
1.1 Need Purpose and Proposed Action 1
1.2 Requirement of Environmental Approval 1
1.3 Project Description 2
1.4 Project Alternatives 2
1.5 Description of the Environment 2
1.6 Public Involvement & Grievance Redress Mechanism 4
1.7 Anticipated Impacts and Mitigation Measures 4
1.8 Environmental Management Plan 6
1.9 Climate Smart Development 7
1.10 Conclusion 7
SECTION 2: INTRODUCTION OF THE PROJECT **7**
2.1 Purpose of Project 7
2.2 Proposed Project 8
2.3 Purpose of IEE 8
2.4 Scope of IEE 9
2.5 Project Categorization 9
2.6 Study Area 9
2.7 Project Management/Consultants 9
2.8 Methodology of IEE 9
SECTION 3: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK **10**
3.1 Requirement of Environmental Approval 10
3.2 National Policy and Legal Framework 11
3.3 ADB's Safeguard Policy Statement, 2009 14
3.4 Safeguard Requirements-1: Environment 14
3.5 Administrative Framework 15
3.6 Comparison of Environmental Quality Standards 15
SECTION 4: PROJECT DESCRIPTION **19**
4.1 Rational of the Project 19
4.2 Location of Project 19
4.3 The Project 19
4.4 Duration of the Project: 22
4.5 Geometric Design of the Proposed Additional Carriageway 22
4.6 Embankment Design 25
4.7 Traffic Count and Projection 25
4.8 Construction Logistics 27
4.9 Construction Materials 27
4.10 Construction Equipment 28
4.11 Personnel Required 28
SECTION 5: DESCRIPTION OF THE ENVIRONMENT **31**
5.1 Physical Environment 31
5.1.1 Geology and Soil 31
5.1.2 Topography and Land Use 31
5.1.3 Climate and Air Quality 31
5.1.4 Water Resources 33
5.1.4 Natural Hazards 40
5.1.5 Noise 42
5.1.6 Environmental Sensitive Receptors 42
5.2 Biological Environment 47
5.2.1 Flora of the Area 47
5.2.2 Conservation and Protection Status 47

5.2.3 Faunal Species in Project Area 49
5.3 Socioeconomic Profile 50
5.3.1 Demographic Characteristics 50
5.3.2 Social Characteristics 51
5.3.3 Economic Characteristics 52
5.3.4 Historical and Archeological Characteristics 53
SECTION 6: ANALYSIS OF ALTERNATIVES 54
6.1 Alternative I: No-Action Alternative 54
6.2 Alternative II: Additional 2-Lane at N-55 Alignment as proposed 54
6.3 Alternative III: Rehabilitation of existing 2-Lanes at N-55 Alignment 55
6.4 Selected Option: 55
6.5 Technological Alternatives 55
SECTION 7: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES 57
7.1 Environmental Consequences 57
7.2 Screening of Potential Environmental Impacts 57
7.3 Positive Impacts of the Project 63
7.4 Pre-Construction/Design Phase 63
7.4.1 Physical Environment 63
7.4.1.1 Topography 63
7.4.1.2 Change in Hydrologic Regime 63
7.4.2 Ecological Environment 63
7.4.2.1 Removal of Roadside Trees 63
7.4.3 Social Environment 64
7.4.3.1 Land Acquisition, Infrastructure and Resettlement 64
7.4.3.2 Changes in Land Value 65
7.4.3.3 Physical Cultural Resources 65
7.4.3.4 Public Utilities 65
7.5 Construction Phase 65
7.5.1 Physical Environment 65
7.5.1.1 Disruption of Existing Public Utilities/ Infrastructure 65
7.5.1.2 Soil erosion and Contamination 66
7.5.1.3 Borrow/Open Pits 67
7.5.1.4 Air Pollution Control 67
7.5.1.9 Impacts of Construction of Bridges 70
7.5.1.10 Disposal of Mucking Material 71
7.5.1.11 Traffic Management 71
7.5.1.15 Occupational Health and Safety 72
7.5.1.16 Storage of Chemicals and Dangerous Goods 73
7.5.1.17 Fire Prevention/ Emergency Preparedness 73
7.5.2 Ecological Environment 74
7.5.2.1 Biodiversity Conservation 74
7.5.3 Social Environment 75
7.5.3.1 Construction Camps/Camp Sites 75
7.5.3.2 Cultural Conflicts 75
7.5.3.3 Physical Cultural Resources 76
7.5.3.4 Economic Activity 76
7.5.3.5 Community Health and Safety 76
7.6 Anticipated Impacts during Operational Phase 77
7.6.1 Physical Environment 77
7.6.1.1 Water pollution 77
7.6.2 Ecological Environment 93
7.6.2.1 Biodiversity Conservation and Natural Resource Management 93
7.6.3 Social Environment 93
7.6.3.1 Road Safety 93
7.6.3.2 Less Wear and Tear of Vehicles 93
7.6.3.3 Community Development 94

7.6.3.4 Accessibility 94
SECTION 8: ENVIRONMENTAL MANAGEMENT PLAN 95
8.1 Environmental Management 95
8.2 Institutional Responsibilities 95
8.2.1 EALS (NHA) 95
8.2.2 Project Implementation Unit (PIU) 96
8.2.3 Asian Development Bank 96
8.2.4 Construction Supervision Consultant (CSC) 97
8.2.5 Contractor 97
8.2.6 Third Party Environmental Monitoring Contractors 97
8.3 Staffing Requirement 97
8.4 Reporting and Feedback Mechanism 98
8.5 Environmental Technical Assistance and Training Plan 98
8.6 Summary of Environmental Management Plan 99
8.7 Environmental Monitoring Requirements 115
8.7.1 Pre-construction Ambient Environment Monitoring 115
8.8 Environmental Management Plan Indicative Cost 123
SECTION 9 PUBLIC PARTICIPATION, CONSULTATION AND INFORMATION DISCLOSURE 124
9.1 Stakeholder Identification and Analysis 124
9.2 Methods Adopted for Stakeholder Engagement 124
9.3 Stakeholder's Concerns and Priorities 124
9.4 Information Disclosure 132
9.5 Grievance Redress Mechanism (GRM) 132
9.5.1 First Level of GRM 132
9.5.2 Second Level of GRM 133
9.5.3 Third Level of GRM 133
9.5.4 Constitution and Function of the GRC 134
9.5.5 Type of Grievances to be Expected 136
SECTION 10 CONCLUSION 137

LIST OF ANNEXES

Annex I: IFC Guidelines and NEQS

Annex II: Environmental Monitoring Criteria

Annex III. Lab Results

Annex IV: Predicted Noise Level for Construction Phase

Annex V: O&M Phase Noise Modelling

Annex VI:Chance Find Procedures

Annex VII: COVID-19 Management Plan

Annex VIII: Sample Letter

Annex IX: Photolog

LIST OF TABLES

Table 3.1: Summary of Applicable Laws, Policies and Conventions at National & International Level 11
Table 4.1: Detail of Structures to be constructed 22
Table 4.2: Summarized Total Traffic Projections by Type of Vehicles 26
Table 4.3 Machinery and Equipment Requirement 28
Table 5.1: Monitoring Results of Ambient Air 33
Table 5.2: Monitoring Results of Surface Water 34
Table 5.3: Monitoring Results of Ground Water 36
Table 5.4: Results of Noise Monitoring 42
Table 5.5: Environmental Sensitive Receptors and their Sensitivity 43
Table 7.1: Characterization of Environmentally Potential Impacts for Construction Phase 58
Table 7.2: Characterization of Environmentally Potential Impacts for Operation Phase 59
Table 7.3: Environmental Impacts Evaluation Matrix during the Construction Phase 60
Table 7.4: Environmental Impacts Evaluation Matrix during the Operational Phase 61
Table 8.1: Reporting Requirements 98
Table 8.2: Training of Institutions involved in Environmental Compliance 99
Table 8.3 Environmental Management Plan 100
Table 8.4: Ambient Environment Baseline Sampling 115
Table 8.5: Environmental Monitoring Plan 116
Table 8.6: Environmental Management Plan Indicative Cost 123
Table 9.1: Public Involvement Process 125
Table 9.2: Departmental Consultation 129

LIST OF FIGURES

Figure 4.1: Location map of the Project Area 20
Figure 4.2: Alignment Map of Shikarpur- Rajanpur Section ACW....21
Figure 4.3: Alignment of Kashmore Bypass 21
Figure 4.4 (a) : Typical Cross Section for Additional Carriageway....23
Figure 4.4 (b) : Typical Cross Section for New Construction 24
Figure 5.1: Land-use map of the Study Area....38
Figure 5.2: Hydrological map of Project Area....39
Figure 5.3: Seismic Zoning Map of Pakistan 40
Figure 5.4: An Overview of the Flood Extent in 2010 41
Figure 5.5- a: Environmental Sensitive Recptors (Rajanpur to Kahsmore)....45
Figure 5.5-b: Environmental Sensitive Recptors (Kahsmore to Shikarpur) 46
Figure 5.6: Showing Existing Reserved/Conserved Forest Area 48
Figure 7.1: Day Time Grid Noise Map 79
Figure 7.2: Night Time Grid Noise Map 80
Figure 7.3: Day Time Grid Noise Map with 7m Noise Protection Wall 86
Figure 7.4: Night Time Grid Noise Map with 7m Noise Protection Wall 87
Figure 9.1: Public Involvement Process 128
Figure 9.2: Flow Chart of the Proposed Grievance Redress Mechanism....135

SECTION 1: EXECUTIVE SUMMARY

1.1 Need Purpose and Proposed Action

1. In order to improve trade and commerce in global markets and improve the connectivity with Central Asian Countries, it is imperative to have a regional approach and good relation with neighboring countries. This is the prime objective of the Central Asia Regional Economic Corridor (CAREC) Program to improve and extend the corridor to the neighboring countries.

2. These Corridors within Pakistan will interconnect surrounding countries acting as a regional hub in order to promote regional integration and intra-and inter-regional trade. CAREC include eleven states and six corridors.

3. Corridors 5 and 6 which are north-south national corridors on the west side of the Indus River running through Pakistan. The Government of Pakistan (GoP) is upgrading and rehabilitating CAREC transport corridor 5 & 6 to improve regional connectivity.

4. Through the National Highway Authority (NHA) of Pakistan, the GoP plans to implement CAREC Corridor Development Investment Program (CAREC CDIP) with financial assistance from ADB through a Multi-tranche Financing Facility (MFF).

5. Pakistan's National Indus Highway 55 (N-55) offers the shortest north-south bound CAREC spin-off transport corridor through Pakistan to link landlocked Afghanistan, Central Asia, and Xinjiang province of the People's Republic of China (PRC) with the Arabian Sea ports at Karachi and Gwadar.

6. It starts at M-9 near Petaro in Sindh Province, traverses through southern part of Punjab Province and terminates at N-5 near Peshawar in Khyber Pakhtunkhwa Province. The total length of the highway is 1264 km. Currently the N-55 is mostly a two-lane single carriageway which is in very poor condition and requires upgrading to 4-lane dual carriageway to sustain the presumed future traffic loads from CAREC countries.

7. Tranches 1 and 2 entail the construction of an additional 2-lane carriageway along the existing 2-lane carriageway, while Tranche 3 involves the rehabilitation of an existing two-lane carriageway (or financed by GoP). Most of the works will follow the existing NHA ROW. However, this will also include proposed improvements in vertical or horizontal alignment of the road in some sections and construction of bypass roads along selected urban centers.

8. The proposed project, construction of additional 2 lane along the existing 2 lane carriageway of N-55 from Shikarpur to Rajanpur included in Tranche 2 of MMF, is located in Sindh and Punjab Provinces of Pakistan.

9. Total length of the project is approximately 221.95 kilometers (383-604 km range) and it runs through the localities of Shikarpur, Kandhkot, Bakhsha Pur, Rahimabad Laro, Faizo Laro, Khanpur, Karam Pur, Kashmore. Rojhan, Ghoos Pur, Kotla Nasir and Rajanpur.

1.2 Requirement of Environmental Approval

10. According to Pakistan Environmental protection Agency (Review of IEE and EIA) Regulations 2000 of Pakistan Environmental Protection Act (PEPA), the proposed project falls under category D (Transport) of Schedule II, which requires EIA before commencement of construction.

11. An IEE study is also required as per ADB's "Safeguard Policy Statement", 2009, for category B projects where the proposed action falls.

1.3 Project Description

12. The proposed alignment runs on the right bank of Indus through the provinces of Sindh and Punjab in Pakistan. It passes through the localities of Shikarpur, Kandhkot, Khanpur, Ghouspur Kashmore, Rujhan and Rajanpur. This section of the highway is a part of CAREC Corridor 6.

13. The proposed highway is planned to be constructed as 2-Lane additional carriageway (ACW) adjacent to the existing 2-Lane facility from Shikarpur to Rajanpur including Kashmore Bypass, thus making the whole facility as 4-lane highway. It includes new bridges and cross-drainage structures on ACW. The total length of alignment from Shikarpur to Rajanpur is 221.95 kilometers (km 383-604).

14. For the construction purpose the alignment (221.95 km) has been divided in three sections including:

    i. Shikarpur- Kandhkot Section - 62.42 km

    ii. Kandhkot- Kashmore Section – 58.78 km

    iii. Kashmore- Rajanpur Section – 100.75 km

15. Additional carriageway will be designed at the first stage and improvement/rehabilitation will be executed in second stage by the GoP or through Tranche 3; however, Improvement/ Rehabilitation is not the part of Tranche -II.

16. Kashmore bypass will be constructed for dual carriageway with the length of 11.9 kilometer to avoid the traffic congestion in the city. This will cross the Pat Feeder Canal emerging from Guddo Barrage on River Indus.

17. The details of structure to be constructed for the corridor from Shikarpur – Rajanpur section is given as under:

Sr. No.	Type of Structure	Numbers
1	Culverts	500
2	Bridges/Flyovers	31
3	Underpasses/Cattle creeps	19

1.4 Project Alternatives

18. As the Project involves construction of additional carriageway along the existing N 55, three alternatives were studied including Alternative-I "No Project Option" Alternative-II "Dualization of Existing Carriageway by constructing of Additional Carriageway and Alternative-III "Rehabilitation of existing 2-Lanes at N-55 Alignment".

19. Taking in to account the socioeconomic and environmental benefits and extending the benefits to regional level and connectivity with the Central Asian region, alternative II, dualization of N 55 as CAREC Corridor 6 is the best choice.

1.5 Description of the Environment

20. The existing environment in and around the project area has been studied with respect to the physical, biological and socio-economic conditions.

21. In the province of Punjab, the additional carriageway of existing N-55 alignment will pass through agricultural cultivated fields and some barren land of Rajanpur district. While in Sindh province the area in the surrounding of alignment is water logged and saline near Shikarpur section, and rice and sugarcane cultivated field and linear planation of tree species between the stretch of Shikarpur and Kashmore Districts.

22. The Indus Plain essentially forms the western extension of Indo-Gangetic Plain, and has been made up of the silt brought by the Indus and its numerous tributaries, such as Jhelum, Chenab, Ravi and Sutlej on the east bank, and Kabul, Kurram, Tochi, and others on the west bank. The Indus Plain is known for its agricultural fertility and cultural development throughout history.

23. The Project Area is located in Seismic Zone 2A, on the seismic zoning map of Pakistan, where 2A represents peak horizontal ground acceleration from 0.08 to 0.16g. An earthquake of magnitude 5 hit Sindh on May 9, 2014.

24. The climate of the Study Area is broadly hot and dry summer, mild winter and rainfall in monsoon. The highest recorded temperature is 52.8 °C (127.0 °F), and the lowest recorded temperature is −3.9 °C (25.0 °F). The mean Annual Precipitation is 110.40 mm.

25. Major water bodies in the Study Area include the Indus River, Kalri Baghar canal. Groundwater table varies from 3 to 20 meter and of saline nature with Total Dissolved Solids (TDS) ranging from 3000 to 4000 mg/ litter which is not fit for human consumption. However, along the River and canals the water is sweet for drinking purpose due to infiltration of surface water. Some wetlands were observed near the evaporation pond formed by the disposal of wastewater from the Guddo power plant and seasonal flood.

26. Project area is flooded by the Indus River which also carries flood water from the other four rivers of Pakistan including Satluj, Ravi, Jhelum and Chenab. These four rivers are tributaries of the Indus and their confluence is at the location of Punjnad. The Indus River has been responsible for 12 of the major floods in Pakistan including the floods of 1950, 1955, 1956, 1973, 1976, 1978, 1988, 1992, 1995, 1997, 2005, 2010 and 2012.

27. The total population of district Rajanpur, Shikarpur and Kashmore stood at 1,995,958, 1,231,481, 1.089,000 respectively during 2017 and the average household size ranges from 5.5 to 6.0 persons in these districts. Siraiki is the predominant language being spoken in the district Rajanpur; while, Sindhi is spoken in the District Kashmore and Shikarpur. Urdu and Balochi are the other languages spoken in the project area.

28. The project area being part of the lower Indus basin, the climate of the tract is semi-arid, sub-tropical, the original flora of the area consists of tropical thorn forest type vegetation, in which thorny, usually hard wooded species and predominated acacia species being particularly characteristic. Approximately 228 privately owned plants of various species will be cut due to construction of additional carriageway. The trees have usually short boles and low branching crowns, which rarely meet except on exceptionally favorable spots. The usual-height of tree is 6-10m.

29. Environmental Monitoring locations have been identified for ambient air, noise and water quality monitoring. However, due to the lock down and travel restrictions imposed by the government due to the Covid-19 pandemic, monitoring could not be conducted. Currently hiring of EPA approved environmental laboratory is in progress and will be finalized in the first week of June 2020, after which monitoring will be initiated accordingly. The results will be incorporated in the report after completion of the process.

30. No threatened or endemic plant species are present in the Study Area. None of the plant species observed was endemic, their distribution is not limited to any specific site or habitat type, and the distribution is widespread.

1.6 Public Involvement & Grievance Redress Mechanism

31. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. Various types of stakeholders identified were the villagers, local residents, government officials, shop owners, public representative, NGO's and general public. All the stakeholders had different types of stakes according to their perception about the project. Majority of the public responded in favor of the project considering the regional level connectivity, uplift of economy, increased land value, better access to the other cities of the country, control on accidents, and ease for the drivers and time saving.

32. In order to receive and facilitate the solution of affected people's (AP) concerns, complaints and grievances about the Project's environmental performance, a three-tier grievance redress mechanism (GRM) including local level and project level of grievance redress systems will be established. 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.

33. Grievance Redress Committee (GRC) will be established at local level, and at project level the displaced persons have been advised to constitute displaced person committees. The AP who is not satisfied with the decision of the GRC will have the right to take the grievance to next higher level, i.e. Environment, Afforestation, Land and Social (EALS) at National Highway Authority (NHA) Head Quarter (HQ) for its redress or to the appropriate judicial forum. All efforts will be made to redress grievances through the project GRM. However, aggrieved people have the right to access the country's judicial system as and when they require.

1.7 Anticipated Impacts and Mitigation Measures

Anticipated Impacts:

34. The proposed construction of the Road will have both positive and negative impacts during the construction and operational phases, for which proper mitigation measures are necessary. Following is the list of anticipated potential impacts during the construction phase of the project:

- Cutting of trees/bushes falling within the proposed corridor and for related facilities;
- Disturbance to the public movement and in daily routine activities during construction;
- Access restriction especially during growing and harvesting seasons for land owners and farmers
- Air and Noise pollution due to the operation of construction machinery. Solid waste generation during construction and leaving the construction waste after completion;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Surface water body (River Indus) contamination by the soil erosion and construction activities; and
- Relocation of public utilities

35. Following are the potential impacts anticipated to occur both positive and negative during the operational phase of the project:

- Trees and landscape maintenance;
- Road safety;
- Pollution prevention and abatement;
- Community Health and safety.

36. On the positive side, the proposed construction of the road is expected to generate considerable economic activity as new opportunities for skilled/unskilled manpower will be available as maximum efforts will be made to hire local labor/staff. Similarly, the project area would be developed and market value of the land would be increased during the operation phase of the project.

Remedial Measures

37. Mitigation measure would be adopted to avoid, minimize or compensate the potential adverse impacts of the project during pre-construction, construction and operation phase, including:

- SSEMP Preparation: EMP would be the part of contract document for implementation. Contractor will prepare SSEMP at preconstruction stage ensuring the compliance of EMP
- Air pollution control: Provision of dust masks, and installing the pollution controlling devices such as Electrostatic Precipitator (EP), bughouse filters to asphalt plant, covering of materials and stockpiles, speed limits, cleanup of public roads and best practices for site management
- Protection of faunal and flora: label all the trees which need to be removed, planting the compensatory trees, grass and sapling aftercare and planting the trees at construction stage not the operation stage.
- Siting of Related Facilities: Appropriate siting and management of project related facilities such as construction camps, borrow pits, asphalt and batching plants;
- Resource conservation: procurement of construction materials from approved quarries and crushers. Water Conservation: through recycling for dust suppression, prevention of pipe leakages and wastages of raw materials,
- Energy Efficiency: best practices to be adopted for energy conservation such as machinery to be shut off while not in use and preservation and track record of raw material
- Water pollution Control: protection of water quality of River Indus and streams, discharging wastewater through septic tanks of appropriate size, covering the manholes, and well-maintained washing facility
- Load on existing infrastructure: Avoid the extra load on existing infrastructure/utilities of the local community and the rehabilitation of existing roads used by the contractor
- Drainage and slope protection: Use of modern techniques for protection of slopes and avoid soil erosion and provision of cut off drains and settling basin to control the surface runoff
- Workers Health & Safety: eliminating the work place hazards, provision of PPEs, lavatories and showers, equipped kitchen & clean eating areas, first aid kits, drinking water and ambience
- Community Prevention and Health& Safety: Disease control by avoiding water impounding, restricted access, traffic control, covering the trenches and openings, and no abandoned structures
- GRM: Establishment and effective management of grievance resolution from workers and community. Placement of complaint register and logging of complaint records and action taken

- Noise Control: Identification of Noise Sensitive Receivers (NSRs), Source control, timings of operation and seeking suggestions from community
- Storage of Chemical and Dangerous Goods: Access control, spill control, and storage on hardened and non-permeable surface
- Waste Management: Waste Minimization techniques and recycle and reuse of construction waste material as fill material, good housekeeping practices, proper storage, labelling and containments of hazardous waste and used tire should not be left at site and proper storage of oil rags,
- Fire Prevention and Emergency Preparedness: Placement of Fire Extinguishers, Accident/ Incident Reporting system and Escape route and gathering area should be mapped, displayed, demarcated and not blocked/ obstructed.
- Protection of Cultural and Heritage Sites: Access for the religious and cultural site should not be disturbed due to construction and if any mosque coming in ROW a new mosque should be built in compensation
- Traffic Management Plan: A traffic diversion plan will be set out how the traffic on road and access to highway would be maintained with proper signage. In case of diversions, the speed limits and signs should be mentioned well ahead to guide the road users resulting in smooth traffic flow
- Tree Plantation: start tree plantation and landscaping during construction stage.
- During operation: mitigations involve road maintenance for potholes & mud holes, management of drainage, pedestrian and animal safety, speed control, management of accidental spill and protection of ROW and embankments. Maintenance of sapling and cutting the branches of tree coming on the roadside.

1.8 Environmental Management Plan

38. EMP would be the part of contract documents. The Contractor should be bound to follow the provisions of the contract documents especially about environmental protection and apply good construction techniques and methodology without damaging the environment.

39. Obligation of the contractor, to safeguard, mitigate adverse impacts and rehabilitate the environment should be addressed through environmental provisions in **the FIDIC[1] conditions of contract for construction, MDB harmonized addition- June 2010** and special clauses included in the contract related to environment. FIDIC clause 4.18 (protection of environment), 4.8 (safety procedures), 6.4 (labor laws), 16.3 (cessation of work/remedial work), 2.3 b (employers' personnel), 4.21 (progress report) are important in this regard.

40. Contractor would be responsible for preparation of SSEMP describing the mechanism to comply with the EMP and get it approved from CSC Environmental unit and PIU Environmental unit prior to mobilization.

41. Institutions involved for the executing of EMP would involve: EALS (NHA), Environmental Unit of PIU headed by (GM) CAREC-MMF, Environmental Unit of CSC, Environmental Unit of Contractor, Independent environmental monitoring contractor and EPA Punjab and Sindh.

42. Reporting and feedback mechanism involve that the contractor's environmental unit will manage the daily activities to be conducted in compliance with the EMP and will be responsible for weekly reporting; while, CSC would be responsible for monthly inspecting and monitoring report. CSC will draft the semiannual environmental monitoring report and finalize with the PIU. PIU will submit that report to EALS for onward submission to ADB.

[1]https://www.adb.org/sites/default/files/fidic-gcc-construction.pdf

EALS would also submit the periodic reports to EPA as per conditions of environmental approval.

43. 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.

1.9 Climate Smart Development

44. Climate change effects would be considered in two aspect:

- **Effect of climate change on the Project:** This could be due to extreme events of temperature change, flood risks, creation of water ponds and wetlands.
- **Effect of Project on climate change**: This is due to generation of GHG emissions due to onsite site construction activities and processes at the related facilities Emission of greenhouse gases cause global warming contributing to climatic changes on regional and global scale. Estimated GHG emissions are 176268 (792x222=176268) CO_2tons equivalent[2]

45. To make the project climate smart development, following mitigation measures should be adopted:

- **Resource conservation:** Avoid the wastage of raw material, leakages of water, oil, fuel, and use the material resistant to weather conditions
- **Energy Efficiency and Controlling devices:** Use energy efficiency techniques and emission controlling devices. Avoid any unnecessary work and keep the material transportation distance to minimum;
- **Enforcement of NEQS** applicable to gaseous emissions generated by construction vehicles, equipment and machinery
- **Green Infrastructure:** provision of eye lands, tree plantations and landscaping

1.10 Conclusion

46. Conclusively, the proposed development will enhance the trade activities on regional basis and provide smooth and safe travelling corridor. This will involve some potential adverse environmental impacts of low to moderate level, which are mostly related to construction stages of the project and are however manageable by properly implementing the EMP and meaning full and timely consultation with the community. No long-term and significant adverse environmental impacts are however envisaged for the operation stage of the project.

SECTION 2: INTRODUCTION OF THE PROJECT

2.1 Purpose of Project

47. In order to improve trade and commerce in global markets and improve the connectivity with Central Asian Countries, it is imperative to have a regional approach and good relation with neighboring countries. This is the prime objective of the Central Asia Regional

[2]http://documents.worldbank.org/curated/en/660861468234281955/pdf/696590ESW0P1010UBLIC00GHG0Web0final.pdf

Economic Corridor (CAREC) Program to improve and extend the corridor to the neighboring countries.

48. These Corridors within Pakistan will interconnect surrounding countries acting as a regional hub in order to promote regional integration and intra-and inter-regional trade. CAREC include eleven states and six corridors.

49. Corridors 5 and 6 which are north-south national corridors on the west side of the Indus River running through Pakistan. The Government of Pakistan (GoP) is upgrading and rehabilitating CAREC transport corridor 5 & 6 to improve regional connectivity.

50. Through the National Highway Authority (NHA) of Pakistan, the GoP plans to implement CAREC Corridor Development Investment Program (CAREC CDIP) with financial assistance from ADB through a Multi-tranche Financing Facility (MFF).

51. Pakistan's National Indus Highway 55 (N-55) offers the shortest north-south bound CAREC spin-off transport corridor through Pakistan to link landlocked Afghanistan, Central Asia, and Xinjiang province of the People's Republic of China (PRC) with the Arabian Sea ports at Karachi and Gwadar.

52. It starts at M-9 near Petaro in Sindh Province, traverses through southern part of Punjab Province and terminates at N-5 near Peshawar in Khyber Pakhtunkhwa Province. The total length of the Indus highway is 1264 km. Currently the N-55 is mostly a two-lane single carriageway which is in very poor condition and requires upgrading to 4-lane dual carriageway to sustain the presumed future traffic loads from CAREC countries.

2.2 Proposed Project

53. Tranches 1 and 2 entail the construction of an additional 2-lane carriageway along the existing 2-lane carriageway, while Tranche 3 involves the rehabilitation of an existing two-lane carriageway (or financed by GoP). Most of the works will follow the existing NHA ROW. However, this will also include proposed improvements in vertical or horizontal alignment of the road in some sections and construction of bypass roads along selected urban centers.

54. The proposed project, construction of additional 2 lane along the existing 2 lane carriageway of N-55 from Shikarpur to Rajanpur included in Tranche 2 of MMF, is located in Sindh and Punjab Provinces of Pakistan.

55. Total length of the project is approximately 221.95 kilometers (383-604 km range) and it runs through the localities of Shikarpur, Kandhkot, BakhshaPur, RahimabadLaro, FaizoLaro, Khanpur, KaramPur, Kashmore. Rojhan, GhoosPur, Kotla Nasir and Rajanpur.

2.3 Purpose of IEE

56. The purpose of IEE is as follows:

- To establish the baseline environmental conditions of the project area;
- To identify and assess the possible biophysical and social impacts of the proposed project on its surroundings.
- Recommend measures to avoid/control/mitigate the impacts envisaged in the assessment process
- To develop comprehensive Environmental Management Plan defining framework of mitigation and monitoring mechanism, institutional responsibilities, reporting requirements and budget to implement the recommended mitigation measures.

2.4 Scope of IEE

57. The scope of the IEE includes collection of information of existing conditions related to biophysical and socio-economic environment of the project area to establish the baseline environmental profile through primary and secondary sources including environmental monitoring. It also includes public consultations to address the concerns of public. Identification of sensitive receptors in the area to assess the magnitude and significance of impact will also be conducted. Recommendation of management approaches to eliminate, control or mitigate the identified impact and developing Implementation framework to execute the proposed mitigation measures with defined responsibilities and estimated financial requirement.

2.5 Project Categorization

58. According to ADB's Safeguard Policy Statement (SPS) 2009, the project is classified as category B project as its potential adverse environmental impacts are less adverse. These impacts are site-specific, and can be controlled or mitigated with mitigation measures. Thus, an initial environmental examination (IEE), including an EMP, is prepared for this project.

2.6 Study Area

59. The study area for IEE purpose is considered to be 50 m both sides of the road.

2.7 Project Management/Consultants

60. The proponent of the project is NHA while the Consultant is NESPAK, the addresses are given as under:

a) Proponent Contact Address:

General Manager (EALS)
National Highway Authority (NHA)
27 Mauve Area, G-9/1,
Islamabad
Ph: 051-8351506

b) Consultant Contact Address

National Engineering Services Pakistan (NESPAK) Private Limited
1-C, Block – N, Model Town Extension
Lahore

Tel: 042-99090000

2.8 Methodology of IEE

61. The following methodology was adopted for carrying out the EIA study of the proposed project:

- The meetings and discussions were held to plan the project execution including acquisition of data and identification of sources, determine time schedules and responsibilities to accomplish tasks; the logistics and other supporting needs for the execution of the project.
- Primary and secondary data were collected through field observations, environmental monitoring in the project area, concerned departments were consulted and published materials to establish baseline profile for physical, biological and socio-economic conditions of the area.

- Data on physical Environment was collected including but not limited to geology, topography, soils, hydrology and drainage, water quality, air quality and noise.
- The status of the flora and fauna of the study area was determined by an ecological survey, review of literature relevant to the area, and an assessment of terrestrial and aquatic environment.
- The socioeconomic baseline was established utilizing literature field investigations, census data, structured interviews, maps, reports to generate the data required for description of the existing social environment including demography, education, land use, livelihoods poverty, traffic, transportation and access roads, health, and municipal status, community facilities, recreational activities, archaeological and cultural heritage.
- Sensitive receptors of environmental impacts were identified along the road alignment.

- The impacts of the project on the physical, biological and socio-economic environment prevalent in the project area were anticipated at the design, construction and operational phases and characterized in relation to identified sensitive receptors of the impacts.
- Adequate mitigation measures were recommended to be incorporated at design stage.
- Implementation framework is also proposed to execute the proposed mitigation measures with defined responsibilities and estimated financial requirement.

2.9 Report Format

62. The structure of the IEE report is given as under:

Section 1	Executive Summary
Section 2	Introduction
Section 3	Policy, Legal and Administrative Framework
Section 4	Project Description
Section 5	Description of the Environment
Section 6	Analysis of Alternatives
Section 7	Anticipated Environmental Impacts and Mitigation Measures
Section 8	Environmental Management Plan (EMP)
Section 9	Public Participation, Consultation and Information Disclosure
Section10	Conclusions
	Appendices

SECTION 3: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Requirement of Environmental Approval

63. According to Pakistan Environmental protection Agency (Review of IEE and EIA) Regulations 2000, the proposed project falls under category D (Transport) of Schedule II, which requires EIA before commencement of construction. Also, the projects with total cost of 50 million rupees and above qualify for an EIA and NOC would be required from the provincial EPAs of Sindh as well as Punjab and is in process.

64. An IEE study is also required as per ADB's "Safeguard Policy Statement", 2009, for category B projects where the proposed action falls.

3.2 National Policy and Legal Framework

65. In March 2005, the Government of Pakistan launched its National Environmental Policy, which provides an overarching framework for addressing the environmental issues Pakistan is facing, particularly pollution of freshwater bodies, coastal waters, air pollution, and lack of proper waste management, deforestation, natural disasters and climate change. The Climate Change Division is the responsible authority for environmental protection policy making in Pakistan.

66. 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 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation.

67. Summary of the applicable laws, policies and conventions are given in the **Table 3.1.**

Table 3.1: Summary of Applicable Laws, Policies and Conventions at National & International Level

Applicable Laws & Policies	Year	Objectives	Applicability
ADB Policy and Operation Manuals			
Safeguard Policy Statement (SPS 2009)	2009	To Ensure environmentally and socially sustainable projects supported by ADB. ADB will not projects that don't comply with ADB Policy and National Laws of Developing Members Countries (DMCs)[3]	Direct
ADB Operational Manuals Bank Policy (BP Section F1/BP) & Operational Procedure (OP section F1/OP)	2013	To achieve the SPS 2009 objective and deliver the policy principles.[4]	Direct
National Laws & Policies			
Sindh Environmental Protection Act	2014	Provide protection, conservation, rehabilitation and improvement of the environment for prevention and control of pollution and sustainable development.[5]	Direct
Punjab Environmental Protection Act	2014	Provide protection, conservation, rehabilitation and improvement of the environment for prevention and control of pollution and sustainable development[6].	Direct

[3]https://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf
[4]https://www.adb.org/sites/default/files/institutional-document/31483/om-f1-20131001.pdf
[5]http://epasindh.gov.pk/
[6]http://www.punjablaws.gov.pk/laws/40.html

Applicable Laws & Policies	Year	Objectives	Applicability
Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations, 2000	2000	These regulations provide lists of the projects requiring IEE and EIA. They also briefly describe the preparation and review of environmental reports. Environmental approval required from Two provinces Sindh &Punjab. Project requires EIA under category D (Transport) of Schedule II. [7]	Direct
National Environmental Quality Standards	2010	Define maximum allowable discharge limits for Air, noise, water and wastewater.8	
Land Acquisition and Resettlement Act, 1894	1894	This law regulates the acquisition of land for public purposes and provides compensation in the form of cash, an alternative land allocation, or through other equitable arrangements (Sec 31).[9]	Direct
Sectoral Guidelines	1997	Pakistan Environmental Assessment Procedure deals with general guidelines as well as sectorial guidelines for environmental assessment studies. The sectorial guidelines have been given for some categories of projects including road Projects.	Direct
Labor Laws (Amended) Ordinance, 1972.	1972	Construction and operational activities can affect the occupational health of the workers. Quantitative national standards with respect to these aspects are yet to be developed in Pakistan. However, guidance in qualitative terms can be obtained from the Labor Laws (Amended) Ordinance, 1972.	Direct
National Environmental Policy	2005	Conservation and efficient use of natural resources and sustainable development	Direct
Canal & Drainage Act	1873	Prevention of pollution of natural or man-made water bodies[10]	Direct
Hazardous Substance Rules	2003	Safe handling of hazardous substances used in any workplace[11]	Direct
Factories Act	1934	Regulating the working environment to accommodate the safety and wellbeing of labourers. .[12]	Direct

[8] *www.environment.gov.pk*
[9] http://www.megrevenuedm.gov.in/act/land-acquisition-act-1894.pdf

[10] http://www.cmsdata.iucn.org/downloads/thecanal and drainage act 1873.pdf
[11] http://www.faolex.fao.org/docs/pdf/pak64438.pdf

[12] http://www.ilo.org/docs/WEBTEXT/35384/64903/E97PAK01.HTM

Applicable Laws & Policies	Year	Objectives	Applicability
SMART Rules	2001	Monitoring and reporting of industrial effluents and emissions	Not Applicable
Forest Act	1927	Safeguard of forests on state lands and private lands	Direct
Antiquities Act 1975& Sindh Cultural Heritage (Preservation) Act	1994	Protection of cultural resources in Pakistan	Indirect
Sind Wildlife Protection Act & Punjab Wildlife Protection Act	1972	To protect wildlife and to prevent /regulate hunting of birds and animals	Applicable
International Conventions & Agreements			
Ramsar Convention on Wetlands of International Importance	1971	Conservation and wise use of wetlands and their resources	Applicable
International Union for Conservation of Nature and Natural Resources	1963	Conservation of flora and fauna species that are at risk of extinction from the globe	Not Applicable
Convention on Migratory Species of Wild Animals (CMS)	1983	Protection of migratory species of animals by every state that lives or passes through their national jurisdiction	Indirect
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)		Safe and Sustainable trade of wild animals and plants without threatening to their survival	Indirect
Millennium Development Goals (MDGs)	2000	Development of nations by eradication of social and environmental issues	Indirect
Vienna Convention for the Protection of the Ozone Layer	1992	Vienna Convention for the protection of the Ozone Layer highlights the need to protect the Ozone layer for conserving environment for the present and future generations.	Indirect
United Nations Framework Convention on Climate Change (UNFCCC)	1994	This convention highlights the broad guidelines to protect the Climate of the Planet.	Direct

Applicable Laws & Policies	Year	Objectives	Applicability
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their disposal:	1994	Basel Convention deals with the controlled trans-boundary movement of Hazardous Wastes and their disposal.	Indirect
Stockholm Convention on Persistent Organic pollutants (POPs)	2001	This Convention protects human health and the environment from the harmful impacts of persistent organic pollutants (POPs).	Indirect
Convention Concerning the Protection of the World Cultural and Natural Heritage	1972	cultural heritage and the natural heritage are increasingly threatened with destruction not only by the traditional causes of decay, but also by changing social and economic conditions which aggravate the situation with even more formidable phenomena of damage or destruction.	Currently not applicable as no cultural heritage site in the ROW
International Labor Organization (ILO)		The ILO aims to ensure that it serves the needs of working women and men by bringing together governments, employers and workers to set labor standards develop policies and devise programs.	Applicable

3.3 ADB's Safeguard Policy Statement, 2009

68. ADB's Safeguard Policy Statement consists of three operational policies on the environment, Indigenous People and involuntary resettlement. SPS, 2009 provides information on good practice approaches to implement the safeguards. Overall, this policy provides to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected, marginalized by the development process.

3.4 Safeguard Requirements-1: Environment

69. The Safeguard Requirement-1: Environment, of SPS, 2009 states to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. Safeguard environmental requirement principal is to conduct an environmental assessment for each developmental proposal to identify potential impacts and then to mitigate all those negative impacts properly. The proposed mitigation measures, monitoring and reporting requirements, institutional arrangements, schedules, cost estimates and performance indicators are to be documented and reflected in the environmental assessment report.

a) Categorization of the Environmental Project

70. According to ADB Safeguard Policy Statement (2009), the project is classified as category "B" and therefore an IEE is required for the project. The process of determining a project's environment category is to prepare a Rapid Environmental Assessment (REA). REA requires the completion of the environmental categorization form prior to the Project initiation. REA uses sector-specific screening checklist, considering the type, size, and location of the proposed project; sensitivity and vulnerability of environmental resources in project area; and the potential for the Project to cause significant adverse environmental

impacts. A project is classified as one of the four environmental categories (A, B, C, or FI) based on the most environmentally sensitive component. Categories are as follows:

71. **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 larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.

72. **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), including an EMP, is required.

73. **Category C**: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

74. **Category FI**: A proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary.

75. For Category 'B' projects, the final IEE report would be posted on ADB website.

3.5 Administrative Framework

National Highways Authority (NHA)

76. The implementing agency of the proposed project is NHA, Government of Pakistan. The management of NHA will ensure that all the proposed measures are effectively implemented at the design, construction and operational stages.

Environmental Protection Agency of Sindh and Punjab

77. Provincial EPAs will be responsible for reviewing the report, issuing No Objection Certificate (NOC) and overall/broad based monitoring of the proposed project activities.

3.6 Comparison of Environmental Quality Standards

78. As per SPS 2009, following is a brief comparison of US EPA, WHO and Local Environmental Quality Standards for Punjab and Sindh for air noise and drinking water and whichever is more stringent is adopted. Since the stringent standards vary for each parameter, the most stringent one is highlighted and that is used as reference.

79. The national standards for noise in Commercial area is more stringent, thus local standards will be adopted. Similarly, for air WB standards are more stringent except NO_2 and O_3. Drinking water quality standards are similar to WB standards except Zinc and Lead, which will be adopted from WB standards and manganese and Nickel will be adopted from US-EPA.

80. **Table 3.2, 3.3** and **3.4** gives comparison of noise, air and water quality standards.

Table 3.2: Comparison of Noise Standards

#	Category of Area	PEQS[13]	SEQS	WB guidelines[14]	USEPA Standards[15]

[13]http://www.environment.gov.pk/PRO_PDF/NoisePaperGen.pdf
[14]http://www.ifc.org/wps/wcm/connect/06e3b50048865838b4c6f66a6515bb18/1-7%2BNoise.pdf?MOD=AJPERES
[15]http://www.environment.gov.pk/PRO_PDF/NoisePaperGen.pdf

		Day Time	Night Time	Day Time	Night Time	Day Time	Night Time	Indoor	Outdoor
1	Residential Area	55	45	55	45	55	45	45	55
2	Commercial Area	65	55	65	55	70	70	70	70
3	Industrial Area	75	65	75	65	70	70	70	70
4	Silence Zone	50	45	50	45	-	-	-	-

Table 3.3: Comparison of Air Quality Standards

#	Pollutant	PEQS		SEQS	USEPA		WB	
		Time Weighted average	Concentration standard	Concentration standard	Time weighted average	Concentration standard	Time weighted average	Concentration standard
1	SO_2	Annual average	80 µg/m^3	80 µg/m^3	Annual arithmetic mean	80 µg/m^3, (0.030 ppm)	24 Hours	20µg/m^3
		24 hours	120 µg/m^3	120 µg/m^3	24-hours average	365 µg/m^3, 0.50 ppm	10 minutes	500 µg/m^3
2	NO	Annual average	40 µg/m^3	40 µg/m^3	-	-	-	-
		24 hours	40 µg/m^3	40 µg/m^3	-	-	-	-
3	NO_2	Annual average	40 µg/m^3	40 µg/m^3	Annual arithmetic mean	100 µg/m^3, (0.053 ppm)	1 year	40 µg/m^3
		24 hours	80 µg/m^3	80 µg/m^3			1 hour	200 µg/m^3
4	O_3	1 hour	130 µg/m^3	130 µg/m^3		235 µg/m^{3,} (0.12 ppm)		
		-	-	-	8-hours average	157 µg/m^{3,} (0.08 ppm)	8 hours daily maximum	100µg/m^3
5	SPM	Annual average	360 µg/m^3	360 µg/m^3	-	-	-	-
		24 hours	500 µg/m^3	500 µg/m^3	-	-	-	-
6	PM_{10}	Annual average	120 µg/m^3	120 µg/m^3	Annual arithmetic mean	50 µg/m^3	1 year	20µg/m^3
		24 hours	150 µg/m^3	150 µg/m^3	24-hours average	150 µg/m^3	24 hours	50µg/m^3
7	$PM_{2.5}$	Annual average	15 µg/m^3	40 µg/m^3	Annual arithmetic mean	15 µg/m^3	1 year	10µg/m^3
		24 hours	35 µg/m^3	75 µg/m^3	24-hours average	65 µg/m^3	24 hours	25µg/m^3
		1 hour	15 µg/m^3	15 µg/m^3	-	-	-	-
8	Lead	Annual average	1 µg/m^3	1 µg/m^3	Quarterly average	1.5 µg/m^3	-	-
		24 hours	1.5 µg/m^3	1.5 µg/m^3			-	-
9	CO	8 hours	5 mg/m^3	5 mg/m^3	8-hours Average	10 mg/m^3, (9 ppm)	-	-
		1 hour	10 mg/m^3	10 mg/m^3	1-hour average	40 mg/m^3, (35 pm)	-	-

Table 3.4: Comparison of Drinking Water Quality Standards

#	Parameters	Concentration Standards			
		PEQS (mg/l)	**SEQS (mg/l)**	**WHO (mg/l)**	**USEPA (mg/l)**
Chemical Parameters					
1	Aluminium (Al)	≤ 0.2	≤ 0.2	0.2	0.05-0.02
2	Ammonium (NH3)	-	-	1.5	NS
3	Antimony (Sb)	≤ 0.005	≤ 0.005	0.005	0.006
4	Arsenic (As)	≤ 0.05	≤ 0.05	0.01	0.05
5	Barium (Ba)	0.7	0.7	0.7	2.0
6	Boron (B)	0.3	0.3	0.3	NS
7	Cadmium (Cd)	0.01	0.01	0.003	0.005
8	Chloride (Cl)	< 250	< 250	250	250
9	Chromium (Cr)	≤ 0.05	≤ 0.05	0.05	0.1
10	Copper (Cu)	2	2	1-2	1.0
11	Cyanide (CN)	≤ 0.05	≤ 0.05	0.07	0.2
12	Fluoride (F)	≤ 1.5	≤ 1.5	1.5	2.0-4.0
13	Iron (Fe)	-	-	0.3	0.3
14	Lead (Pb)	≤ 0.05	≤ 0.05	0.01	0.015
15	Manganese (Mn)	≤ 0.5	≤ 0.5	0.1-0.5	0.05
16	Mercury (Hg)	≤ 0.001	≤ 0.001	0.001	0.002
17	Molybdenum (Mo)	-	-	0.07	NS
18	Nickel (Ni)	≤ 0.02	≤ 0.02	0.02	0.1
19	Nitrate (NO_3)	≤ 50	≤ 0.50	NS	10.0 as N
20	Nitrite (NO_2)	≤ 3		NS	10.0 as N
21	Selenium (Se)	0.01	0.01	0.01	0.05
22	Silver (Ag)	-	-	NS	0.1
23	Sodium (Na)	-	-	200	20
24	Sulphate (SO_3)	-	-	250	250
25	Residual Chlorine	0.2-0.5	0.2-0.5	-	-
26	Zinc (Zn)	5.0	5.0	3.0	5.0
Physical Parameters					
27	Color	≤ 15 TCU	≤ 15 TCU	15 cu	15 cu
28	Taste	Non-Objectionable/ Acceptable	Non-Objectionable/ Acceptable	-	-

#	Parameters	Concentration Standards			
		PEQS (mg/l)	**SEQS (mg/l)**	**WHO (mg/l)**	**USEPA (mg/l)**
29	Odor	Non-Objectionable/ Acceptable	Non-Objectionable/ Acceptable	N S	3 TON
30	Turbidity	< 5 NTU	< 5 NTU	5 NTU	0.5-5.0 NTU
31	Total hardness	< 500 mg/l	< 500 mg/l	-	-
32	TDS	< 1000	< 1000	1000	500
33	pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Biological Parameters					
34	E-Coli	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	0	0
35	Total Coliforms	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	0	0

WHO Environmental Quality Standards and NEQS are attached as **Annex I.**

SECTION 4: PROJECT DESCRIPTION

4.1 Rational of the Project

81. This section of Indus highway (N 55) is the part of CAREC Corridors 6 within Pakistan and will interconnect neighboring countries acting as a regional hub in order to promote regional trade. CAREC include six corridors in eleven states. The Government of Pakistan (GoP) is upgrading and rehabilitating CAREC corridor 6 inside the boundaries of Pakistan to improve regional connectivity. This is the shortest north – south route between Peshawar and Hyderabad.

4.2 Location of Project

82. The proposed alignment runs on the right bank of Indus through the provinces of Sindh and Punjab in Pakistan. Project road starts ahead of junction of N-55 and N-65 (Sukkur - Quetta National Highway) at Shikarpur and traverses through various cities /districts Kandhkot, Khanpur, Ghouspur, Kashmore, Rujhan and terminates at Rajanpur after crossing Rajanpur City. It also passes through various tributaries of River Indus. The alignment passes through two provinces: i.e Punjab and Sindh. The highway is a part of CAREC Corridor 6 as shown in **Figure 4.1.**

4.3 The Project

83. The proposed highway is planned to convert existing 7.3 m wide road section into standard four lane road facility from Shikarpur to Rajanpur including Kashmore Bypass, thus making the whole facility as 4-lane highway. It involves localized improvements in geometric configuration of existing road geometry at locations and extension of existing culverts/bridges. The total length of alignment from Shikarpur to Rajanpur is 221.95 kilometers (km 383-604).

84. For the construction purpose the alignment (221.95km) has been divided in three sections including:

    1. Shikarpur- Kandhkot Section - 62.42 km
    2. Kandhkot- Kashmore Section – 58.78 km
    3. Kashmore -Rajanpur Section – 100.75 km

85. Additional carriageway will be designed at the first stage and improvement/rehabilitation will be executed in second stage by the Government of Pakistan; however, Improvement/ Rehabilitation is not the part of Tranche -II. Alignment map revealing the cities, towns and rural settlements along the corridor is given in **Figure 4.2.**

86. The alignment from Shikarpur to Rajanpur passes through plain terrain, where majority of the area is heterogeneous in terms of landscape (mainly including water-logged areas, vegetative land along N-55 highway, commercial structures and arable field).

87. New four lane bypass with a length of 11.9 km is provided for Kashmore city which is a densely populated center to avoid the traffic congestion in the city. This will cross the Pat Feeder Canal emerging from Guddo Barrage on River Indus. Bypass alignment is shown in **Figure 4.3.** Construction of new culverts and bridges will also be involved in the bypass portion. In addition, major junctions i.e: Junction of N-55 & N-65 at Shikarpur, entry of Kandhkot city & entry of Rajanpur city are provided with grade separation by provision of loops/ramps arrangement with combination of underpass.

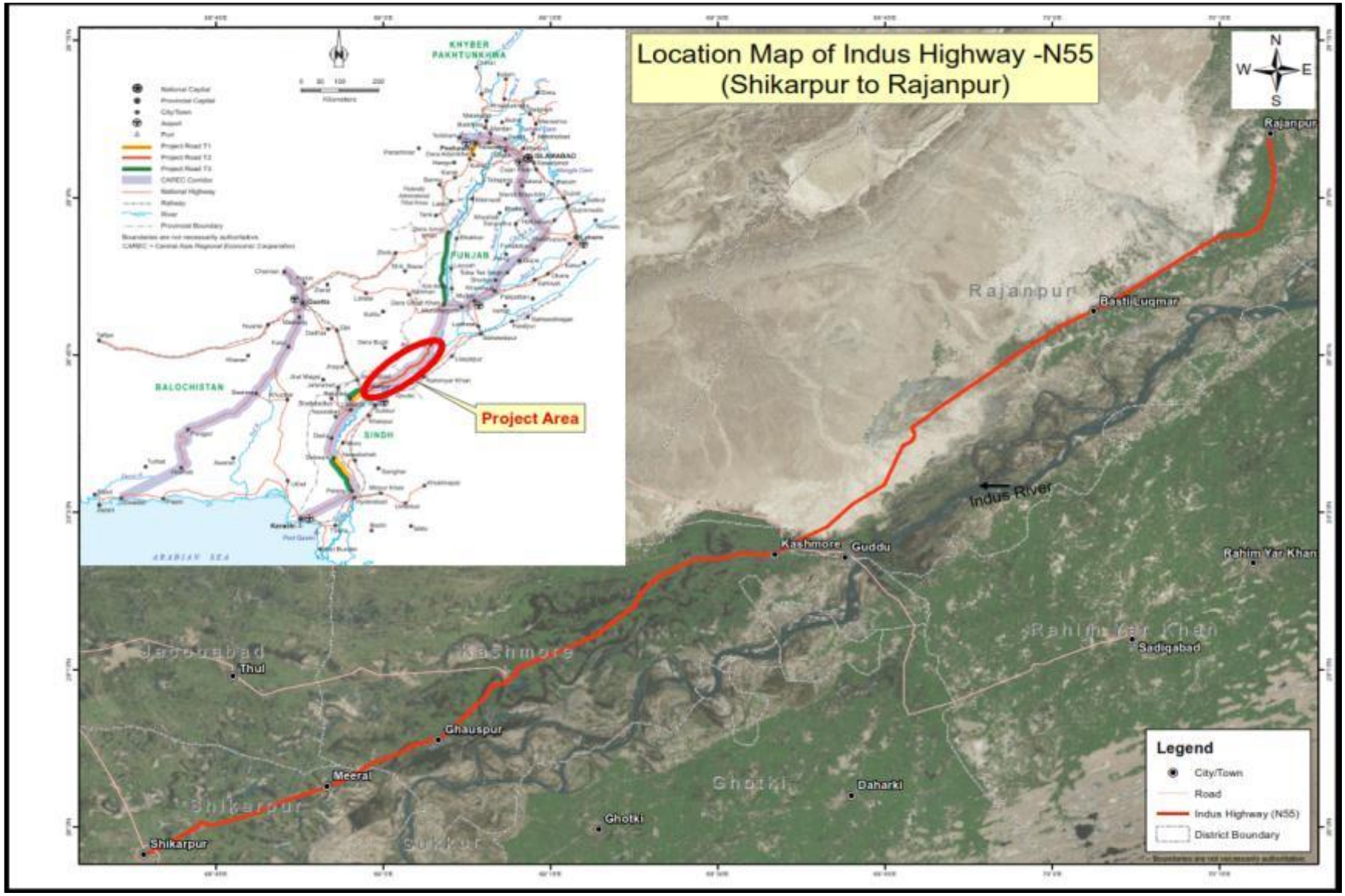


Figure 4.1: Location map of the Project Area

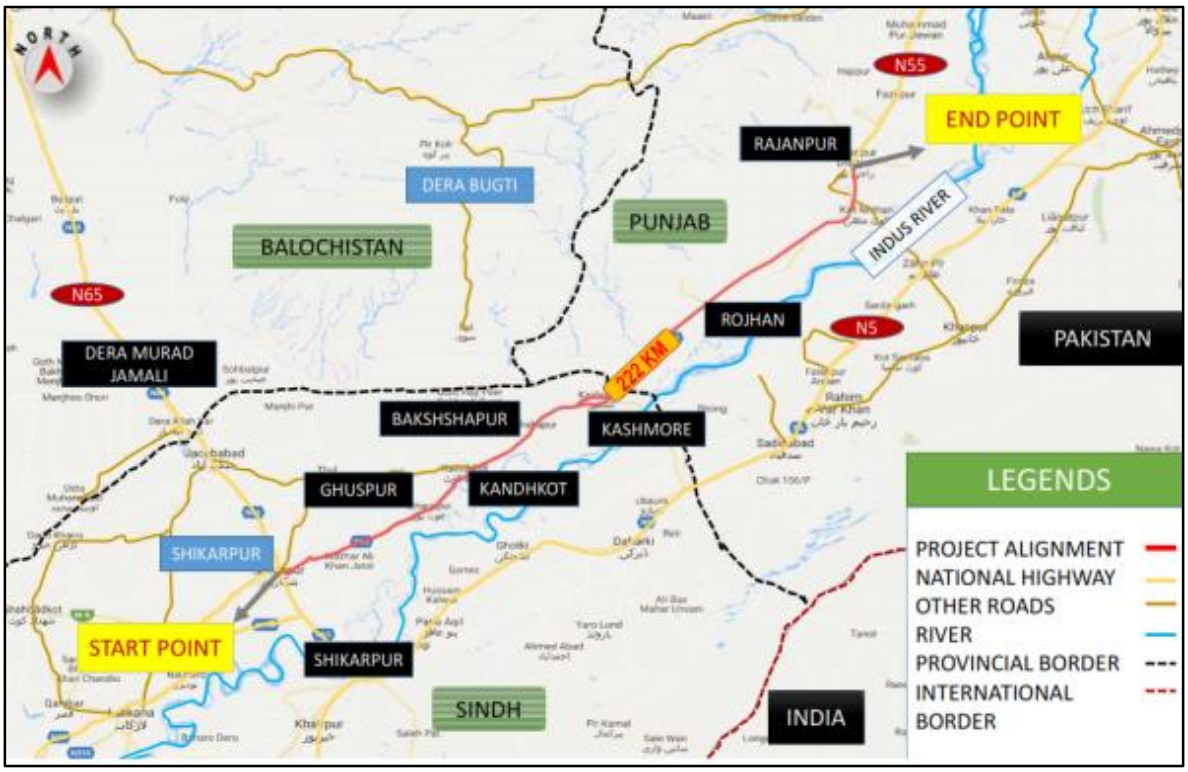


Figure 4.2: Alignment Map of Shikarpur- Rajanpur Section ACW

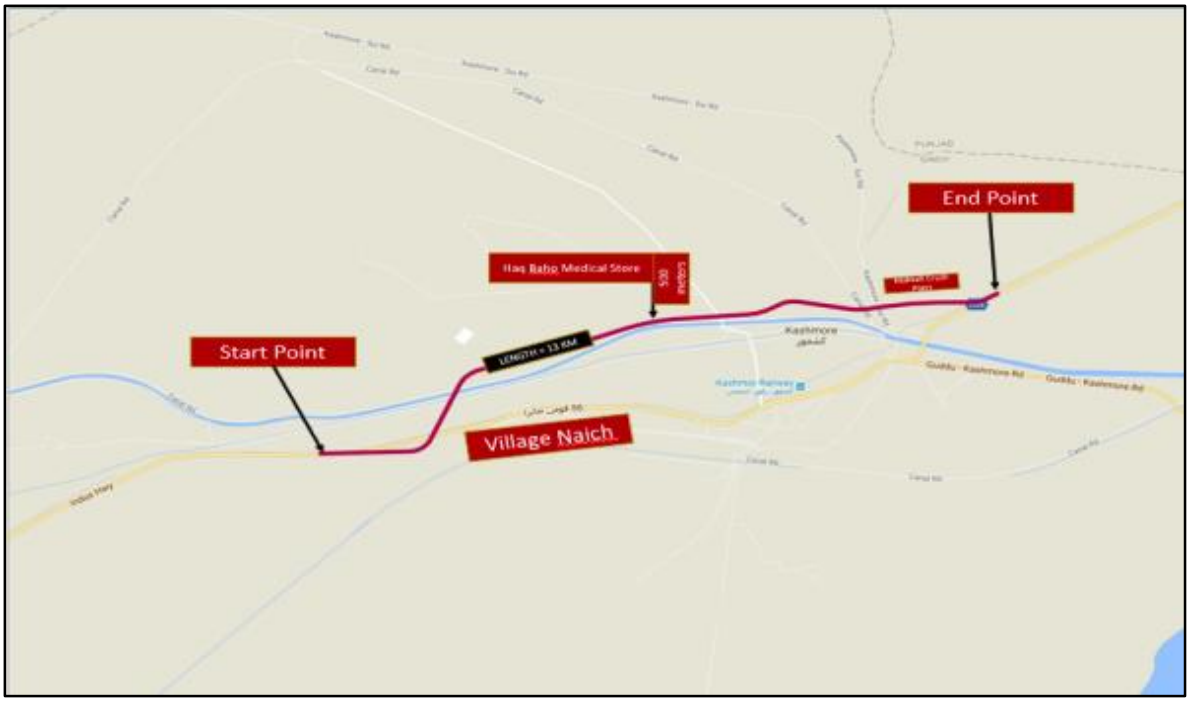


Figure 4.3: Alignment of Kashmore Bypass

88. The details of structures to be constructed to dualize the Shikarpur – Rajanpur section is given in **Table 4.1.**

Table 4.1: Detail of Structures to be constructed

Sr. No.	Type of Structure	Numbers
1	Culverts	500
2	Bridges/Flyovers	31
3	Underpasses/cattle Creeps	19

89. Three major canals emerging from Guddo Barrage on River Indus crosses the alignment near Khandh Kot and Kashmore where bridges will be constructed for additional carriageway. A flyover will be constructed on Railway track near Kashmore.

90. Water ponds can be frequently observed on both sides of the highway from Shikarpur to Rajanpur, where special protection work will be required for additional carriageway. All the structures like culverts/bridges and cattle corridors will be extended/rehabilitated. Sharp curves will be addressed, and geometric configuration will be improved keeping in view the TOR requirement and client consent.

4.4 Duration of the Project:

91. The expected duration for construction is about 3 years.

4.5 Geometric Design of the Proposed Additional Carriageway

92. The geometric design of the proposed road Project meets the following criteria:

Geometric design - AASHTO policy on Geometric design of highways & streets -2004
Material & testing - AASHTO – ASM
Pavement Design -AASHTOguideforDesignofPavementStructures1993
Seismic Design - Uniform Building Code (UBC) and seismic zone map of Pakistan &AASHTO

93. The typical cross section for the Additional carriageway of N 55 is shown in the **Figure4.4 (a) & (b).**

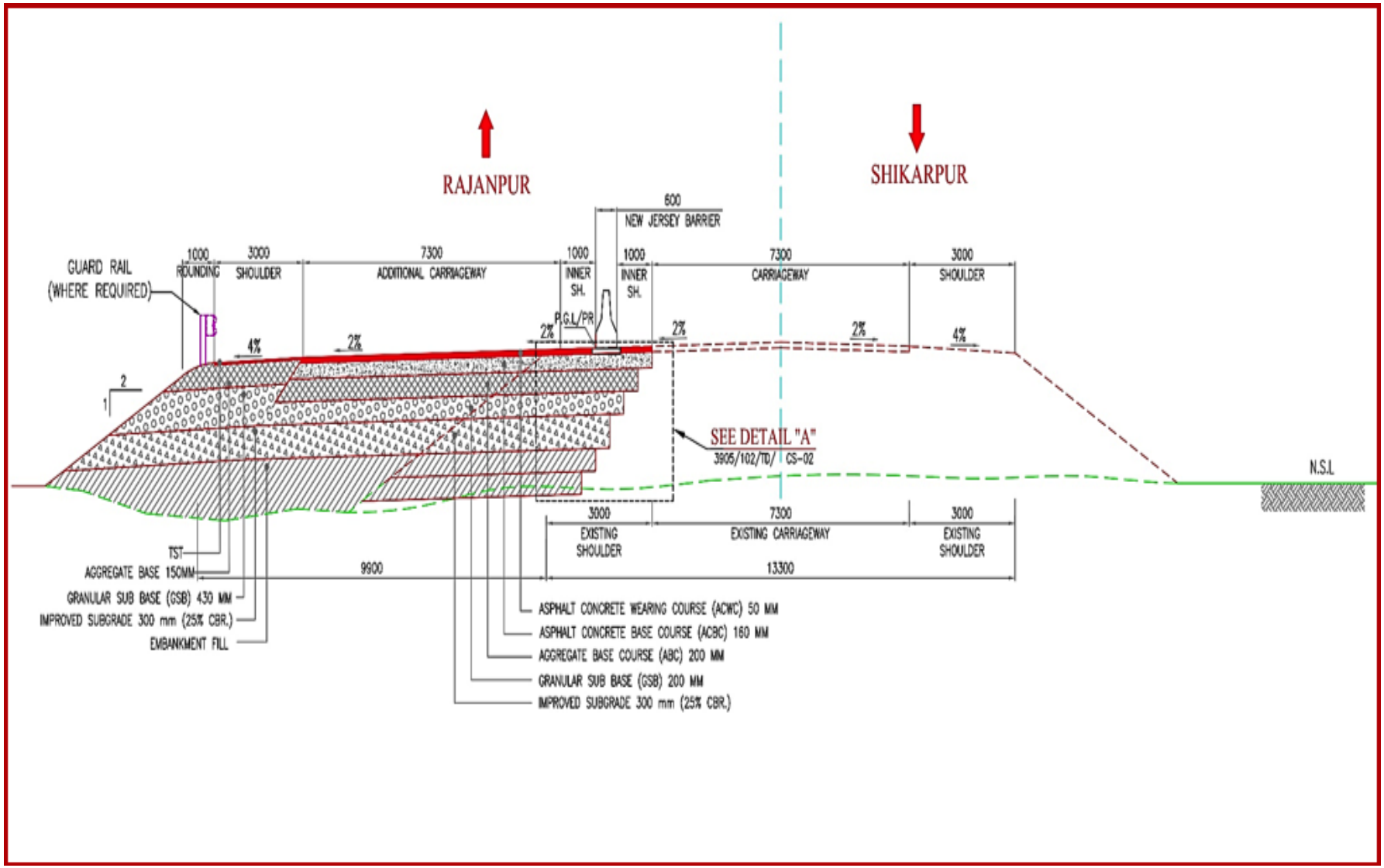


Figure 4.4 (a) : Typical Cross Section for Additional Carriageway

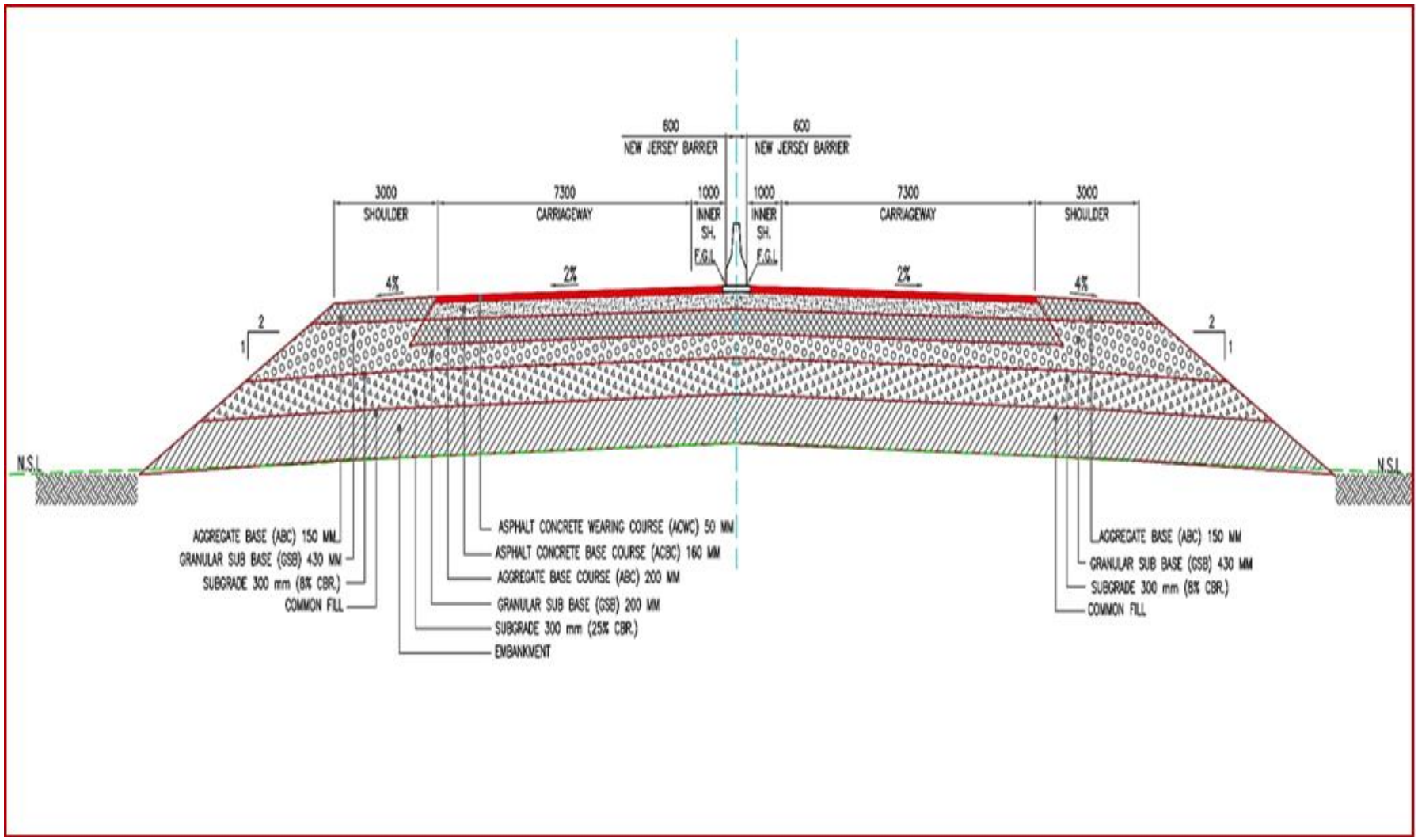


Figure 4.4 (b) : Typical Cross Section for New Construction

94. The proposed road additional carriageway at N-55 (Indus Highway) shall conform to the following specifications:

Design Speed:

Design Speed for Plain Terrain	:	100 km/hr.
Design speed on few constrains	:	80 Km/hr.

Road Cross Section:

Number of Lanes	:	4 Lanes (Two Additional Lanes& Two already exists)
Lane Width	:	3.65 m

Paved Shoulder:

Inner Shoulder	:	1 m
Outer Shoulder	:	2.5 m to 3.0 m (with 0.5m to 1m earthen rounding)

Road Cross Slope

Carriage Way	:	2 %
Shoulders	:	4%
Proposed Right of Way:	:	20 m for additional carriageway 100 m for bypass

95. The recommended pavement thickness for the additional carriageway is given below:

- Asphaltic Concrete Wearing Course (ACWC): 50 mm
- Asphaltic Concrete Base Course (ACBC) : 160 mm
- Aggregate Base Course (ABC) : 200 mm
- Granular Sub-base (GCB) : 200 mm
- Improved Subgrade : 300 mm (25% CBR)

4.6 Embankment Design

96. In the areas of high-water table, filter cut-off layer shall be provided to protect the pavement structure. It includes the provision of day-lighting drainage gallery at the bottom of pavement over subgrade top. The consultant may allow the filter cut-off to function both as a pavement subgrade and filter cut-off layer. Surface drainage will also be designed properly with defined disposal points with the special considerations. Design CBR for the embankment will be based on NHA specification of 5%, however, if potentially high strength material is available within easy lead of the project vicinity, design CBR value for embankment will be changed in order achieve cost benefit. In case of paddy fields, granular sand to appropriate depth will be provided to arrest the seasonal water ponding.

4.7 Traffic Count and Projection

97. Traffic study to determine AADT at various locations was carried out by the design consultant. The projected traffic was calculated for the period of thirty years and the predicted design levels over the design life of the N-55are presented in **Table 4.2**.

Table 4.2: Summarized Total Traffic Projections by Type of Vehicles

JACOBABAD CHOWK SHIKARPUR (Start Point)

Both Direction: Shikarpur to Khanpur

Years	Number of Years(n)	VEHICLES									TRUCKS				Total Traffic
		Rickshaw	Motor Cycle	Car/Jeep Suzuki	Pajero Puck	Hiace Wagon	Mini Bus	Bus	Loader pick-ups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	/5-AXLE &Above	
2017	1	1255	2855	678	96	28	3	16	163	61	73	31	3	10	5272
2029	13	1736	4959	908	128	40	4	22	254	82	99	42	4	13	8292
2042	26	2208	7189	1149	163	52	5	29	360	106	128	55	5	17	11465

ADMORE PUMP AT RAJANPUR ON N-55 (End Point)

Both Directions Rojhan to Rajanpur

Years	Number of Years (n)	VEHICLES									TRUCKS				Total Traffic
		Rickshaw	Motor Cycle	Car/Jeep Taxi	Pajerozuki Puck	Hiace Wagon	Mini Bus	Bus	Loader pick-ups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	/ 5-AXLE &Above	
2017	1	269	2739	2851	99	168	2	356	139	285	977	1085	258	635	9864
2029	13	373	4758	3819	133	235	3	498	216	384	1316	1461	347	856	14399
2042	26	474	6898	4832	168	305	4	648	306	497	1703	1891	449	1107	19284

98. The traffic categories noted during count survey were: Animal-drawn Vehicles; Cycles; Motorcycles; Rickshaws; Cars/Jeeps/Taxis/Pajeros; Loader Pickups; Hiace, Buses; Mini Buses/Coasters; Tractors/Tractor Trolleys; Trucks 2–Axles; Trucks 3–Axles; Large Trucks/Trailers/4-Axles and above. Traffic forecasts have been made for 30 years. The traffic analysis at start and end point of this section are given in table 4.2. The project is expected to facilitate about 20,000 Annual Average Daily (AAD) vehicles in its design life.

4.8 Construction Logistics

99. The location for project facilities such as Camp sites, material storage yards, equipment yards, workshops, will be selected keeping in view the availability of access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Final locations will be selected by the contractor in consent with supervision consultant SC) after approval from NHA.

100. It is envisaged that the Project will attract about 1500-2000 skilled/unskilled labor for each section. It should be ensured that maximum labor hired would be local who will return home in the evening. However, the majority of the skilled labor working on site is likely to be migrated from other part of the country. It is a contractor's contractual obligation to provide a labor camp and consultants and employer office on site. The location of the labor camps should be at least 500 meters away from the nearby human settlements. They will require services such as electricity, water, sanitation facilities and masonry work. The specific site for these facilities cannot be determined at this stage and would be finalized at the time of contractor's mobilization.

101. The Asphalt and batching plants would be installed at appropriate areas adjacent to the proposed ACW. These facilities should be at least 500 meters away from any human settlement and equipped with emission controlling devices.

102. The municipal solid wastes generated in construction & workers camp will be disposed of at nearest identified location of disposal / landfill sites of local authority under their consent. Lavatories with shower facilities should be provided with sufficient water availability to labor and the wastewater disposal should be through septic tank and soakage pit of the adequate size.

4.9 Construction Materials

103. The materials used in construction of the road for the proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, cement etc. According to the geotechnical investigation report of the proposed project, crushed base and sub-base materials will consist of a blend of processed aggregates such as crushed stone fragments and rock dust. To meet the grading requirement, blending may also be required. The design CBR for these materials shall be governed by the project specifications.

104. Contractor will decide for sources of construction material and that would be approved by NHA. Aggregate is available at Shahwali and Rohri aggregate quarry; while, sand is available at Sui. Furthermore, the approved list of quarries and borrow pits is given on Composite Schedule Rates (CSR) prepared by NHA for Punjab and Sindh province 2014[16]on theses websites:

[16] http://nha.gov.pk/wp-content/uploads/2018/02/CSR-2014-Punjab.pdf
http://nha.gov.pk/wp-content/uploads/2018/02/CSR-2014-Sindh.pdf

105. The earth required for construction of additional carriageway and alternative routes at the proposed location (Shikarpur to Rajanpur) would be considered at the available government land (demarcated RoW by NHA). If earth is required to be lifted from private own land, then the owner(s) of the land will be duly compensated. Contractor will be responsible to make an agreement with land owner to excavate and restore the borrow area considering the conditions given in Management Plan.

106. Construction material for the proposed project will be required in following quantities:

Subbase: 1.06 million cubic meter

Aggregate base: 0.85 million cubic meter

Asphalt: 1.5 million tons

4.10 Construction Equipment

107. The list of the machinery and the equipment required for the proposed project is provided in **Table 4.3**.

Table 4.3 Machinery and Equipment Requirement

Sr. #	Type of Machinery/ Equipment	Sr. #	Type of Machinery/ Equipment
1	Bulldozer	13	Rollers
2	Excavator	14	Tandem
3	Dump Trucks	15	Vibratory Combination Rubber Mounted Tandem Roller
4	Grader	16	Crane
5	Grader with Scarifier	17	Beam Launching Truss
6	BackHoe	18	Piling Equipment
7	Water Tanker	19	Vibrator for Concrete
8	Front End Loader	20	Road Marking Machine
9	Paver	21	Concrete Batching Plant
10	Power Broom	22	Asphalt Premix Plant
11	Bitumen Pressure Distributor	23	Laboratory with Equipment (1 permanent & 1 mobile)
12	Pug Mill		

4.11 Personnel Required

108. Staff requirements during construction phase of the proposed Project are 206 and 107 for NHA and consultant respectively[17].

109. Man power requirement of NHA for construction is given below:

Designation	No. of Posts	Months
General manager (Construction)	1	36
Project Director (Engineer)	3	36
Deputy Director (Engineer)	3	36
Assistant Director (Engineer)	3	36
Assistant Director (Environment)	3	36

[17] PC-1 of Shikarpur-Rajanpur Section (November, 2019).

Designation	No. of Posts	Months
Assistant Computer programmer	3	36
Inspector/Supervisor	6	36
Deputy Director (Land)	1	12
Assistant Director (Legal)	3	12
Assistant Director (L & S)	3	12
Land acquisition (collector)	3	12
Qanoongo	9	12
Patwari	15	12
Surveyor	6	36
Accountant	2	36
Superintendent (Admin)	2	36
Account Assistant	2	36
Computer Operator	6	36
Office Assistant	6	36
Stenotypist	3	36
UDC	6	36
LDC	6	36
Driver	30	36
Naib Qasid	6	36
Helper	15	36
Chowkidar	10	36
Sweeper	10	36
Round guard	10	36
PA	30	36

110. Man power requirement for consultant during construction stage:

Designation	No. of Posts	Months
Head office	1	24
Resident Engineer	4	96
Highway Engineer	4	96
Structure Engineer	4	96
Environmental Engineer	4	96
Bridge Engineer	4	96

Designation	No. of Posts	Months
Material Engineer	4	96
Material Inspectors	8	192
Site Inspectors	16	384
Surveyors	16	384
Lab technicians	8	192
Quantity Surveyors	4	96
Others	30	720

111. The estimated man power requirement for contractor including skilled and unskilled labour is 300.

SECTION 5: DESCRIPTION OF THE ENVIRONMENT

5.1 Physical Environment

5.1.1 Geology and Soil

112. Based on the physical environment and geology, the project area falls in the Indus Basin. The Indus Plain essentially forms the western extension of Indo-Gangetic Plain, and has been made up of the silt brought by the Indus and its numerous tributaries, such as Jhelum, Chenab, Ravi and Sutlej on the east bank, and Kabul, Kurram, Tochi, and others on the west bank.

113. The Indus Plain is known for its agricultural fertility and cultural development throughout history. On the basis of landforms and hydrology, the Indus Plain may be divided into the 'upper' (north) and 'lower' (south) Indus Plains.

114. The Upper Indus Plain (where the project is located) differs from the Lower Indus Plain in that the land surface is divided into several interfluves, or doabs, by the major tributaries. Area close to Indus River is categorized as loamy and seasonal flooded soil of river plains.

5.1.2 Topography and Land Use

115. The elevation of the Study Area generally ranges between 15 and 45 m above mean sea level. It slopes towards the Indus River which runs along the eastern boundary. There are small sedimentary hills in the western and southwestern side that rise to an elevation of about 100 meters. The western side is gravel plain with very little natural vegetation cover. The eastern half of the is part of the Indus River flood plain.

116. There are two main land uses in the Study Area within around 5-7Km from the proposed dualized section of road. These are the agricultural land in the east and the urban and semi urban areas in the south. The Indus River floodplain has good alluvium soil and has been converted to productive farmlands.

117. Areas important to be considered are water logged and salinity areas, rice and sugarcane cultivated field and linear planation of tree species of Shikarpur and Kashmore Districts The land-use map of the study area from Shikarpur to Rajanpur is shown in **Figure 5.1.**

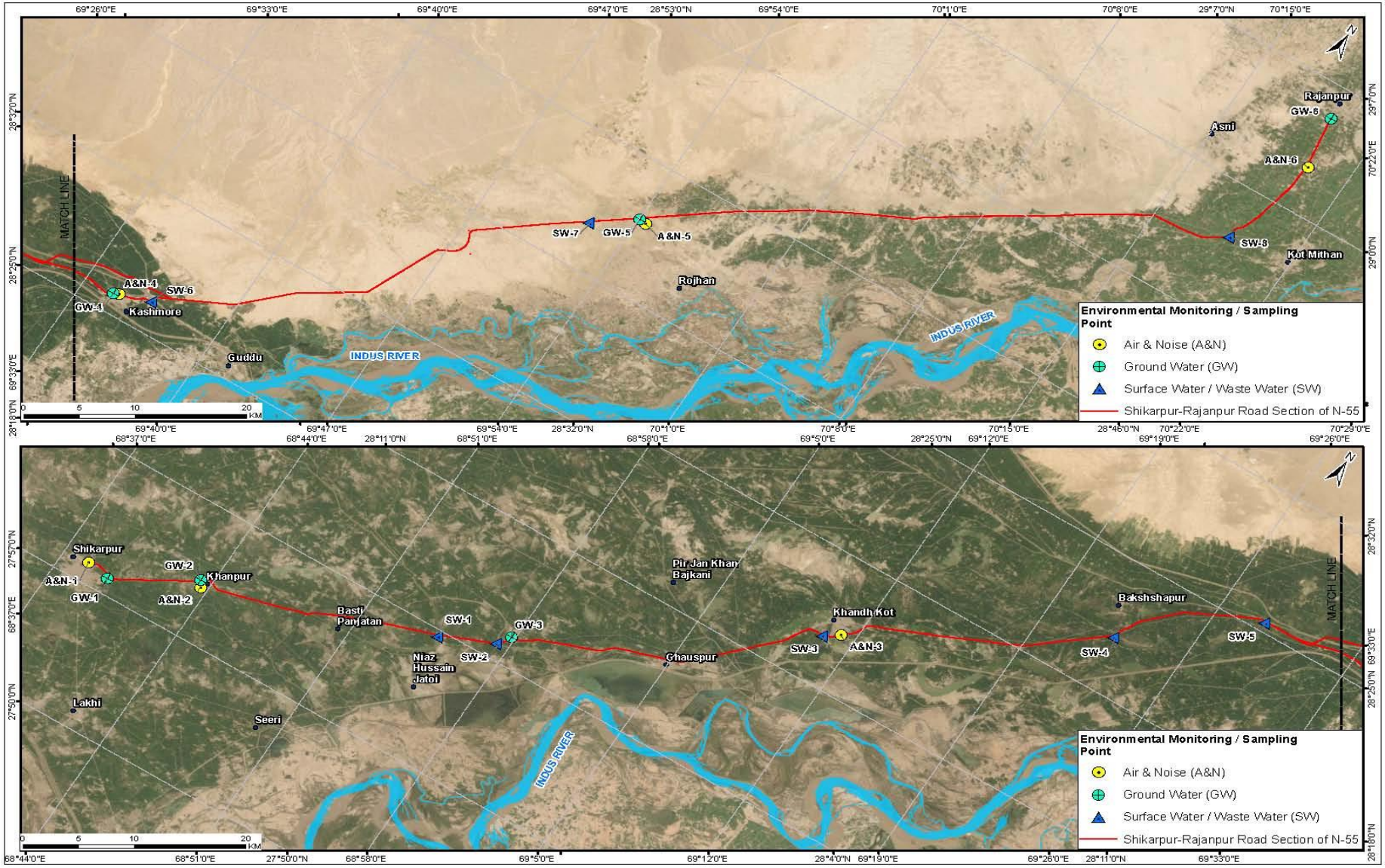
5.1.3 Climate and Air Quality

118. The climate of the project area is broadly described as hot and arid in Rojhan and its closed proximity areas. Particularly Shikarpur and Kandhkot area has a hot desert climate with extremely hot summers and mild winters.

119. The highest recorded temperature is 52.8 °C (127.0 °F), and the lowest recorded temperature is −3.9 °C (25.0 °F). The project area lies in a region where monsoon rainfall is low, and the distinction between the summer and monsoon seasons is not very well marked.

120. The mean Annual Precipitation is 110.40 mm. Even the scarce rainfall is not very distributed, and around 55 – 60% of it occurs within the months of July and August. The rain's effect, on temperature for instance, is minimal. The Dominant wind direction is southwest.

121. Baseline air quality monitoring has been conducted in July 2020 for NO, NO_2, SO_2, PM_{10}, CO and the results are provided in the **Table 5.1**. The criteria for selection of monitoring locations are attached as **Annex II.** Monitoring reports for ambient air, noise, surface water and ground water are attached as **Annex III** whereas monitoring/sampling points are presented in the figure below.


MATCH LINE
A&N-4
SW-6
GW-4
Kashmore
Guddu
INDUS RIVER
SW-7
GW-5
A&N-5
Rojhan
INDUS RIVER
SW-8
Kot Mithan
Asni
Rajanpur
GW-6
A&N-6
Environmental Monitoring / Sampling Point
Air & Noise (A&N)
Ground Water (GW)
Surface Water / Waste Water (SW)
Shikarpur-Rajanpur Road Section of N-55
Shikarpur
GW-2
A&N-1
Khanpur
GW-1
A&N-2
Basti Panjatan
SW-1
GW-3
SW-2
Niaz Hussain Jatoi
Lakhi
Seeri
Pir Jan Khan Bajkani
Khandh Kot
SW-3
A&N-3
Ghauspur
Bakshshapur
SW-4
SW-5
MATCH LINE
INDUS RIVER
Environmental Monitoring / Sampling Point
Air & Noise (A&N)
Ground Water (GW)
Surface Water / Waste Water (SW)
Shikarpur-Rajanpur Road Section of N-55

Ambient Air & Noise (A&N) Monitoring		
A&N-01	Residential Area	Shikarpur
A&N-02	Rural Health Centre & Residential Area	Khanpur
A&N-03	Masjid Ali-ul-Murtaza & Residential Area	Kandhkot
A&N-04	Jamia Masjid Qadria & Residential Area	Kashmore
A&N-05	Rural Health Centre & Residential Area	Rojhan
A&N-06	Noorani Masjid & Residential Area	Rajanpur

Table 5.1: Monitoring Results of Ambient Air

Location	Parameter				
	PM_{10}	**CO**	**NO**	**NO_2**	**SO_2**
Units	**µg/m³**	**mg/m³**	**µg/m³**	**µg/m³**	**µg/m³**
Duration	**24 hrs**	**8 hrs**	**24 hrs**	**24 hrs**	**24 hrs**
Kund Kot	102.6	1.17	13.5	14.9	14.35
Kashmore	103.8	0.98	12.7	14.7	14.02
Rojhan	104.1	1.15	12.36	15.06	14.16
Rajanpur	100.9	1.05	12.88	14.93	13.86
Shikarpur	100.7	1.10	13.72	14.9	13.68
Khanpur	102.8	0.81	11.83	14.10	13.19
SEQS Limit	150	5	40	80	120
IFC Guidelines	50 (24 hour)	-	-	40 (1 year) 200 (1 hour)	20 (24-hour)

122. The results are within prescribed limits of national and international standards for NO_2 and SO_2. PM-10 exceeds values recommended in IFC guidelines. The detailed results are attached as **Annex III**.

5.1.4 Water Resources

a. Surface Water

123. Major water bodies in the Study Area include the Indus River, Kalri Baghar and Desert canal, Kandhkot branch, Choi branch, Umar Wah, and Kadra canal.

124. Water quality in major water bodies has been monitored during July 2020 in sampling points indicated in the figure above and detailed in a table below.

Surface Water (SW) Sampling		
SW-01	Nullah Crossing	Meeral
SW-02	Begari Canal Crossing	Kandhkot
SW-03	Nearby Water Pond	Kandhkot
SW-04	Nearby Water Pond	Near Bakshapur
SW-05	Pat Feeder Distributary Crossing	Kashmore
SW-06	Pat Feeder Canal Crossing	Kashmore
SW-07	Matwah Distributary Crossing	Near Rojhan
SW-08	Kadra Canal Crossing	Near Kot Mithan

The results of the surface water monitoring are given in **Table 5.2**.

Table 5.2: Monitoring Results of Surface Water

Sr. No.	Parameters	Units	PEQS	Kot Mithan, Rajanpur	Rojhan	Kashmore	Bakhshapur Kahsmore	Bakhshapur (2) Kahsmore	Kandhkot	Niaz Hussain Jatoi, Khanpur	Niaz Hussain Jatoi (2), Khanpur
1.	Temperature	^{0}C	---	16	18	19	15	16	18	16	18
2.	pH	--	6 – 9	7.9	7.8	8	7.8	7.9	8.1	7.8	7.9
3.	TDS	mg/L	3500	1963	1854	2167	1993	2087	2371	1934	2130
4.	COD	mg/L	150	135	127	116	124	128	116	127	103
5.	BOD_5 at 20^{o}C	mg/L	80	71	69	73	76	81	73	83	76
6.	Phenolic Compounds (as Phenols)	mg/L	0.1	0.08	0.06	0.08	0.09	0.06	0.09	0.07	0.003
7.	Chloride	mg/L	1000	261	272	152	143	149	136	129	110
8.	Copper (Cu)	mg/L	1.0	0.86	0.97	0.82	0.67	0.51	0.53	0.41	0.040
9.	Iron (Fe)	mg/L	8.0	0.96	1.03	0.93	0.82	0.73	0.81	0.33	0.25
10.	Lead (Pb)	mg/L	0.5	ND	ND	ND	ND	ND	ND	ND	ND
11.	Manganese (Mn)	mg/L	1.5	0.14	0.093	0.087	0.073	0.067	0.051	0.046	0.037
12.	Sulfate (SO_4^{2-})	mg/L	600	168	142	167	192	162	142	122	114
13.	Zinc (Zn)	mg/L	5.0	0.81	0.9	0.7	0.6	0.09	0.08	0.092	0.089
14.	Silver (Ag)	mg/L	1.0	0.54	0.06	0.09	0.12	0.05	0.06	0.04	0.02
15.	Boron (B)	mg/L	6.0	0.19	0.7	0.05	0.08	0.08	0.16	0.08	0.07
16.	Barium (Ba)	mg/L	1.5	0.13	0.62	0.04	0.034	0.026	0.049	0.056	0.06

The results are within permissible limits except BOD_5 at Niaz Hussain Jatoi, Khanpur.

b. Ground Water

125. Ground water is brackish with TDS value generally higher that's why it is not major source of drinking water in the Study Area. However, along the river and canals the water is sweet for drinking purpose. The depth of groundwater table varies from 3 to 20 m. Hydrological Map is shown in **Figure 5.2.**

126. Water quality in aquifers has been monitored during July 2020 in sampling points indicated in the figure above detailed in a table below.

Ground Water (GW) Sampling		
GW-01	Kundan Mosque & Residential Area	Shikarpur
GW-02	Govt. Higher Secondary School & Residential Area	Khnapur
GW-03	Cadet College	Kandhkot
GW-04	Masjid-e-Bilal & nearby Residential Area	Kashmore
GW-05	Rural Health Centre & Residential Area	Rujhan Chowk
GW-06	Mushtaq Hotel & nearby Residential Area	Rajanpur

127. The results of the Ground water are given in **Table 5.3**.

Table 5.3: Monitoring Results of Ground Water

Sr. No.	Parameters	Units	Limits Values (PEQS)	Rajanpur	Rojhan	Kashmore	Niaz Hussain Jatoi Khanpur	Khanpur	Shikarpur
1.	pH	-	6.5 – 8.5	6.4	6.8	6.1	6.9	5.9	6.3
2.	Taste & Odour	-	Non-Objectionable/ Acceptable	Salty	Non-Objectionable/ Acceptable	Salty	Non-Objectionable/ Acceptable	Salty	Salty
3.	Color	TCU	≤15	9	6	11	5	7	8
4.	Turbidity	NTU	<5 NTU	6	5	7	3	6	5
5.	Total Coliform Bacteria	Nunber/100mL	---	0	0	0	0	0	0
6.	Fecal Coliform (E. Coli)	Nunber/100mL	Must not be detectable in any 100 mL sample	0	0	0	0	0	0
7.	Total Dissolved Solids	mg/L	<1000	1694	372	1068	289	942	861
8.	Total Hardness as $CaCO_3$	mg/L	<500	267	94	122	59	106	119
9.	Nitrate	mg/L	≤ 50	7.6	4.1	6.7	3.3	4.1	4.7
10.	Nitrite	mg/L	≤ 3	**0.85**	0.09	0.91	0.0054	0.05	0.06
11.	Ammonia	mg/L		1.94	0.083	1.8	0.057	0.72	0.58
12.	Arsenic (As)	mg/L	≤ 0.05	ND	ND	ND	ND	ND	ND

Sr. No.	Parameters	Units	Limits Values (PEQS)	Rajanpur	Rojhan	Kashmore	Niaz Hussain Jatoi Khanpur	Khanpur	Shikarpur
13.	Antimony (Sb)	mg/L	≤ 0.005	ND	ND	ND	ND	ND	ND
14.	Barium (Ba)	mg/L	0.7	ND	ND	ND	ND	ND	ND
15.	Chloride (as Cl^-)	mg/L	<250	**194**	72	202	56	117	102
16.	Fluoride	mg/L	≤ 1.5	1.1	091	0.98	0.84	0.61	0.49

The results are mostly in compliance with the standards. However, the water at some points is turbid, salty and has higher TDS, and lower pH.

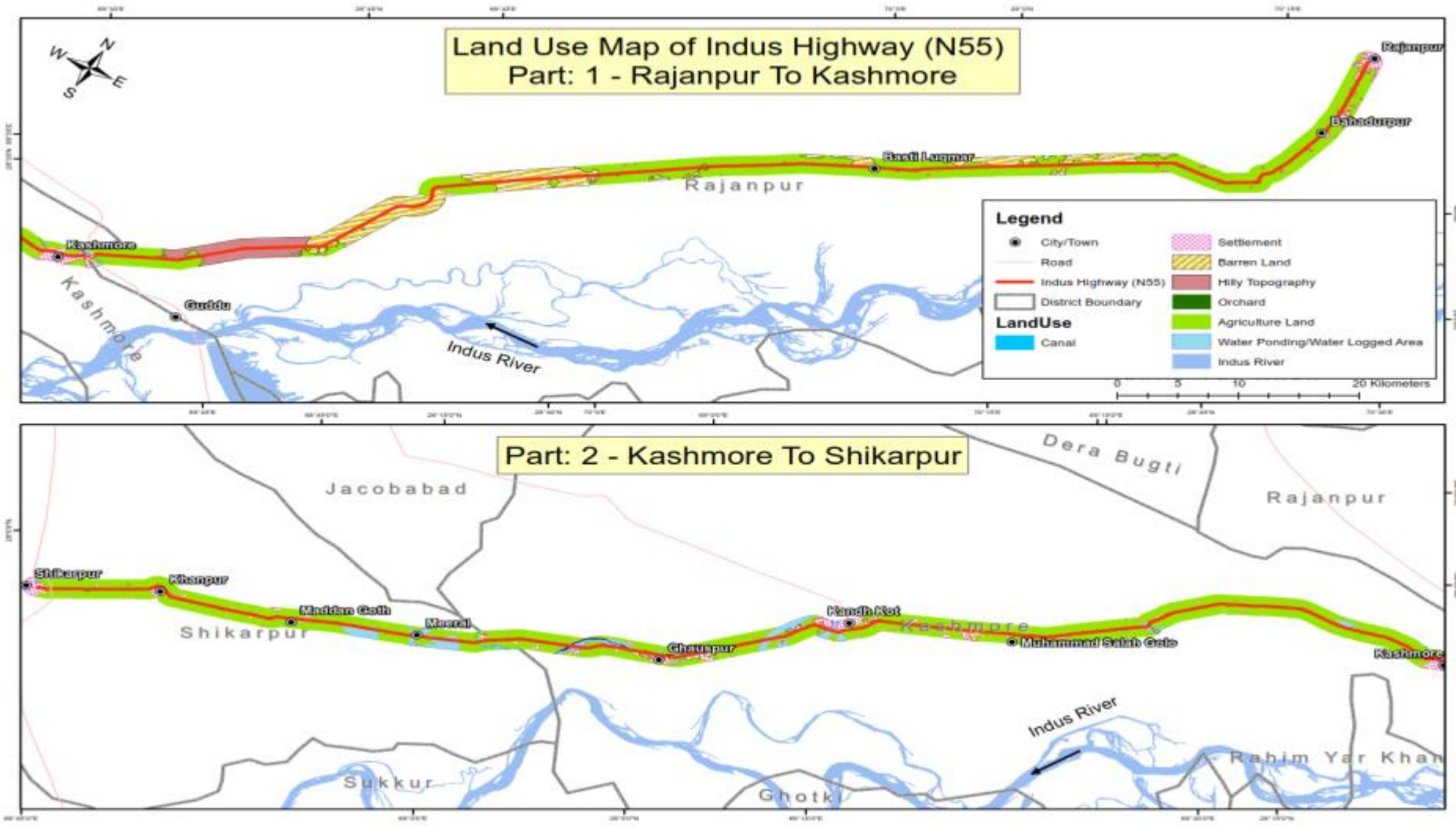


Figure 5.1: Land-use map of the Study Area

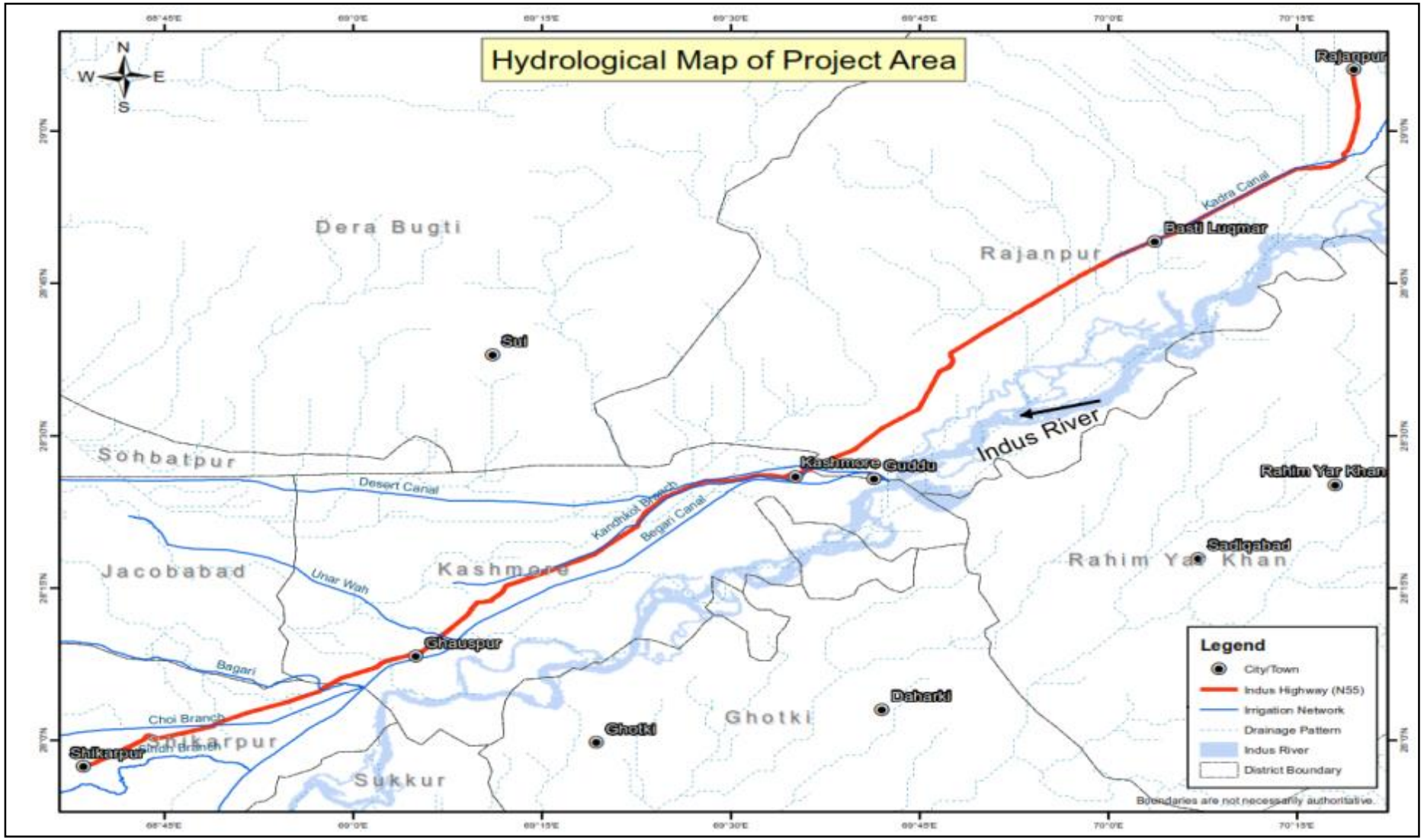


Figure 5.2: Hydrological map of Project Area

5.1.4 Natural Hazards

i. Seismology

128. The Project Area is located in Seismic Zone 2A, on the seismic zoning map of Pakistan, where 2A represents peak horizontal ground acceleration from 0.08 to 0.16g. An earthquake of magnitude 5.0 hit Sindh on May 9, 2014. The quake was followed by two aftershocks measuring 4.7 and 4.9 magnitude with epicenters located northeast and northwest of Nawabshah. **Figure 5.3** shows the seismic zoning map of Pakistan with the project area falling under Seismic Zone-2A. The road design must meet the criteria to withstand in seismic zone 2A.

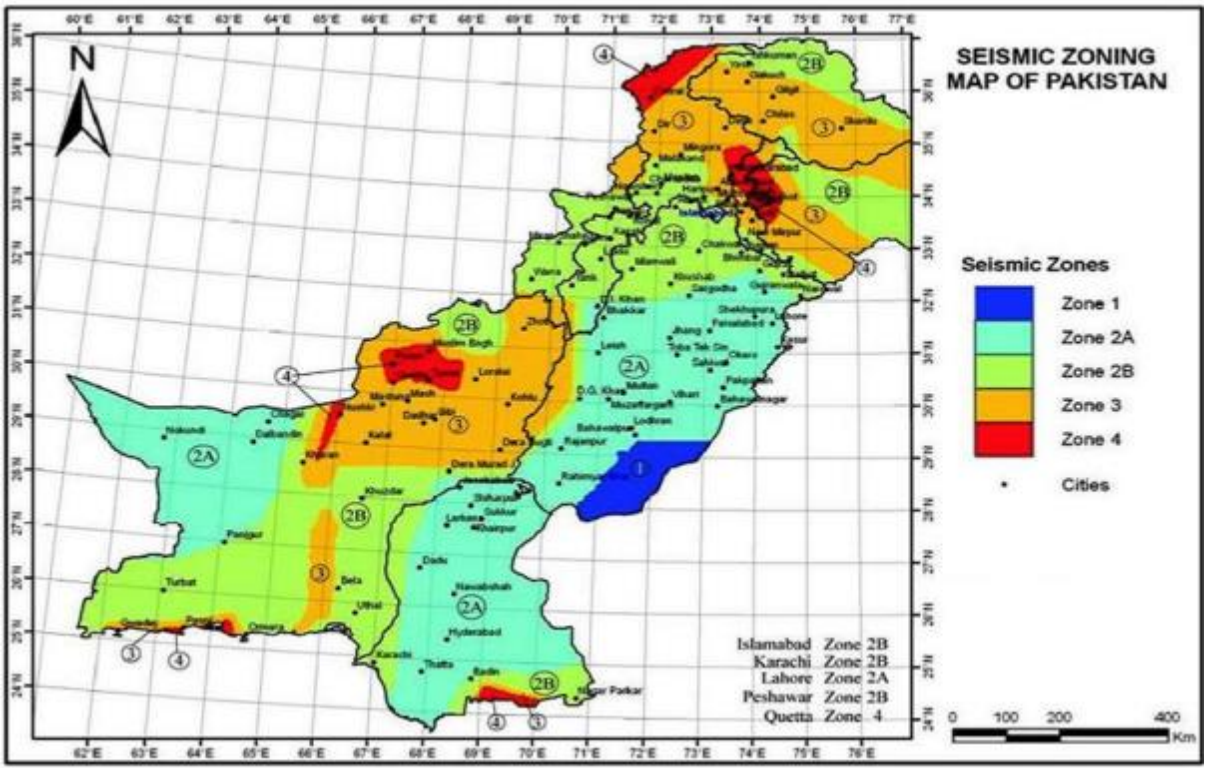


Figure 5.3: Seismic Zoning Map of Pakistan

ii. Floods

129. Project area is flooded by the Indus River which also carries flood water from the other four rivers of Pakistan including Satluj, Ravi, Jehlum and Chenab. These four rivers are tributaries of the Indus and their confluence is at the location of Punjnad. The Indus River has been responsible for 12 of the major floods in Pakistan including the floods of 1950, 1955, 1956, 1973, 1976, 1978, 1988, 1992, 1995, 1997, 2005, 2010 and 2012.

130. The project area of influence (AOI) lies in the floodplain of the river and is constantly susceptible to flooding. The floods of August, 2010 provide a good example of the extent of damage caused by overflowing water. 3781 villages (70 percent of district villages) were flooded and 85 percent of the district area got inundated, blocking 1365 km of roads (85 percent of total roads) for six weeks. **Figure 5.4** shows the areas of Pakistan affected by the floods of 2010.

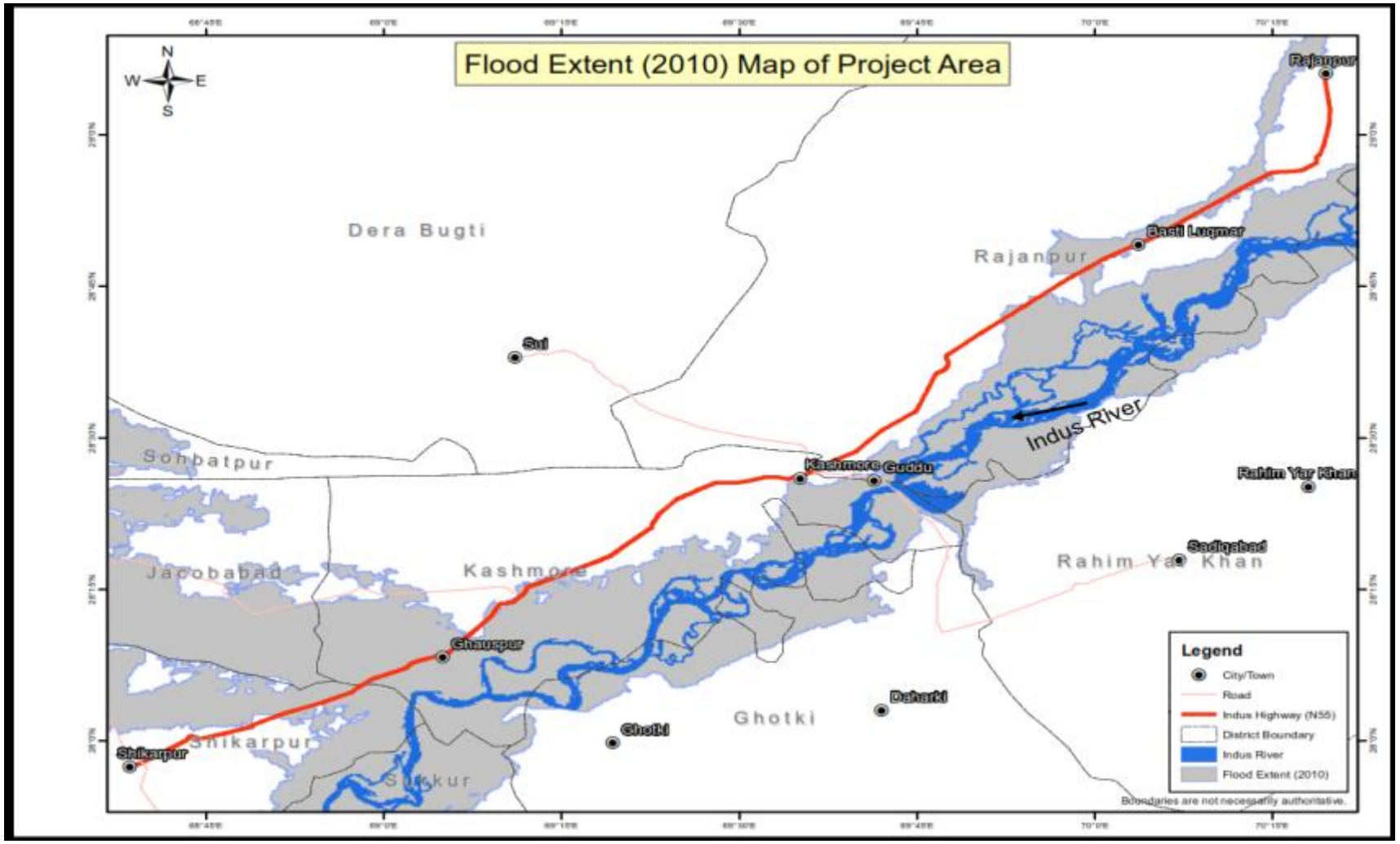


Figure 5.4: An Overview of the Flood Extent in 2010

5.1.5 Noise

131. Monitoring of the noise baseline in the project area has been conducted together with monitoring of other environmental parameters in July 2020. The map showing the measurement points is shown in Section 5.1.3 and the details in a table below.

Ambient Air & Noise (A&N) Monitoring		
A&N-01	Residential Area	Shikarpur
A&N-02	Rural Health Centre (RHC) & Residential Area	Khanpur
A&N-03	Masjid Ali-ul-Murtaza & Residential Area	Kandhkot
A&N-04	Jamia Masjid Qadria & Residential Area	Kashmore
A&N-05	RHC & Residential Area	Rojhan
A&N-06	Noorani Masjid & Residential Area	Rajanpur

132. Noise monitoring results are given in **Table 5.4** which depicts that day time noise values are within limits in all monitored areas when compared with commercial standards. However, night time values for commercial areas are slightly higher. Similarly, noise values are also exceeding day and night time thresholds when compared with residential standards particularly at Rajanpur (Noorani Masjid), Rojhan (RHC), Kashmore (Jamia Masjid Qadria), Kandhkot (Masjid Ali-ul-Murtaza), Khanpur (RHC) and Shikarpur (residential areas). This may be mainly due to heavy traffic load on existing N-55 road.

Table 5.4: Results of Noise Monitoring

Sr. No.	Locations	Duration	PEQS dB (A)		Results dB (A)
			Commercial	Residential	
1.	Rajanpur	Day Time	65	55	63.03
		Night Time	55	45	61.02
2.	Rojhan	Day Time	65	55	59.79
		Night Time	55	45	58.48
3.	Kashmore	Day Time	65	55	62.89
		Night Time	55	45	61.58
4.	Kandhkot	Day Time	65	55	60.89
		Night Time	55	45	59.58
5.	Khanpur	Day Time	65	55	60.30
		Night Time	55	45	58.66
6.	Shikarpur	Day Time	65	55	58.51
		Night Time	55	45	56.53

5.1.6 Environmental Sensitive Receptors

133. The sensitive receptors are shown in the **Table 5.1** and a comprehensive map showing environmental sensitive receptors of the project area such as surface water bodies, animal corridor, agricultural land, urban areas, schools, mosques, monuments, dispensaries, etc. is given as **Figure 5.5 (a).** Tentative locations of these sensitive receptors are shown on the map. The map depicts that the proposed alignment mainly passes through agricultural areas with scattered and thick populated areas. The schools, mosques, monuments and health facilities may be affected during and after the construction of the proposed alignment. The sensitive receptors/structures directly affected by the project are given in **Table 5.5.**

Table 5.5: Environmental Sensitive Receptors and their Sensitivity

Sr. No.	Category	Name/Type of sensitive receptor	Remarks
1	**Schools**	School Located 20 m to ROW at Miran Pur City Area	Sensitivity due to access, dust, noise and vibrations especially during teaching hours during construction phase.
		School Shamsabad at 100 m distance from the road.	
2	**Mosques**	Noorani Masjid, Rajanpur	Sensitivity due to noise and vibrations. Exposure to dust and access problems may occur at certain locations during construction phase.
		Jamia Masjid Kotla Nasir (0-10 m)	
		Mosque located at 581 Km at Kot Bahadur	
		Mosque located at 10 m from ROW at Shamsabad	
		Mosque located 20 m away from Baskhsha Pur City	
		Mosque located at 20 m away from ROW at Karampur area.	
		Mosques located 20 m away from the road alignment at Karampur Area.	
		Jamia Masjid Qadria, Kashmore	
		Masjid Ali-ul-Murtaza, Kandhkot	
		Mosques located 10 m away from ROW at Ghoos Pur Area	
		Mosque located 10 m at Khanpur Area	
		Mosques Located 20 m from ROW at Shikarpur Area	
3	**Residential Areas**	Rajanpur	Sensitivity due to noise and vibrations. Exposure to dust and access problems may occur at certain locations during construction phase.
		Rojhan	
		Kashmore	
		Locality of Kotla Nasir along road (0-5m)	
		Miranpur City Area at Km 548	
		Kandhkot	
		Shamsabad	
		Khanpur	
		Shikarpur	
4	**Water logged areas/ water ponds**	Water pond at Km 581, located at around 18 km to Rajanpur	Sensitive due to increased sedimentation loading from the road and construction activities.
		Water Pond Located at 10 m ROW at Basti Bajwa	
		Water logged area (saline water bodies at different locations) at Bakhsha Pur City area	
		Large Area confined with water logging at Goth Nawab Khan	
		Water Logged area at Ghoospur city	
		water logged patches at different locations Shikarpur areas	
5	**Other important areas**	Police station Shamsabad 50 m	
		RHC, Rojhan	
		Graveyard located adjacent to the existing raod at Bakhsha Pur City	
		Police Checkpost along the N-55 highway at Karam Pur Area	

Sr. No.	Category	Name/Type of sensitive receptor	Remarks
		Police Station at Napar Ghot (Karam Pur) at 20 m	
		RHC, Khanpur	

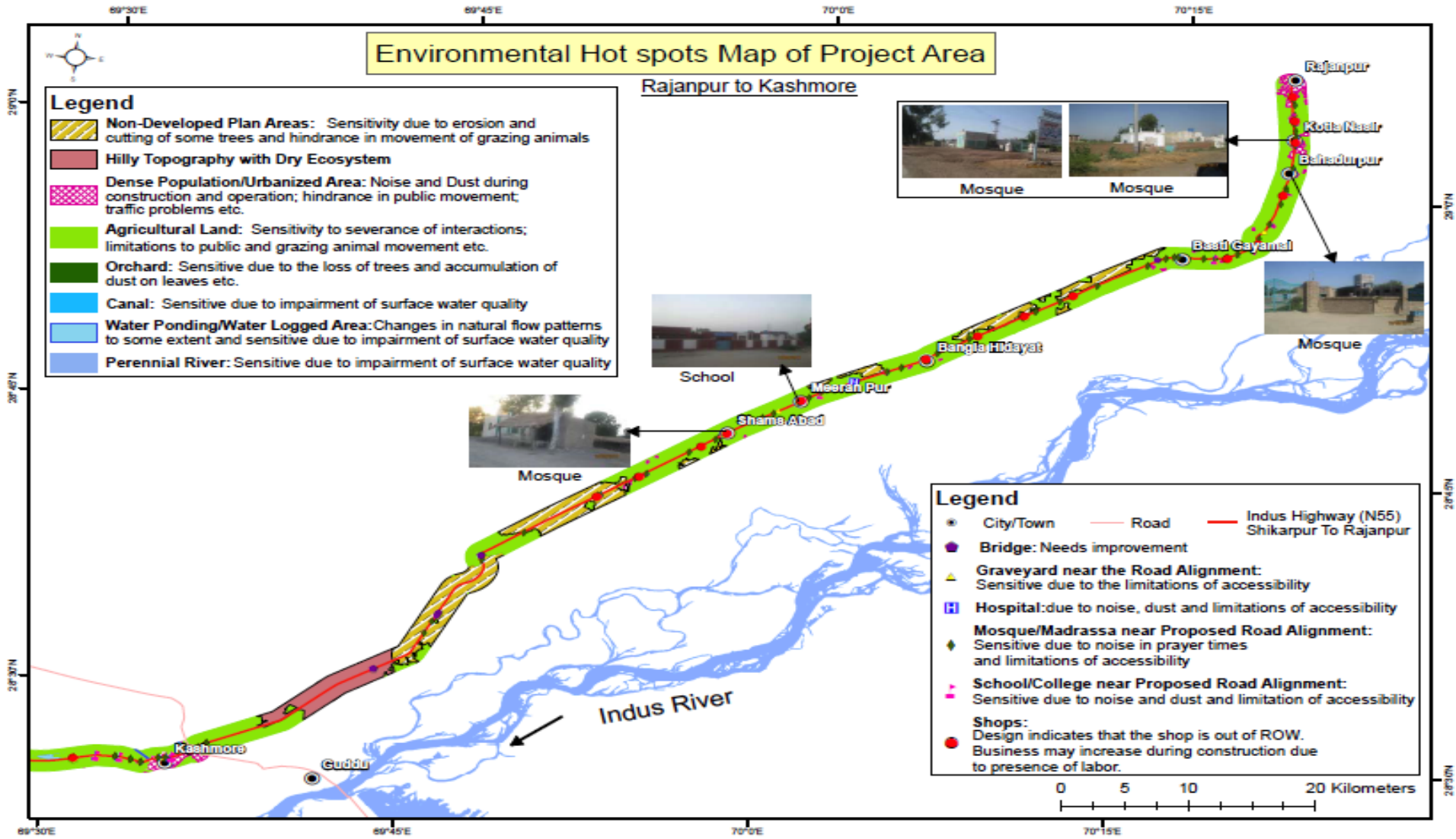


Figure 5.5- a: Environmental Sensitive Recptors (Rajanpur to Kahsmore)

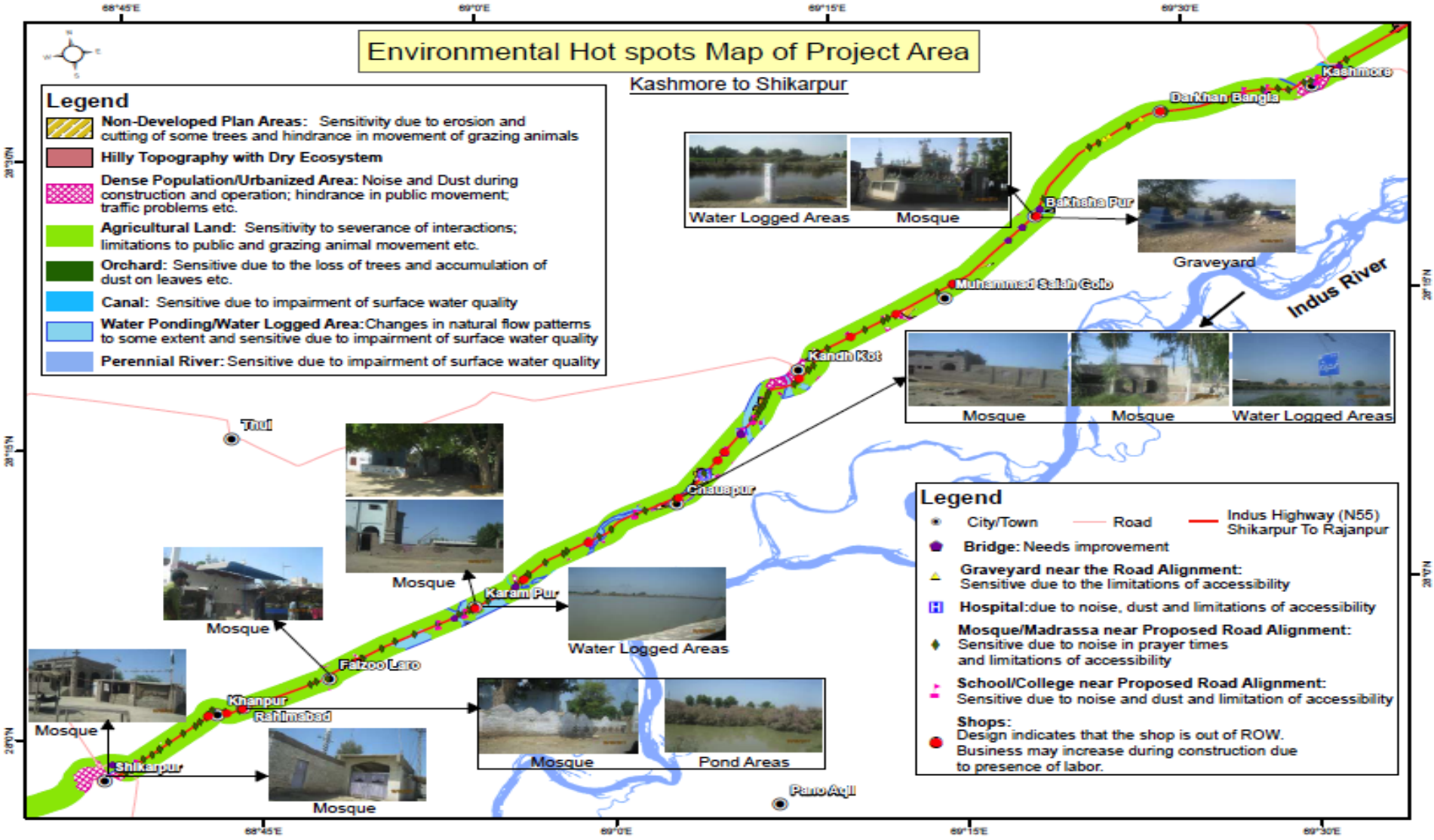


Figure 5.5-b: Environmental Sensitive Recptors (Kahsmore to Shikarpur)

5.2 Biological Environment

5.2.1 Flora of the Area

134. The project area being part of the lower Indus basin the climate of the tract is semi-arid, sub-tropical, the original flora of the area consists of tropical thorn forest type vegetation, in which thorny usually hard wooded species predominate, acacia species being particularly characteristic. The trees have usually short boles and low branching crowns, which rarely meet except on exceptionally favorable spots. The usual-height of tree is 6-10 m.

135. From Shikarpur to Rajanpur section, flora of the project area falls in the scrub Dry Tropical Thorn Forest Zone. This is the natural vegetation of the Indus Basin. It has the capacity to survive and grow in areas with extremely high temperatures and low precipitation. The flora consists of spiny and hard wooded species. Acacia species are the dominant one. The trees usually have short boles and low branching areas. Their usual height is 6-9 meters. The leaves are small, except in a few genera like Salvadoran and Caltrops. Main trees in the Project Area are *Acacia nilotica* (Keekar), *Eucalyptus camaldulensis* (Safaida), *Phoenix dactylifera* (Date Palm), *Dalbergiasissoo* (Shisham). *Azadirachtaindica* (Neem), *Salvadoraoleoides* (Peelu) and *Ficusreligiosa* (Peeple).

136. Among the grasses; *Arislidadepressa* (Lumb), *Eleusinecompressa* (Chemmer), *lasiurussindicus* (Gorkha) and *Saccharumbengalensis* (Kana) are found in the project area.

5.2.2 Conservation and Protection Status

137. No threatened or endemic plant species were observed in the Study Area during the survey nor reported from the literature survey.

138. No threatened or endemic plant species are present in the Study Area. None of the plant species observed was endemic, their distribution is not limited to any specific site or habitat type, and the distribution is widespread.

139. **Figure 5.6** shows the reserved forest along the River Indus: however, these are far away from the alignment and would not be affected.

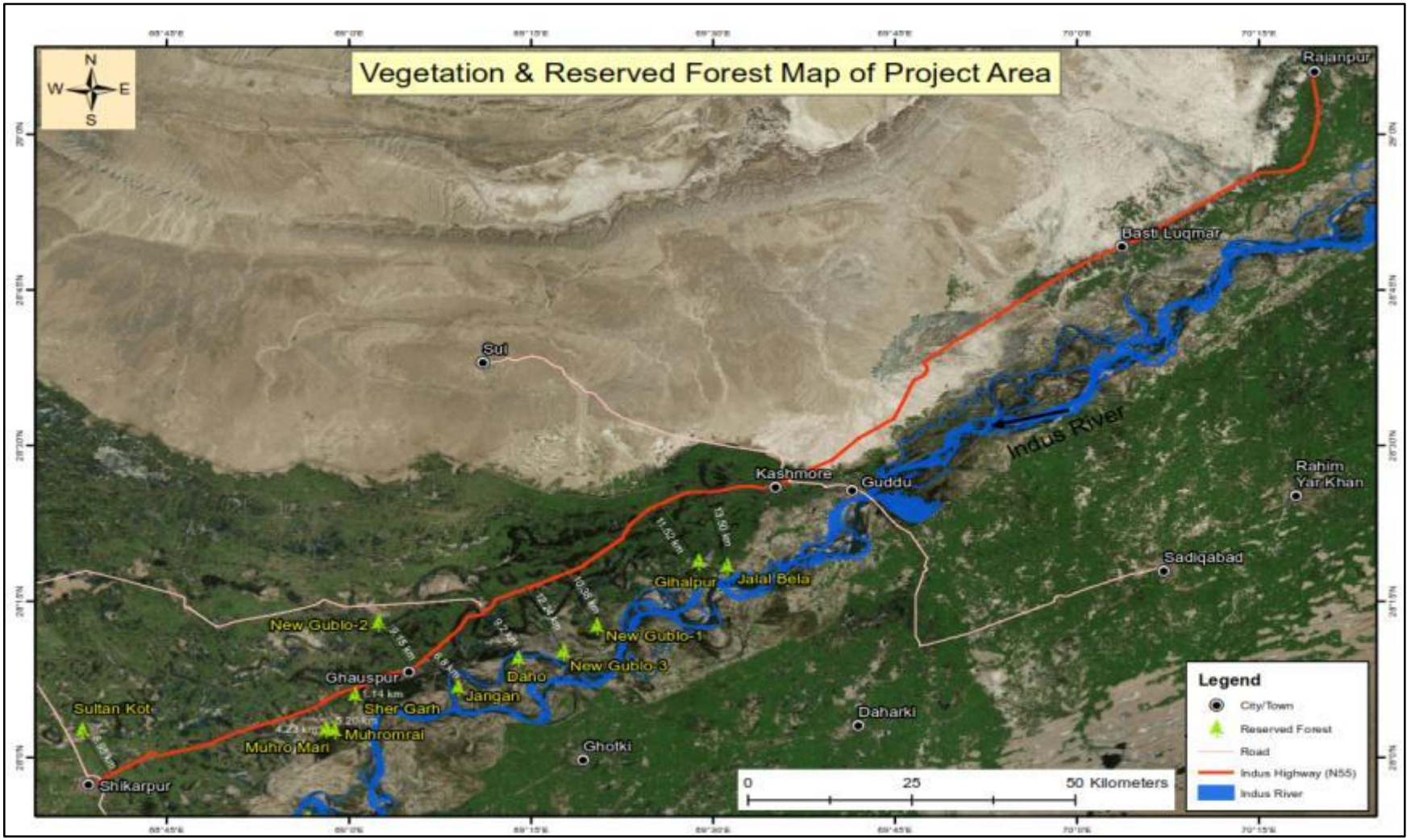


Figure 5.6: Showing Existing Reserved/Conserved Forest Area

5.2.3 Faunal Species in Project Area

140. Natural fauna of the area is fairly rich and comprises mammals, reptiles and birds etc.

i) Mammals

141. Mammals found in the project area are Jackals (*Canisaureus*). Stray dogs are found in abundance in the project area. Porcupine (*hystrixindica*) is also seen in the area and causes damage to the agricultural crops. Fox (*Vulpusvulpus*) and Wild Boar (*Susscrofa*) are also reported in the area. Domestic animals include goats, sheep, cows, buffaloes and camels. Buffaloes are common in Sind. Other mammals in project area include Bat (*Rasperugonastrus*), Squirrel (*Funambuluspennanti*), Mongoose (*Herpestesauropunctatus*), Hares (*Lepusnigricollis*), and Rats (*Rattusrattus*).

ii) Reptiles

142. Reptiles include snakes like Cobra (*Najanaja*), and rat eater snakes. Small sized lizards are also common sight in the area. These include Spiny Tailed Lizard (*Uromastixhardwickii*), Fringed Toed Sand Lizard (*Acanthodactyluscontoris*), Krait (Snake), *Bungaruscaeruleus*, *Sand Boa* (Snake), *Eryxjohniand* Desert Monitor lizard *Varnusgriseus*.

iii) Birds

143. The tract is fairly rich as far as avifauna is concerned. Partridges and Quails are seen in the agricultural fields after the harvesting of the Rabi or Kharif crops. Common birds found in the area are Common Mynah (*Aondotherestristis*), House Crow (*Corvussplendens*), House Sparrow (*Passer domesticus*), Koel (*Eudynamysscolopacea*), Bulbul (*Pycnontuscafar*), Pigeon (*Columbialivia*), Parrot (*Pisttaculakrameri*), Partridge Black (*Francolinus francoinus*), Partridge Grey (*Francolinuspondicerianus*), Quail (*Coturnexcoturnix*), Hoopoe (*Upupaepops*).

144. Common Teal (*Nettapus coromandelianus*), Fish Eagle (*Aquilarapax*), King Fisher (*Alcedoatthis*), Heron (*Ardeapurpurea*), Collard Dove (*Streptopelladecaoto*), Little Egrets (*Egrettagarzetta*).

iv) Fisheries

145. The worlds' largest earth and rock filled dam, Tarbala dam and six barrages (Jinnah, Chashma, Taunsa, Guddu, Sukkur and Kotri) are constructed on Indus River in Pakistan. There are not less than 193 freshwater fish species in Pakistan (Rafique and Khan, 2012). But more than 180 fish species are found in Indus River. Complete picture of the fish diversity and distribution pattern in Indus River and its drainage system need attention. Moreover, there are serious threats to the fish biodiversity of Indus River due to industrial pollution, illegal hunting of fish, extensive deforestation, global warming and westward shifting of its course. However, proposed Project is not posing any impact on aquatic fauna of the Study Area and its vicinity.

146. The fisheries in the project area include the following commercially important fishes *Chitala chitala, Cirrhinus mrigala, Cirrhinus reba, Catla catla, Labeo rohita*, and *Labeo gonius*.

Endangered Fauna

i) Birds

147. Birds like Black partridge, (*Francolinus francolinues)*, Falcon (*Falco peregrinus*) are now rarely seen in the area as they have been subjected to excessive hunting and catching, on account of their good quality and tasty meat or their commercial value as a prey bird and at present are endangered species but would not be influenced by the project.

ii) Migratory *Birds*

148. Migratory Birds from Siberia visit the plains of Sindh during winter. Majority of these birds land on major wetlands and pond areas of various head works and major canals including Begari canal and Khirther canal.

iii) Fish Species

149. No endangered fish species were found in the Study Area. However, available fish fauna of the Study Area includes Chitala chitala (*Chitala ornate*) LC, *Cirrhinus mrigala* VU, *Cirrhinus* Reba LC, *Catla catla VU*, *Labeo rohita LC* and *Labeo gonius LC*.

5.3 Socioeconomic Profile

150. The following section deals with the socio-economic conditions of project area. During the desk study, available literature, reports and documents were studied comprehensively for data collection.

151. The proposed project area falls in the administrative jurisdiction of District Rajanpur and Shikarpur and Kashmore. Rajanpur district falls in the province of Punjab and has three tehsils namely Rajanpur, Rojhan, and Jampur. However, the proposed section of additional carriageway runs through two tehsils Rajanpur and Rojhan. Gorchani, Darishak, Mazari and Tummons are declared as tribal areas of Rajanpur district.

152. Shikarpur District is in Sindh province of Pakistan. And two National Highways (N-65 & N-55) intersect the city of Shikarpur making it the junction points of 4 provinces. Shikarpur was an important place as commanding the trade route through the Bolan Pass, and its merchants have dealings with many towns in central Asia. Shikarpur was a city closed within a fort, that fort had seven gates like Hathi Gate, Lakhi Gate, Hazari gate, Khanpur Gate, Suvi Gate, Wagana Gate, Karan Gate & Noshero Gate

153. The district of Shikarpur is sub-divided into four talukas / tehsils, these are: Garhi Yasin , Khanpur, Lakhi, Shikarpur of which Shikarpur and Khanpur towns are on this section of ACW.

154. Kashmore District is subdivided into three tehsils namely, Kandhkot, Kashmore and Tangwani of which Kashmore and Kandhkot towns are directly located on N55.

5.3.1 Demographic Characteristics

155. The total population of district Rajanpur, Shikarpur and Kashmore stood at 1,995,958, 1,231,481, 1.089,000 respectively and the average household size ranges from 5.5 to 6.0 persons in these districts (census report 2017)

156. Urban population for district Rajanpur is 337,202 and rural is 1,658,756. There are two municipal committees and four Town Committees. And 532 Mauzas, a smallest revenue unit.

157. The rural population of district Shikarpur is 668,000 constituting 76 percent of the total population. The urban population of district Shikarpur is 212 thousand which constitutes 24.1 percent of its total population in other words every fourth persons live an urban area. There are seven (07) urban localities in the district.

158. The population of district Rajanpur is predominantly Muslims i.e. 97.72 percent. The next higher percentage is of Ahmadi with 0.05 percent, followed by scheduled casts 0.03 percent. While other minorities like Christian, Hindu etc. are very small in number.

159. The population of district Shikarpur is predominantly Muslim. They constitute 98.03 percent of the total population. The important minorities are Hindus and Christians who are 1.73 and 0.09 percent respectively.

160. Siraiki is the predominant language being spoken in the district Rajanpur, while Sindhi is spoken in the District Kashmore and Shikarpur. Urdu and Balochi are the other languages spoken in the Project area.

161. The communities in the vicinity along the N-55 corridor follow different traditions / customs. Most of the people living in rural areas of district Rajanpur, wear Kameez and Dhoti (Tehband) and in urban areas Kameez Shalwar. The people are engaged in cultivation, business, employment and labor. In marriages, they follow the dictates of Islam. However, watta-satta which is big social evil causing entanglement in most of the families owing to illiteracy. The women situation is not good due to male dominated culture.

162. Shikarpur, after the conquest of Sindh by Muhammad Bin Qasim, the Arabs ruled over Sindh for about three hundred years. During this period, Sukkur close to Shikarpur was the Headquarter of Sindh Province, from where the Islamic teachings flourished throughout Sindh. The custom amongst all Sindhi families of playing drums and Shahnai at least a week before the marriage is universal. Many fairs are held in the districts which are connected with Urs of well-known saints.

5.3.2 Social Characteristics

i) Health & Medical Facilities

163. There is 1 District Headquarter Hospital, 32 Basic Health Units, 6 Rural Health Centers, 2 Dispensaries and 1 Mother & Health Child Centers in district Rajanpur; while,1 Civil Hospital, 3 Taluka HQ Hospital, 33 BHUs, 6 Govt. Dispensaries, 4 Maternity Homes and Child Health Units, 39 School Health Clinics and 14 District Council Dispensaries in Shikarpur.

ii) Educational Institutions

164. Rajanpur has a total of 1,160 government schools out of which 41 percent (480 schools) are for girl students. The district has an enrolment of 148,746 in public sector schools[18].Educational Institutions include 4 Degree Collage, 37 High schools for boys and 19 High schools for girls, 30 Middle school for boys, 26 Middle school for girls, 471 Primary school for boys, 510 Primary school for girls and 9 Community Model schools in the district Rajanpur.

165. A number of educational institutions exist in district Shikarpur. These include 3 Degree Collage, 1 Law collage (private), 2 higher secondary school, 49 high schools, 62 middle schools and 609 primary schools. Besides these institutions there are 507 Mosque schools and 17 Mohalla schools for girls in the district.

iii) Literacy Ratio

166. A person was treated as literate if one can read newspaper or a journal of same standard and could write a simple letter in any language. The literacy is measured as the ratio, in percentage, of literate population to corresponding population aged 10 and over. The literacy ratio[19] in district Rajanpur is 20.7 percent. The literacy ratio for males is 29.0 percent as against 11.3 percent for females.

167. The literacy ratio of district Shikarpur among the population aged 10 years and above is 31.94 percent. The male literacy ratio is higher i.e. 44.95 compared to 18.04 for females. There are sharp differences in the literacy ratios by sex and residing area. The ratio in urban areas is 55.33 compared to only 23.92 in rural areas.

iv) Communication

Railways

[18] Punjab Annual Schools Census Data 2014-15.

[19] District Census Report 1998

168. Good trains are an effective means of transporting bulk of surplus goods from Rajanpur district to other parts of the country. Railway track connects the Rajanpur district on the north with Dera Ghazi Khan, Kot Adu, and Multan while on the west and south-east with Jacobabad, Larkana and Quetta sections.

169. District Shikarpur is connected by railway line with Jacobabad in the north, Larkana in south-west and Sukkur in the south-east. All the talukas of district are well connected with the district HQ with metalled roads. Moreover, Shikarpur is easily accessible by air through Sukkur which is air connected with different cities.

Roads

170. The area has a well-connected road system consisting of National and provincial highways such as N-55, and N-65 connecting to Baluchistan. In addition to that, following are some important roads network of district Rajanpur and District Shikarpur.

- D.G Khan Mittan Kot section Manan Bangla to Kot Mithan
- Rajanpur-Kashmore road section Kotla Naseer to Kashmore
- Jampur-Dajal Road
- Fazilpur to Hajipur
- Rajanpur to Aqikpur
- Kot Janu to Kot Tahir
- KotlaEsan to Shikarpur
- Kampur to KotlaMughlan to Muhammaddin
- Shikarpur-Sukkur.
- Shikarpur-Larkana
- Shikarpur-Kandhkot. Shikarpur-Jacobabad.

Transportation

171. The main source of transportation in the district Rajanpur is railway and private transportation. The main railway line with double track passes through the entire length. The private transportation is successful in the district and it provides transportation facilities almost for all the areas.

v) Irrigation System and Agriculture

172. The total irrigated area of district Rajanpur comprises 295,034 hectares. Agriculture in Rajanpur depends solely upon canal irrigation namely, Kadra canal, Dajal canal since rainfall is negligible in the region. Rainfall occurs during the monsoon season (July–September). Rajanpur district is famous for cotton and sugarcane crops.

173. District Shikarpur is also irrigated by canals which take off from Sukkur and Guddu barrages. Shikarpur is the mainly rice growing area. The main crops during Rabi are wheat, barley, gram, and pulses. The main crops during Kharif are rice, sugarcane, cotton and jawar etc.

5.3.3 Economic Characteristics

i) Economically Active Population

174. The economically active population is defined as the person working most of the time during the year. The economically active population in district Rajanpur as enumerated in the last census[20]was 25.1 percent of the total population. Of the total male population, 36.0 percent were economically active, while 64.0 percent are not economically active.

175. For Shikarpur, it is 44.76 percent for males compared to only 2.23 for females, resulting in very low overall participation rate. The rural / urban labor force participation rate does not differ much as it is 23.02 percent in rural and 27.60 in urban areas.

[20] Census Report 1998

ii) Unemployment

176. Unemployment rate is measured as ratio of looking for work and laid off in total economically active population comprising employed, looking for work, laid off and un-paid family helpers, generally representing in percentage. The unemployment rate in the district Rajanpur for male population is 19.3 percent and just 2.2 percent for females.

177. The unemployment rate of district Shikarpur is 9.04 percent. The unemployment rate varies for males and females as well as for rural and urban areas. The un-employment rate is 9.42 for males and 1.04 percent for females.

5.3.4 Historical and Archeological Characteristics

178. There are no remarkable historical buildings in district Rajanpur which can be included in the narration of historical monuments. However, some ancient buildings on the pattern of Mughal architecture are situated in district Rajanpur.

179. The Historicand ancient fort is located nearby the city of Harrand, Jampur, District RajanPur. Hindu Raja Harnacus" and his son "Lok Bhagat had constructed the Fort of Harrand on the style of Monojodero. The fading signs of the edifice are still there in the forms of derbies and bricks scattered around the old site. Present structure of the Fort a valuable part of our heritage is situated about 25 kilometers west in district RajanPur. The Fort is spread over an area of 50 acres of land.

i) Hazrat Khawaja Ghulam Farid of Mithankot

180. The tomb of saint poet Hazrat Khawaja Ghulam Farid is situated in Mithankot. Khwaja Ghulam Fareed, a well-known spiritual personality of Indo-Pak and a popular Sufi poet, was born on 3 December in 1845 in Chacharan Shareef, Rahim Yar Khan District. His poetry carried out the message of Islam ethics and social equality among the Muslims. He was only inspired by the eternal teachings of Islam but also had a keen eye on his surroundings. He, therefore, expressed his thoughts and ideas by symbolizing the phenomenon of nature around him with the teaching of Islam. His poetry has been translated into English and is greatly appreciated and admired throughout Pakistan.

ii) Marri

181. Marri is some sort of resort Hill Station in Rajanpur similar to Muree. Its altitude is 4800 ft from sea level with cold weather in summer. Marri is beautiful Hill Station in District Rajanpur South Punjab, Dera Ghazi Khan Division. Beautiful site sand newly built road is also seen-able. Visitors can go marri from fazalpur, hajipur, lalgarhroad. Itisal so called Tumman-Gorchani.

182. Contrary to this, there are no remarkable historical places in district Shikarpur. Although, ShahiBagh was known for its thriving vegetation and scented flowers. ShahiBagh had zoo with number of lions, cheetahs, bears and wild boars. These animals were later shifted to Karachi Zoo. Many other public and private gardens and open spaces of Shikarpur have vanished. Recently some water parks have been built around the territories of Shikarpur district, and Shikarpur has some nice restaurants to go to and have a nice dinner or lunch which are Kundan Restaurant, A.R Fast Food, and Zaiqa Restaurant etc.

SECTION 6: ANALYSIS OF ALTERNATIVES

183. The following alternatives have been identified and are discussed in further detail below:

- The No-Action Alternative
- The N-55 Alignment as proposed
- Rehabilitation of the existing road

6.1 Alternative I: No-Action Alternative

184. The following positive impacts are anticipated:

- Avoidance of destruction of natural habitats, arable land and affected structures
- Cost saving for the Construction of rehabilitation and dualized portion
- No disturbance to the communities due to construction

185. In case of no action for the proposed alignment, following two consequences will follow; Firstly, due to increased traffic volumes on N-55, the road will deteriorate, resulting in uncomfortable and unsafe driving conditions, deterioration of vehicles and increased accidents. Secondly, due to poor accessibility to the approach nearby areas and other cities area, the probability of time travelling would be high, furthermore the area may become unattractive for investors, which will have a negative effect on economic growth and associated job opportunities.

- Continued delays may be experienced within the inter-provincial areas during morning and evening peak hours;
- High maintenance and fuel costs for motorists using the existing roads in poor condition,
- Loss of potential associated employment opportunities for communities near to alignment.

6.2 Alternative II: Additional 2-Lane at N-55 Alignment as proposed

186. The following positive impacts are anticipated:

- The construction of this alternative will reduce the travel times, from urban centers and residential settlements in rural areas around N-55 other provincial cities, to and from Rajanpur to other parts of Sindh areas;
- Reduced maintenance and fuel costs associated with better quality roads;
- Job opportunities will be created during the construction phase as well as the post-construction phase. It will give local residents the prospect of earning an income to better sustain their families;
- Improved travelling conditions during commute.
- The project area falls in CAREC Corridor 6. The Indus Highway N-55 has a significant importance of the CAREC program. So, by improving this CAREC corridor, regional connectivity and trade via the CAREC Corridors trade and commerce in global markets will be boots-up.

187. The following Negative impacts are possible:

- Occurrence and richness of vegetative land mainly tree densities along the existing alignment and land utilized for orchards and agricultural practices will be affected. Resultantly, bio diversification of the area will be affected
- Relocation of residents whose properties fall within the alignment and the associated project limits;
- Possible contamination of ground and surface water in close proximity the proposed alignment.

- As the area is considered as an important Agro-Ecological zone of different crops. So, cropping patterns due to ecosystem dynamics may be disturbed due to additional 2-Lane carriageway
- The utilities i.e. power transmission lines, gas supply pipes, water supply pipes, telephone cables, telecommunication cables, etc. that will come in ROW, will be properly relocated. Similarly, the built-up properties i.e. Kilns, mosques, houses, shops etc., will be timely relocated to avoid any disruption in work and their compensation will be paid to the Project Affected Persons (PAPs) as per the approved rates of relevant building department.

6.3 Alternative III: Rehabilitation of existing 2-Lanes at N-55 Alignment

188. The following positive impacts are anticipated:

- Lesser destruction of natural habitats, arable land and affected structures
- Cost saving for the construction of dualized portion
- Lesser disturbance to communities due to earlier completion a lesser work

189. Negative impacts will include that the existing road will be unable to cater increased traffic loads on N-55, which may lead to the uncomfortable and unsafe driving conditions and increased accidents. Secondly, due to traffic congestions the commute will be longer and tiresome. More noise and vehicular emissions would be generated. The areas connected by the road may become unattractive for investors, which will have a negative effect on economic growth and associated development and job opportunities.

6.4 Selected Option:

190. Taking in to account the socioeconomic and environmental benefits and extending the benefits to regional level and connectivity with the Central Asian region, alternative 2, dualization of N55 as CAREC Corridor 6 is the best choice.

6.5 Technological Alternatives

191. Asphalt and concrete pavement were considered by detail design team. Priority was given to asphalt for following reasons:

- Less noise during operation compared to concrete
- Less vibration as compared to concrete
- Better visibility of horizontal marking on Asphalt surface
- Recyclable material
- Better efficiency in extreme weather.

Table 6.1: Comparison of Alternatives

Sr. No.	Alternatives	Economical	Environment	Social
1.	No-Action Alternative	No cost incurred	No loss of vegetation and habitat Increase in noise and vehicular emission over time due to growth in traffic volumes	No disturbance to public due to shifting of utilities, land acquisition and resettlement Congestion of roads resulting in conflicts Stagnant development and economy due to lesser movement and connectivity
2.	Additional 2-Lane at N-55 Alignment as proposed	Cost incurred	Loss of vegetative land	Land acquisition and resettlement
3.	Rehabilitation of existing 2-Lanes at N-55 Alignment	Lesser cost	Lesser destruction of natural habitats Increased noise and vehicular emissions	Lesser structures affected Lesser disturbance to communities due to earlier completion and lesser work Congestion of roads resulting in conflicts Stagnant development and economy due to lesser movement and connectivity

SECTION 7: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Environmental Consequences

192. This section provides the analysis of the potential impacts during pre-construction/design, construction and operational phases of the proposed project on the physical, biological and socio-economic environment of the project area. Environmental sensitivity of the project area is described through the thematic sensitivity map and evaluation of significance of impacts is carried out through Environmental Matrices. In addition, it also narrates the measures that will mitigate the project's potential environmental impacts. Environmental impacts have been considered not only as they pertain to road ROW, but also to the site associated with the road project.

7.2 Screening of Potential Environmental Impacts

193. Primarily, anticipated impacts have been categorized as direct, indirect and induced impacts. These groups of impacts can be further broken down according to their nature into:

- Positive and negative impact;
- Minor, major and moderate impact;
- Local and widespread impact;
- Temporary and permanent impact;
- Short and long-term impact; and
- Reversible and Irreversible impact.

194. Characterization of Impacts is given both at construction and operation phase in **Table 7.1 & 7.2**. Furthermore, the environmental impact evaluation matrices have also been developed to indicate magnitude of the impacts on different environmental settings for both construction and operational phases (see **Tables 7.3 and 7.4**). The following scale has been used for the evaluation of potential impacts on different environmental settings:

O = Negligible/No Impact
LA = Low Adverse
MA= Medium Adverse
HA = High Adverse
B = Beneficial

195. The criteria used to define the high medium and low adverse impacts are as follows:

Negligible/No Impact: The impact, which has unapparent and negligible influence on natural and socio-economic environment.

Low Adverse Impact: The impact, which has a slight influence on the natural and socio-economic environment.

Medium Adverse Impact: The impact, which can be eliminated/ mitigated after applying the appropriate mitigation measures.

High Adverse Impact: The impact, which can be partially/ but not fully mitigated by applying the mitigation measure.

Positive/Beneficial Impact: The impact, which improve/enhance the natural and socio-economic environment.

Table 7.1: Characterization of Environmentally Potential Impacts for Construction Phase

Environmental Component	Impact Characteristics														
	Direction		Duration		Location		Frequency		Extent		Significance			Reversibility	
	Positive	Negative	Long	Short	Direct	Indirect	Continuous	Intermittent	Wide	Local	Large	Moderate	Small	Reversible.	Irreversible
Topography		●	●		●		●			●			●		●
Surface Water Quality		●		●	●			●	●			●		●	
Groundwater Quality		●		●	●			●	●				●		●
Air Quality		●		●	●			●	●			●		●	
Soil Quality/Erosion		●		●	●			●		●		●		●	
Noise		●		●	●			●		●		●		●	
Flora		●	●		●			●		●	●			●	
Fauna		●		●	●			●		●			●	●	
Disturbance to Public Life		●		●	●			●		●		●		●	
Solid Waste		●		●	●		●			●			●	●	
Land Acquisition		●	●		●		●			●	●				●
Traffic Management		●		●	●			●		●			●	●	
Occupational Health and Safety		●	●		●			●		●		●			●
Lifestyle and Culture	◙		◙		◙		◙		◙			◙			◙

Legend: Negative Impact (●) Positive Impact (◙)

Table 7.2: Characterization of Environmentally Potential Impacts for Operation Phase

Environmental Component	Impact Characteristics														
	Direction		Duration		Location		Frequency		Extent		Significance			Reversibility	
	Positive	Negative	Long	Short	Direct	Indirect	Continuous	Intermittent	Wide	Local	Large	Moderate	Small	Reversible.	Irreversible
Local Economics	▣		▣			▣	▣		▣		▣				▣
Air Quality		●	●		●		●		●				●	●	
Noise		●	●		●		●		●				●	●	
Flora	▣		▣		▣		▣			▣			▣		▣
Fauna		●	●		●		●			●			●		●
Traffic Situation	▣		▣		▣		▣		▣		▣				▣
Lifestyle and Culture	▣		▣			▣	▣		▣			▣			▣
Community Development	▣		▣		▣		▣		▣		▣				▣

Legend: **Negative Impact (●)** **Positive Impact (▣)**

Table 7.3: Environmental Impacts Evaluation Matrix during the *Construction Phase*

Sr. No.	Environmental Component / Project Activities	Physical Environment								Biological Environment		Socioeconomic Environment						
		Topography/Drainage	Soil Quality	Landscape	Surface Water	Groundwater Quality	Landslide/Slope Stability	Air Quality	Noise & Vibration	Flora	Fauna	Health & Safety	Disruption of Public	Employment	Population	Social Disorder	Cultural/Religious	Traffic Management
1	Construction camps, workshops etc.	MA	LA	O	LA	LA	LA	LA	LA	HA	MA	LA	LA	MB	MA	LA	LA	LA
2	Site clearing	LA	LA	LA	LA	O	LA	LA	LA	HA	MA	LA	LA	MB	LA	O	O	O
3	Excavation operations at borrow & quarry areas	LA	MA	MA	LA	O	MA	LA	MA	MA	LA	MA	LA	MB	LA	O	LA	LA
4	Transportation of construction materials	O	LA	O	O	O	LA	LA	MA	O	O	LA	O	LB	LA	O	LA	LA
5	Open storage of construction materials, fuel etc.	O	HA	O	LA	LA	LA	LA	O	LA	LA	LA	O	O	O	O	O	LA
6	Solid waste generation	LA	LA	LA	LA	LA	O	MA	O	LA	LA	LA	LA	MB	LA	O	LA	LA
7	Use of Chemicals	O	MA	O	LA	LA	LA	LA	O	LA	LA	LA	LA	LB	LA	O	O	O
8	Earthwork operations	MA	MA	MA	LA	O	MA	LA	MA	LA	LA	MA	LA	MB	LA	O	LA	LA
9	Operation of Asphalt & concrete batching plant	LA	LA	MA	LA	O	MA	MA	MA	LA	LA	MA	LA	MB	LA	O	LA	LA
10	Crushing Operation	O	LA	LA	MA	O	LA	HA	HA	LA	LA	MA	O	MB	MA	O	LA	LA
11	Use of generators	O	LA	O	LA	O	LA	MA	MA	LA	LA	LA	O	MB	LA	O	O	LA
12	Construction of Road	LA	LA	LA	LA	La	LA	LA	LA	LA	LA	LA	MB	MB	LA	LA	LA	LA

Legend

O - Insignificant / no impact **LA = Low Adverse** **MA = Medium Adverse** **HA = High Adverse**

NA - Not Applicable LB = Low Beneficial MB = Medium Beneficial HB = High Beneficial

Table 7.4: Environmental Impacts Evaluation Matrix during the *Operational Phase*

Sr. No.	Environmental Components / Project Activities	Physical Environment								Biological Environment		Socioeconomic Environment				
		Topography	Soil Quality	Landscape	Surface Water Quality	Groundwater Quality	Land Slide/ slope Stability	Air Quality	Noise & Vibration	Flora	Fauna	Public Safety	Employment	Population Disturbance	Economic Activities	Traffic Management
1	Movement of Vehicle	O	O	O	LA	LA	LA	LA	LA	O	LA	LA	MB	O	MB	O
2	Ticketing	O	O	O	O	O	O	O	LA	O	O	O	HB	O	MB	O
3	Generation of surface runoff	O	LA	MB	LA	LA	MA	LA	O	O	O	LA	O	O	O	O
4	Generation of Solid Waste	O	LA	LA	LA	LA	O	LA	O	O	LA	LA	LB	O	O	O
5	Signaling / Traffic Control	O	O	O	O	O	O	LA	O	O	O	O	MB	O	MB	HB
6	Maintenance of Roads	LA	LA	LA	LA	LA	LA	LA	LA	LA	LA	LA	MB	LA	MB	LB
7	Generators (Power Supply)	O	O	O	O	O	O	LA	LA	O	LA	O	O	O	O	O
8	Accidental Spill	O	HA	MA	HA	HA	O	HA	O	O	O	HA	O	MA	LA	HA

Legend

O - Insignificant / no impact **LA = Low Adverse** **MA = Medium Adverse**

NA - Not Applicable **LB = Low Beneficial** **MB = Medium Beneficial**

7.3 Positive Impacts of the Project

196. Due to the implementation of the proposed project components following benefits will be attained in terms of environmental, social, public health and economic sustainability:

- Smooth flow of traffic;
- Saving of vehicle travel time and vehicle operating costs of commuters;
- Reduction in traffic accidents and casualties by traffic congestions;
- Efficient movement of trade, goods and traffic in relatively shorter time;
- Quicker transports of agricultural products including perishable goods to final destination;
- Reduction in the fuel consumption and transportation cost caused by traffic congestion and bumpy roads;
- Reduction in air emissions from vehicular exhaust especially in case of traffic congestion; and
- Increase in economic growth by providing employment opportunities to the local residents and vendors.

7.4 Pre-Construction/Design Phase

197. Following is the brief description of impacts envisaged and the recommended mitigation measures during Pre-construction and Design Phases.

7.4.1 Physical Environment

7.4.1.1 Topography

198. The topography in the project area will change but only to some extent due to the construction of project related structures such as embankments, bridges, flyovers and interchanges especially during the construction of bypasses to avoid the traffic disruption in cities.

199. Visual changes to the topography will be of permanent but slightly adverse in nature and need no mitigation measures except that the project design should consider aesthetic concerns.

7.4.1.2 Change in Hydrologic Regime

200. The project has an extensive network of drainage channels/ nullahs and tributaries of River Indus. For the crossing of drains and water courses, small bridges and culverts should be constructed, wherever, required

201. Mitigation measure would involve:

- Proper design of bridges on water bodies to accommodate design flows;
- Small bridges will be constructed on 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 drainage network to take design flows.

7.4.2 Ecological Environment

7.4.2.1 Removal of Roadside Trees

202. Approximately 228 plants of various species belonging to the communities will be cut due to construction of additional carriageway. Most of trees are Acacia (Acacia), Eucalyptus (Eucalyptus), Shisham (Dalbergia sissoo), and Peepal (Ficusreligiosa). Trees along the corridor belong to NHA. Mostly, these wood and fruit trees grown in the NHA owned public ROW, were planted by NHA and are managed through the district forest department. Instead of providing compensation, the lost government

trees will be replenished through replantation of new trees as per government policy after implementing the project civil works.

203. Where possible, the design and road construction teams will seek to avoid the cutting of trees. Contractor will identify and label the trees to be cut prior to construction so those can be monitored during construction. Trees will be removed only coming in the road corridor of impact while other trees in the ROW would not be affected. Plants would be transplanted and compensatory trees would be planted maintaining the ratio of 1:8 plants from project budget. Proper compensation will be paid to the owner of trees as recommended in the LARP.

7.4.3 Social Environment

7.4.3.1 Land Acquisition, Infrastructure and Resettlement

One of the major project related impact will be the land acquisition for the Project ROW that will result in causing disturbance to the affected residents of the project area. A summary of affected assets based on LARP of the project is given in **Table 7.5.**

Table 7.5: Affected Assets Based on LARP of the Project

Category of Affected Assets	Unit	Shikarpur-Kandhkot Section		Kandhkot-Kashmore Section		Kashmore-Rajanpur Section	
		Impact Magnitude	Number of DHs	Impact Magnitude	Number of DHs	Impact Magnitude	Number of DHs
Loss of land	Acres	4.3	7	316.9	67	37.34	27
Loss of cropped area	Acres	53.7	126	326.7	115	49.8	94
Loss of trees	Nos.	9	1	28	3	206	39
Affected residential structure	Nos.	51	37	19	24	277	102
Affected commercial structures	Nos.	361	154	379	155	798	450
Renter business operators in affected structures	Nos.	-	233	-	90	-	105
Employees in affected structures	Nos.	-	228	-	-	-	16
Total DHs	-	-	**786**	**-**	**454**	**-**	**833**
Affected Community Assets							
Mosques (affected washroom area with no impacts to mosque hall, boundary wall act.)	Nos.	16	Community	11	Community	26	Community
Hand pumps	Nos.	4		2		3	
Village signboards	Nos.	-		-		8	
Graveyards	Nos.	-		-		1	
Affected Public Assets and Infrastructure							
School (Rooms)	No	2	Education Dept.	-	-	-	-
NHA Room	Nos.	2	NHA	1	NHA	-	-
Boundary Walls (School/Hospital/ PTCL/Police Post/Gas Station)	Nos.	4	Education & Health Dept.	4	PTCL/ Police Deptt./ SNGPL	-	-
Police Check post	Nos.	31	Police Dept.	7	Police Deptt	-	-
Roadside passenger waiting sheds	Nos.	7	NHA	2	NHA	7	NHA
Transmission line/ Transformer	Nos.	46	WAPDA	45	WAPDA	-	-

Category of Affected Assets	Unit	Shikarpur-Kandhkot Section		Kandhkot-Kashmore Section		Kashmore-Rajanpur Section	
		Impact Magnitude	Number of DHs	Impact Magnitude	Number of DHs	Impact Magnitude	Number of DHs
Gas pipeline/ gas supply units	Nos.	1	SSGPL	-	-	1	SNGPL
Tube well managed by (PID)	Nos.	-	-	-	-	1	PID
Village Signboards	Nos.	-	-	-	-	17	NHA
Water Filter Plant	Nos.	-	-	-	-	1	PHED
Mobilink Towers	Nos.	2	Pakistan Mobile Communications Limited	-	-	-	-
Street Lights	Nos.	6	NHA	29	NHA	-	-
Railway Crossing	Nos.	1	Ministry of Railways	-	-	-	-
Source: Land Acquisition and Resettlement Plan of Shikarpur-Rajanpur Road Section (April, 2020)							

204. For the land coming in the ROW, the affected people should be compensated as per provisions of LARPs prepared for these packages of CAREC Corridor N 55.

7.4.3.2 Changes in Land Value

205. The proposed Project is expected to increase the land values, especially, along the bypasses. Landowners will have an opportunity to sell their land on increased prices and start new businesses. This impact will be major positive in nature.

7.4.3.3 Physical Cultural Resources

206. Since no Physical Cultural Resource is falling within the Right of Way (ROW) of the proposed alignment of the Dual carriageway, so there is no need for relocation of such resource. Cultural resources such as graveyards, mosques and shrine are situated in nearby communities and are visited by local people. If any mosque is coming in the ROW that should be relocated.

207. Mitigation measures will include provision of pedestrian corridors near the communities, which have important Physical Cultural Resource.

7.4.3.4 Public Utilities

208. Due to the proposed project, public utilities affected may create disruption of public services and economics. This impact is however temporary and minor negative in nature.

209. Mitigation measures will include:

- Incorporate technical design features to minimize effect on public utilities; and
- All public utilities likely to be affected by the proposed project need to be relocated well ahead of the commencement of construction work.

7.5 Construction Phase

210. Following is the brief description of impacts and their mitigation envisaged during the Construction Phase.

7.5.1 Physical Environment

7.5.1.1 Disruption of Existing Public Utilities/ Infrastructure

211. There may be some disruption to the already existing utilities like electricity poles, underground telephone lines, power transmission lines, water courses, small village roads, etc. in the project area during the construction phase. These impacts are, however, temporary and minor negative in nature.

212. Mitigation measures will include rehabilitation of existing utilities before construction to avoid any inconvenience to the residents of the project area or provide them with alternate arrangement during the construction period.

7.5.1.2 Soil erosion and Contamination

213. Soil erosion may occur on roadside, at contractors' camps and at embankment works as a result of uncontrolled run-off from equipment washing yards, excavation of earth/cutting operations and clearing of vegetation; whereas, contamination of soil may be caused by oil and chemical spills at asphalt plant sites, workshop areas and equipment washing yards. Also, due to unauthorized use of borrow areas and quarries, soil erosion may occur resulting in degradation of landscape. This may limit the future use of land for agricultural purposes. This impact is, however, of temporary and moderate negative in nature.

214. Mitigation measures will include:

- Minimizing the area of soil clearance
- Low embankments will be protected by planting vetiver grass that can flourish in relatively dry conditions;
- High embankments will be protected by providing stone pitching or riprap across embankments. This practice will also be applied across cross-drainage structures where embankments are more susceptible to erosion by water run-off;
- Soil contamination by asphalt will be minimized by placing all containers in a bunded area away from water courses;
- Provision of impervious platform with oil and grease trap for collection of spillages during equipment and vehicle maintenance;
- Provision of secondary containment during handling of lubricants (e.g. provide drip trays);
- Decanting and or controlled disposal of oil and grease as collected at collection tanks of maintenance yard and chemical storage areas;
- Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the legal prescriptions for dumpsites;
- Soil erosion checking measures such as the formation of sediment basins, slope drains with cascading, etc., will be carried out;
- Productive land or land adjacent to agricultural/irrigated land may not be preferred for excavation;
- Non-productive, barren lands in broken terrain, nullahs and publicly recognized waste lands should be given preference for borrowing materials;
- Aggregate required for road construction procured from quarries and river beds will need approval from authorities; and
- Contaminated should be recapped or paved with clean soil up to 1-meter depth.

7.5.1.3 Borrow/Open Pits

215. Borrow/open pits and its excavation activities may result in land disputes, soil erosion, and loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments. Borrow/ Open pits may also result in potential sources of mosquito breeding and may prove hazard to human beings, livestock and wildlife. This will also degrade hygienic condition of the project area. This impact is permanent and minor negative in nature.

216. Mitigation measures will include:

- Land record should be checked before signing any contract with locals to borrow soil
- Careful selection of borrow areas to choose barren land and conversion of borrow pits into fish farms
- Necessary permits must be obtained for any borrow pits from the competent authorities; and no excavations are allowed within distance of 500 m to ROW;
- In borrow pits, the depth of the pit 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 shall be regularly checked to prevent / mitigate impacts on adjacent lands; and
- In case borrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites. Pollution Prevention and Abatement.

7.5.1.4 Air Pollution Control

217. Air quality will be affected by fugitive dust emissions from construction machinery, asphalt plants and vehicular traffic. Emissions may be carried over longer distances depending upon the wind speed, direction, horizontal difference in atmospheric pressure, temperature of surrounding air and atmospheric stability.

218. The critical sources of air pollution during the construction phase will be:

- Asphalt plants and concrete batching plant and quarry areas;
- Traffic diversion routes marked along dirt tracks that generate fugitive dust when in use by vehicular traffic; and
- Transportation of materials and other construction activities that create dust emissions.

219. During construction, the continuous operation of machinery and movement of heavy trucks and vehicles may generate gaseous emissions and have a moderate negative impact on the surrounding environment. The overall impact on the quality of air during the construction phase will, however, be limited to the project's implementation phase only.

220. Mitigation measures will include:

- **Site management**: Preventive measures against dust should be adopted for on-site mixing and unloading operations. Regular water sprinkling of the Site should be carried out to suppress excessive dust emission(s), open burning of waste should be strictly banned;
- **Material transport**: all vehicles carrying dusty loads should be covered/ watered over to extent that water should not drop on the main roads during carriage
- **Power generators and construction machinery**: are important point sources at the construction sites. Proper maintenance and repair are needed to minimize the hazardous emissions;
- **Asphalt, hot mix and batching Plants**: should be equipped with dust control equipment as a pollution preventive measure such as fabric filters or wet scrubbers

or electrostatic precipitator to reduce level of dust emissions. These plant and quarry areas should be located 500 meter away in downwind directions from communities:

- **Stockpiles** location should be downwind from receptors and must be sprayed during material movement. Additional measures such as fencing from higher barrier required when within 300 metres from receptors.
- **NEQS**: applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works; and

221. The majority of dust problems caused during the construction phase of the project could be effectively mitigated by the implementation of simple procedures by the Contractor including but not limited to the following:

- **Service roads** (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather;
- **Excavation work** should be sprinkled with water;
- **PPEs** for Construction workers should be provided with masks for protection against the inhalation of dust;
- **Vehicle speed** in the project area should be prescribed not more than 20 km/ hr. and controlled accordingly; and
- **Monitoring:** Air quality monitoring should be carried out as mentioned in **Table 8.3**.

7.5.1.6 Noise and Vibration Control

222. Noise is the most pervasive environmental problem in the urban areas especially on the road side. Noise is a by-product of human activity, and area of exposure increases as function of mobility and construction activities. Main sources during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers asphalt plants and other equipment. The above machinery is expected to generate noise levels that would be severe in the areas whereas previously no roadside construction is carried out such as Kashmore bypass. Noise generated by construction machinery is likely to affect sensitive receptors located within 50 meter of the proposed roadway. This impact is temporary and minor negative in nature.

Construction Noise Modeling

223. For the prediction of noise generated from the machinery used for the construction activities and its effect on the Noise Sensitive Receiver (NSR), a model was developed by performing calculation on the excel sheet.

224. **Methodology:** Construction equipment sound levels are the sound levels emitted by equipment under actual field operating conditions. Construction equipment operate under two primary modes – mobile and stationary. Mobile equipment such as dozers, scrapers etc., operate in a cycle in which full power is followed by reduced power. Stationary equipment can be subdivided in two groups: one group such as compressor, batching and asphalt plants and generator which operate at constant power while the jack hammers, auger drill, falls into impact machinery with instantaneous sound levels. The following steps were taken to develop the noise model to predict the hourly equivalent noise levels at the site:
    - Identification of main construction operation or phases;
    - Equipment used to complete each construction phase;
    - Determination of the peak noise levels and minimum noise level for a work cycle of equipment;
    - Determination of hourly equipment equivalent noise level at the receptor by considering the distance between the receptor and equipment and also the usage factor;

225. Determination of expected cumulative hourly equivalent noise level at the site from different construction operations. Results of the noise modeling are attached as **Annex**

IV, which shows the projected noise level will be 107 dB(A), 101 dB(A), 98 dB(A), 95 dB(A) and 93(A) for 20m, 40m, 60m, 80m and 100m distances respectively. The results of the modeling show the worst-case scenario when all equipment's are operating at the same time which is least likely to occur. However, the most affected would be the workers and required to use PPES. Identified noise sensitive receptors (NSR) include religious, education institutions, wellbeing facilities and residential areas. National Environmental Quality Standards (NEQs) for Pakistan & WHO Standard[21] would be followed:

226. Other mitigation measures mentioned below should be taken in order to minimize the impacts of noise in the project area. These measures include, but are not limited to the following:

- **Source Control:** Selection of up-to-date and well-maintained plant or equipment with reduced noise levels ensured by suitable in-built damping techniques or appropriate muffling devices. Operate Compressor or generator with closed doors and idle plants/ equipment should be throttled down or turned off:
- **Timings:** Confining excessively noisy work to normal working hours in the day between 8 a.m. – 6 p.m., as far as possible; Preferably, restricting construction vehicles movement during night-time;
- **PPEs:** Providing the construction workers with suitable hearing protection like ear cap, or earmuffs and training them in their use;
- **Community notification and Consultation:** Inform community prior to noisy operations and get the information regarding the exams in school, prayer timings etc.
- **Siting:** Locating the rock crushing, concrete mixing, semi-finished workshops and materials shipment yards at least 500 m from NSRs including residential areas, particularly schools, hospitals, and nursing homes. Such activity taking place near or through villages will broadcast continuous noise in the 70–80 dB (A) range or above.
- **Noise monitoring** should be carried out as mentioned in **Table 8.3**.

7.5.1.7 Waste and Hazardous Waste

227. Due to construction activities, waste will be generated at construction and contractors camp site. The construction waste will include wastewater, oil spillage from machinery, domestic waste and solid waste etc. The handling and storage of oil, asphalt/bitumen, fuel and various chemical/ additives may be a source of hazardous waste. This will result in unhygienic conditions, health risk to work force and public at the camp site. This impact is temporary and minor negative in nature.

228. Mitigation measures will include:

- **Management**: keep the site clean and tidy e.g. litter free and good housekeeping and disallow the burning of waste
- **Solid waste handling:** Provided storage containers of appropriate size for workers food waste and construction waste. The containers should be properly labelled for food waste, recyclables, and general refuse. The waste should be removed on regularly basis by the licensed contractors.
- **Chemical waste:** oil drums and plants/ equipment should be provided with drip trays as secondary containment and these drips should be free of oil. In case of oil spill clean up the spill immediately, store the chemical waste in the labelled container with clear instructions to handle it and should be disposed of by licensed contractor. The oil rags should be stored properly to avoid the fire risks. Oil filter

[21]Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999. 55 For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999).

should be collected in a separate container to be placed under the shades and sold out to contractor.

- **Site handover.** Ensure that no debris, spoil or residue of materials should be left at the site and this should be removed before signing of the contract
- **Spoil and Inert waste:** will be disposed of by the contractor on only the sites approved by SC. The best practice is to rehabilitate the land for schools or private land with the willingness of the owner.

7.5.1.8 Water Pollution Control

229. Wastewater is anticipated to be generated from the construction camps, wheel washing facilities, asphalt plants and batching plants and from various construction activities. Water ponding and direct discharge to surface water bodies may pose severe consequences.

230. Mitigation measure will include:

- **Wastewater from workshops**: 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;
- **Sanitary wastewater**: Sanitary wastewater should be treated through buried septic tank and the capacity of the septic tank should be three times than the generated effluent per day. Manholes onsite should be covered and sealed. Guidelines for sanitary wastewater from IFC/ World Bank may be consulted.
- **Public Roads**: around the site entrance and site hoardings should be kept clean and free of muddy water
- **Road drainage:** provision of retention pound with cascading to drain the road surface runoff.
- **Water ponding at Batching Plants:** Stored water for batching plants should be used or drained during shut of as this will cause water ponding leaving the scum at the top serving as a habitat for mosquitoes and vectors.
- **Canal Water:** Construction debris should not find its way in to canals and washing machinery with the canal water should be prohibited.
- **Water quality** monitoring should be carried out as mentioned in **Table 8.3**.

7.5.1.9 Impacts of Construction of Bridges

231. Due to Drainage works and use of vehicles during construction of bridges construction of bridges, negative impact on flora and fauna from increased sediment loading of streams will occur. Negligence in materials management may pose harm to aquatic flora and fauna from oil, fuel, cement or other substances entering watercourses.

232. Mitigation measures include;

- During the spawning seasons (April-August) the construction activities must be avoided
- An appropriate water management system shall be used during the construction period for instance efficient land drainage and the use of constructed ponds for receiving site runoff to reduce the impact of runoff on nearby watercourses.
- Oil interceptors or drip trays must be in practice especially in vehicle parking areas, and must be inspected and cleaned regularly.

7.5.1.10Disposal of Mucking Material

233. Inevitable cut and fill earthwork operations will open up scars on the land around the project area. This impact is temporary and minor negative in nature.

234. Mitigation measure will include proper landscaping, which should be given due consideration along with re-establishment of the local/indigenous vegetation. The excavated materials that are unsuitable for use will need to be stored, transported and disposed of appropriately at designated sites.

7.5.1.11Traffic Management

235. Due to the proposed construction activities, proper traffic management may pose a challenge in the project area, particularly, where the construction of Interchanges, underpasses and Flyover will take place. This impact is temporary and minor negative in nature.

236. Mitigation measures will include:

- Movement of vehicles carrying construction materials should be restricted during the daytime to reduce traffic load on the existing roads;
- Coordinated planning of traffic diversions by the traffic police and NHA in accordance with the construction program with advance warnings to the affected residents and road users and availability of continuous services of the police in the diversion and control of traffic; and
- Proper diversion signage with lightening devices at a reasonable distance so that the traffic could easily merge to the lanes open for traffic.

7.5.1.12 Green House Gas (GHG) Emission and Climate Change

237. Climate change effects would be considered in two aspect:

238. Effect of climate change on the Project: This could be due to extreme events of temperature change, flood risks, creation of water ponds and wetlands.

239. Effect **of Project on Climate Change**: This is due to generation of GHG emissions. The main sources of greenhouse gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed Additional Carriageway (ACW) will include both mobile and stationary sources. The mobile source will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases cause global warming contributing to climatic changes on regional and global scale.

240. Mitigation measures will include:

- **Resource Conservation**: Avoid the wastage of raw material, leakages of water, oil, fuel, and use the material resistant to weather conditions
- **Energy Efficiency and Controlling Devices**: Use energy efficiency techniques and emission controlling devices. Avoid any unnecessary work and keep the material transportation distance to minimum;
- **Enforcement of NEQS** applicable to gaseous emissions generated by construction vehicles, equipment and machinery
- **Green Infrastructure**: provision of eye lands, tree plantations and landscaping

7.5.1.13 Resource Conservation

241. Almost all the materials to be used in the construction of Additional carriageway are non-renewable and therefore their sustainable use is necessary for the future use. Large quantities of water are used in the construction of concrete structures and in watering the unfinished surfaces. Use of water is of major concern while developing

resource conservation strategy. Other construction material like aggregate and sand are locally available and there is no concern of scarcity in future use. Bitumen is not locally produced and its sources are not locally available so its sustainable use is prerequisite.

242. Mitigation measures will include:

- Water conservation: Wastage of water should be controlled through providing proper valves and through controlling pressure of the water and use of water jets and sprays for watering surfaces rather than using overflow system; Water use should not disturb the existing community water supplies and avoid unnecessary equipment washings;
- Avoid timber use by providing gas cylinders
- Bitumen/ Cement Use: procure and use only the required amount of bitumen/ cement and iron for road construction.

7.5.1.14 Energy Efficiency

243. Use of electricity will be insignificant. Diesel and residual fuel oils will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not to continue future use but it will also help to reduce air emissions.

244. Mitigation measures will include:

- Ensure adequate insulation to reduce heat loss through batching plants;
- Flue gas monitoring: Regularly monitor CO and CO_2 content of the flue gases to verify that combustion systems are using practical excess air volumes;
- Mechanical Energy losses Control: Regular service of the vehicles and bathing plants will reduce the mechanical losses of energy. Maintain clean heat transfer surfaces in asphalt batching plant.

7.5.1.15 Occupational Health and Safety

245. Health risks and workers' safety problems may result at the workplace if the working conditions provide unsafe and/or unfavourable working environment due to storage, handling and transport of hazardous construction material. Workers will be provided with safe and healthy working environment taking into account risks inherent to the particular sector and specific classes of hazards in Project area.

246. Mitigation measures will include to ensure that;

- Installation of warning taps and flags to isolate trenches and active sites
- Detours provision for traffic and watering regularly for dust suppression
- Provision of barricading for excavation, trenches etc.
- Arrangement for onsite traffic control for example use of speed limits, flagman etc.
- Locked areas available for hazardous material
- Fuel storage area should be covered and tanks are properly buried or placed on properly built frame.
- Firefighting system in place at active site and camp site/ workshops
- Provisions of first aid kit and arrangements of the medical practitioner and the contact number displayed for Doctors and ambulances
- Drinking water available at sites and camps in the form of dispenser/ coolers
- Fans/ coolers are available at site and camps for ambience
- Wastewater discharged through Septic tanks
- Sufficient Lavatories and Showers with reasonable quantity of water is available for the workers, campsites and subcontractor campsite
- Potable water of good quality and quantity available at site
- Provisions of clean eating area, gas cylinder, stoves available at site

- Removal of any hazards present of working at high, slip and fall and any chance of struck by objects and moving machinery. The area needs to confined by warning tap or barricading
- Workers have available the PPEs for head protection, eye protection, face protection, body protection, feet protection, hand protection and properly trained to use it
- Warning signs for speed limit /use of speed control devices at place
- Workplace properly illuminated for work and lighting arrangement at place
- Proper air supply for workers such as fans, cooler etc.
- The sites access restricted to avoid trespassing
- Signboards at place for electrical devices, compressor rooms, material, safety measures, emergency exits, and the signage are according to International Standards?
- Equipment containing hazardous substance properly labelled such as piper color coding and communication of hazard at place
- Power cords and extension cords are protected from traffic by shielding or suspending above traffic areas
- No approach zones established around or under high voltage power lines
- Electrical cords, cables, and hand powers tools are checked for fray or exposed cords
- Welder goggles/ full-face eye shield are provided to the workers involved in Welding / hot works. Additionally, fire extinguishers are at place
- Workers constantly involved in the nature of work involving repetitive motion/ manual handling and if so they must work in revolving shifts.
- Eliminate the chances of biological hazards due unhygienic conditions such as spread of dengue fever
- Eliminate any Hazards related to contaminated land by oil/ chemical spills etc.?
- The workplace safety instruction at place of work/ workstation.

7.5.1.16 Storage of Chemicals and Dangerous Goods

247. Hazardous material being used for the road construction or used as insecticides if transported, handled and stored improperly may pose to serious threat to the health of workers and community.

248. Mitigation required are as follow:

- Contractor must comply with the conventions such as Basel convention, Stockholm convention for which the country is signatory during the selection of the hazardous material and will follow the hazardous substance rule 2003 for safe work practices
- Must be stored in locked area only accessible to trained staff with clear instructions
- Provision of secondary containment for handling and spill kit/sand/ saw dust should be available in case of spill.

7.5.1.17 Fire Prevention/ Emergency Preparedness

249. Fire is the most common and the dangerous hazard at the campsite and active sites for work and required the following arrangements to be in place:

- Provision of fire extinguishers/ fighting facilities and maintained and not expired. Fire escape route and assembly area must be demarcated and not blocked/ obstructed
- Displaying of emergency contact detail
- Reporting and reviewing of accidents/ incidents for corrective/ preventive actions
- Establishing mechanism to handle catastrophic situation such as flooding during bridge constructions.

7.5.2 Ecological Environment

7.5.2.1 Biodiversity Conservation

250. **Flora:** Due to the proposed Project, a number of trees of different species and belonging to different age groups will be rooted up. The trees coming in the ROW are mostly Phulai, Eucalyptus, Shisham, Kikar etc.

251. Establishment of contractor's camps and warehouses for storage of equipment, material etc. shall involve clearing of vegetation from the area causing a negative impact. During the entire construction period, dust laden polluted air will form a dust film on the leaves, thus blocking sunshine and stomata, thereby hindering photosynthesis process having detrimental effect on the plant health. Also, during the construction activities, the contractor's workers may damage the vegetation including trees (for use as firewood to fulfill the camp's requirements).

252. Mitigation measures will include:

- The indigenous trees most suited to the tract like Neem, kikar, Sheesham, should be re-planted in ROW.
- An awareness campaign targeted on the neighborhood 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;
- The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes. They will use the paths and tracks for movement and will not be allowed to trespass through farmlands;
- Construction vehicles, equipment and machinery will remain confined within their designated areas of movement;
- Contractor will supply gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel will not be allowed;
- Camp sites and asphalt plants will be established on waste/barren land rather than on forested or agriculturally productive land. However, if such type of land is not available, it will be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to the trees, under growth and crops; and
- Compensation for trees required to be cut on account of their coming in the ROW of additional carriageway must be paid to farmers/owners in accordance with market rates.

253. **Fauna:** Due to the implementation of the proposed Additional carriageway Project, the free movement of fauna would be disturbed as the Dual carriageway will restrict their free movement. Another impact on the fauna of the project area will be the probable dislocation of the birds/animals (rodents) from their nests and burrows.

254. Reptiles like snakes and lizards, living in the holes or underground shall either get killed or move to the adjacent areas. Similarly, birds like sparrows, mainas, crows, who have nests on the trees located in the ROW or who frequently visit the project area in search of food shall receive a negative impact and shall have to move to adjoining areas. These trees provide resting and nesting places to the animals and birds, so the cutting of these trees will have negative effect on fauna. However, this impact will be temporary and minor negative in nature.

255. Also, due to the leakages/spills from the construction equipment/machinery the local ponds/water storages and water courses where the animals/birds drink water may get contaminated; thus, affecting/endangering the fauna of the project area. This impact is temporary and minor negative in nature.

256. Mitigation measure will include:

- Plantation of large number of trees along the proposed Additional carriageway to regain the ecological habitat;

- New and good condition machinery with minimum noise will be used in construction;
- Animal corridors must be provided along the whole alignment, wherever necessary;
- Noisy work will not be carried out in night time so that there should be no disturbance to local birds and animals;
- Contractor will ensure that the no hunting, trapping of animal will be carried out during construction;
- Borrow pits will be fenced so that no animal can fell into these;
- The camps will be properly fenced and gated to check the entry of wild animals in search of eatable goods. Similarly waste of the camps will be properly disposed off to prevent the chances of eating by wild animals, which may prove hazardous to them;
- Special measures will be adopted to minimize impacts on wild birds such as avoiding noise generating activities during the critical period of breeding; and
- Alternate nesting facilities shall be tried for those birds disturbed during hatching season.

7.5.3 Social Environment

7.5.3.1 Construction Camps/Camp Sites

257. Due to the camp sites, loss of vegetation and assets on the selected land and dissatisfaction of rehabilitation measures during and after completion of construction phase may occur. However, it will be a temporary and minor negative impact. However, a range of impacts those either remain likely to occur or are unavoidable. For theses impacts, mitigation measures have been developed to minimize the likelihood, extent or duration of their occurrence, and any associated adverse effects.

258. Mitigation measures will include:

- Locate camp site 500 meter from communities and 50 meters from scattered residences.
- All efforts during the design stage should be made to minimize the removal of existing macro-plants at camp sites; The contractor(s) will provide plan for removal & rehabilitation of site upon completion; Photographical and botanical inventory of vegetation before clearing the site; and Compensatory plantation to be scheduled when construction works near end.
- No trespassing or animal crossing should be allowed from construction camps by marinating administrative controls
- Maintain high standards of cleanliness, provision of septic tanks, Lavatories and washing facilities with sufficient quantity of water and this is both for contractual and sub-contractors labor.
- Provide adequately sized solid waste bins/ containers at key locations around the camp and waste should be regularly collected and disposed off
- Fully equipped kitchen with sinks emptying to buried septic tank and provision of gas cylinders
- Build an adequate drainage system leading surface water to a settlement pound of sufficient capacity to control the large quantities of wet season rain and runoff
- Guidance on acceptable behavior in the campsite for workers in and around the campsite and communities.

7.5.3.2 Cultural Conflicts

259. There are chances of arising of issues related to cultural differences/conflict between the Contractor’s workforce and the local inhabitants, conflicts arising due to the mix of local and migratory job seekers as the use of local resources and products will be increased. In this situation, local residents may resist Contractor’s workforce attitudes, cultural clashes particularly when local/international contractors are engaged, social

disturbance and dissatisfaction with employing outsiders, competition for natural resources e.g. with farmers/livestock raisers etc. may arise. This impact is temporary and minor negative in nature.

260. This impact can be mitigated by adopting the following mitigation measures:

- Establishment of formal links with affected communities and avoid damage to crops along the highway;
- Plan for social grievance redress mechanisms (GRM) including the Nazims of Union Councils and community leaders;
- Judicial payment to land affectees and for the leased areas and avoid cutting the link between communities
- Seek assistance from and cooperation with local NGOs;
- Familiarize outside laborers on local etiquettes;
- Local labor should be employed for construction works.

7.5.3.3 Physical Cultural Resources

261. There are no physical cultural resources as listed in UNESCO World Heritage list of archaeological sites coming in the ROW. However, this Indus valley has its own civilization and it was the ancient route for trade. A list is given in section 4.

262. As the project involves excavation work and in case of any accidently discovered archaeological/ historical heritage during the construction phase, contractor should stop the activities immediately and inform the Supervision Consultant and chance find procedures should be adopted as given in **Annex VI.**

7.5.3.4 Economic Activity

263. Due to the construction of the proposed Project, economic activity will be generated in the project area as the laborers and semi-skilled staff will have an opportunity to work in the project area. This will provide them an opportunity to develop their skills and capacities. This is a moderate positive impact.

7.5.3.5 Community Health and Safety

264. The construction activities and vehicular movement at construction sites and access service roads may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. This is a temporary and minor negative impact. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents etc. The labor works with different transmittable diseases may cause spread out of those diseases in the local residents. The borrow pit areas located near the residential, settlements, may cause accident for the people moving near to those areas.

265. Mitigation measures will include to ensure that

- Grievance Redress mechanism at place with complaint registers at each site
- Awareness raising programs and procedural adaptation to minimize the traffic related accidents of workers and communities
- Maintenance of deterioration of existing roads due to movement of heavy machinery and any rehabilitation work
- No water pounding creating habitat for mosquitoes breeding especially near batching and asphalt plants
- No water quality and quantity disruption affecting communities
- Access restriction by combination of institutional/ administration control to site and camps, by provision of fencing, signage etc.
- Covering of uncovered opening or open trench left creating the fall hazard

- No free access to hazardous material and there is any that must be locked and restricted area sign should be placed
- There should be no chances of Pedestrian interaction with machinery
- Construction activities should not be effecting the business of locals
- Protection of any vector born and communicable diseases among the workers and communities including the current coronavirus pandemic.

266. Covid-19 management plan is attached as **Annex VII.**

7.6 Anticipated Impacts during Operational Phase

267. The anticipated environmental impacts related to the proposed project have been studied for the operational stage of the Project as discussed hereunder.

7.6.1 Physical Environment

7.6.1.1 Water Pollution

268. No major adverse impact on groundwater is anticipated during the operational phase with the exception of some occasional oil spills, which may be restricted up to the road surface, however, sometimes the road runoff may be washed into surface water during rains etc.

7.6.1.2 Air & Noise

269. During the operational phase, Improvement in road condition will help reduce traffic related emissions in the short term by allowing a smoother traffic flow. The noise levels are anticipated to increase due to traffic related noise pollution; vibrations from engines and tires and mainly use of pressure horns. This impact is permanent and moderate negative in nature.

Noise Modeling Through SoundPLAN Essential 5.1

270. The noise model, SoundPLAN Essential Version 5.1 by Braunstein + Berndt GmbH / SoundPLAN International LLC was used to assess the impact of noise generated during the operational phase of the proposed Project. The assessment was made for the following two (02) scenarios:

- Unmitigated Noise Modeling– Scenario 1
- Noise Assessment with Mitigations – Scenario 2

Unmitigated Noise Modeling, Scenario 1

271. The steps followed in this assessment are:

- Step 1: Measure the existing noise levels at various receptors. The sampling sites were selected to be representative and results are mentioned in Chapter 5.
- Step 2: Undertake a noise measurement for calibration/quality assurance purpose. In this exercise, the traffic noise at existing roads was estimated simultaneously. The noise from the counted highway traffic.
- Step 3: The existing baseline noise level was determined by modeling the worst-case traffic volume (2042), as reported in the PC-1. The modeled levels are not expected to be exactly the same as the measured levels because the traffic volume on the day of measurement may not be identical to the reported average traffic volume.
- Step 4: The individual receptors for modeling were identified. Representative receptors were selected to ensure spatial distribution in the Study Area, both horizontally and vertically.
- Step 5: The noise levels for each receptor at building and at ground level other than building was assessed through model.

272. ***Receptors:*** The buildings located along the proposed alignment are considered as the receptors for this study. There are 1543 structures of different sizes in the Study Area where 24,617 receptors were considered. Furthermore, additional 18 receptors were considered at different critical locations (sensitive receptors) to assess the noise level situation at these receptors. The impact on noise levels due to the proposed Project was determined by modelling the noise generated by the motor vehicles on this road.

273. ***Model Input:*** The following inputs were used to develop the model:

- Estimated traffic projections as obtained from the PC-1 of Indus Highway (N-55) Additional Carriageway Project, Shikarpur-Rajanpur Section (November, 2019);
- Speed on the roads are assumed to be 100 km/h, Road Surface for existing roads: Smooth Asphalt, road elevation of the proposed Project was obtained from the Digital Elevation Model (DEM);
- Each receptor was separately identified, with location, building height and number of floors. An average floor height of 2.8 m; and
- Weather parameters used were temperature: 27 ºC, humidity: 64% and pressure 1001 mbar.

274. The following conclusions can be drawn:

- The noise levels at structures along the proposed Project are exceeding the PEQS and SEQS Noise limits for commercial zone for both daytime and nighttime (i.e. over 65 dBA during the day and over 55 dBA during the night, as seen from the respective grid noise maps).
- The noise levels at the façade facing the proposed Project but behind the first row of structures are relatively low;
- The noise levels at the façade facing away from the proposed Project are in compliance with PEQS and SEQS noise limits;
- Noise sources such as community noise from existing roads are also included in the modeled values; and
- Modeling of the unmitigated scenario revealed that about 31% and 44% values for day and night time are higher than permissible limits mentioned in PEQS and SEQS respectively (which can also be seen from the respective grid noise maps). The maximum assessed value during day time is 81.7 dBA and minimum value is 36.6 dBA. Similarly, the maximum assessed value during night time is 78.9 dBA and minimum value is 35.5 dBA.

275. Outputs of the model for unmitigated scenario in the forms of grid noise maps are presented in **Figure 7.1** and **Figure 7.2** for day and night time respectively. The detailed stretch wise noise modeling maps are also provided hereafter.

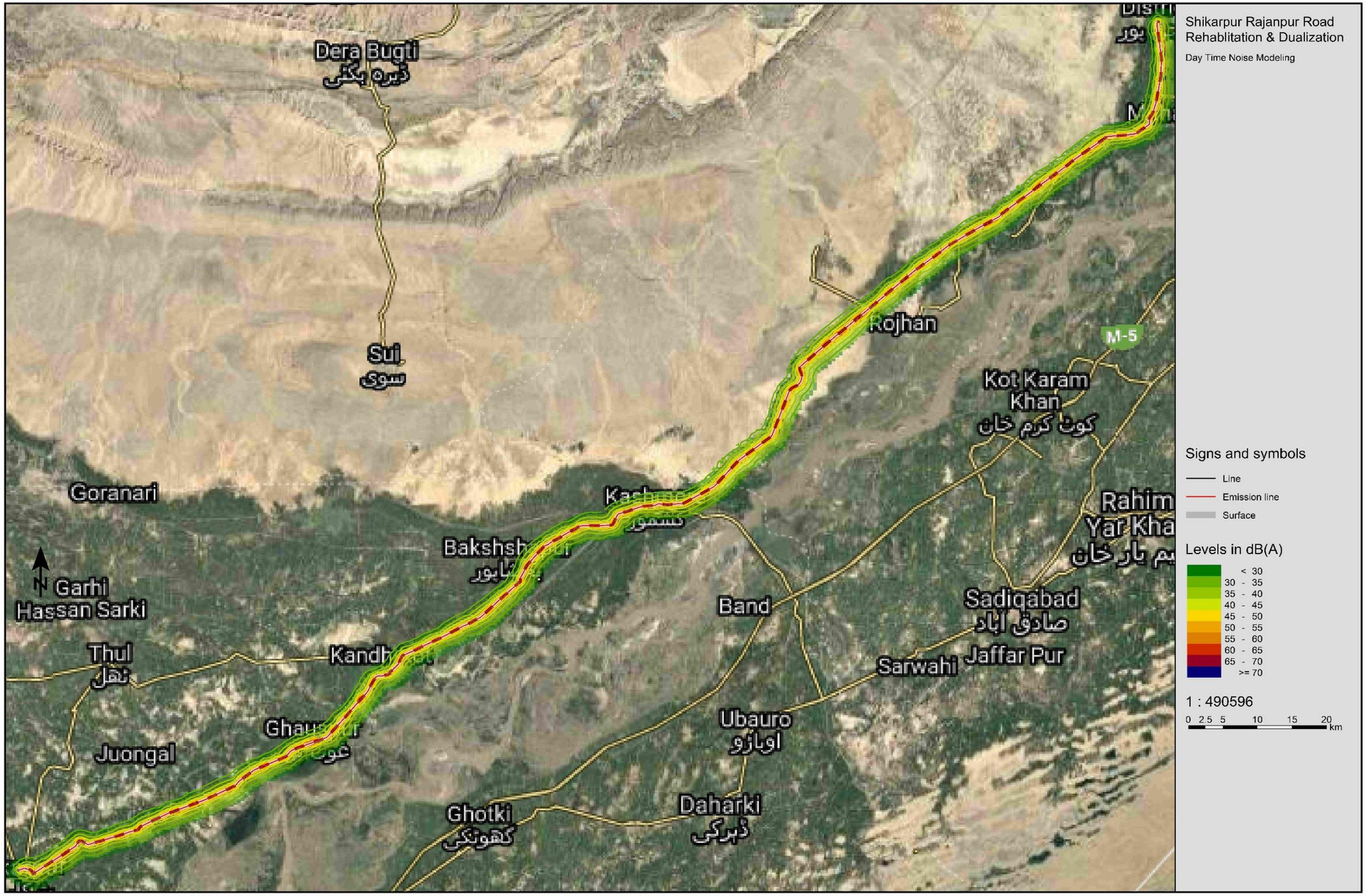


Figure 0.1: Day Time Grid Noise Map

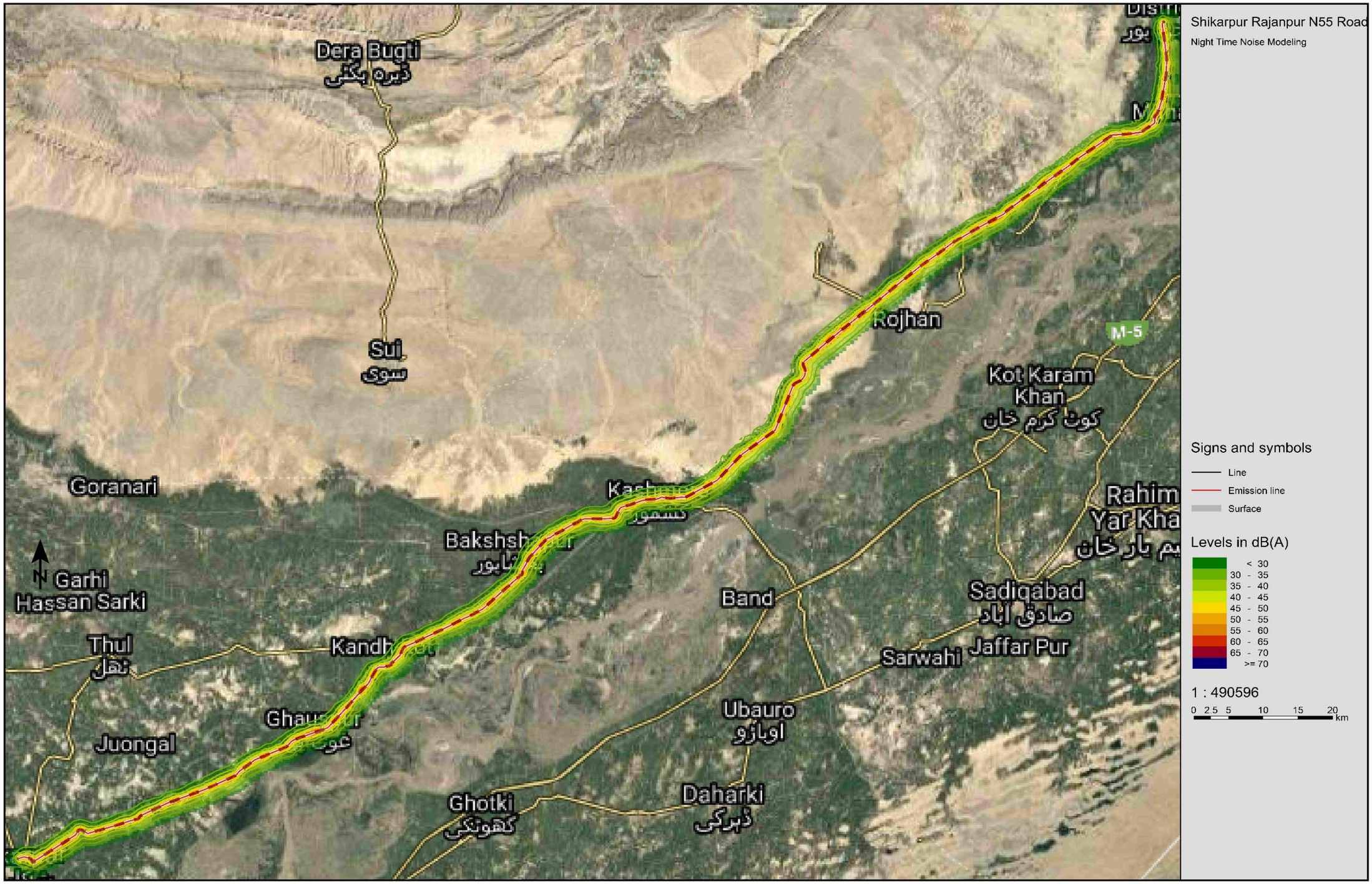
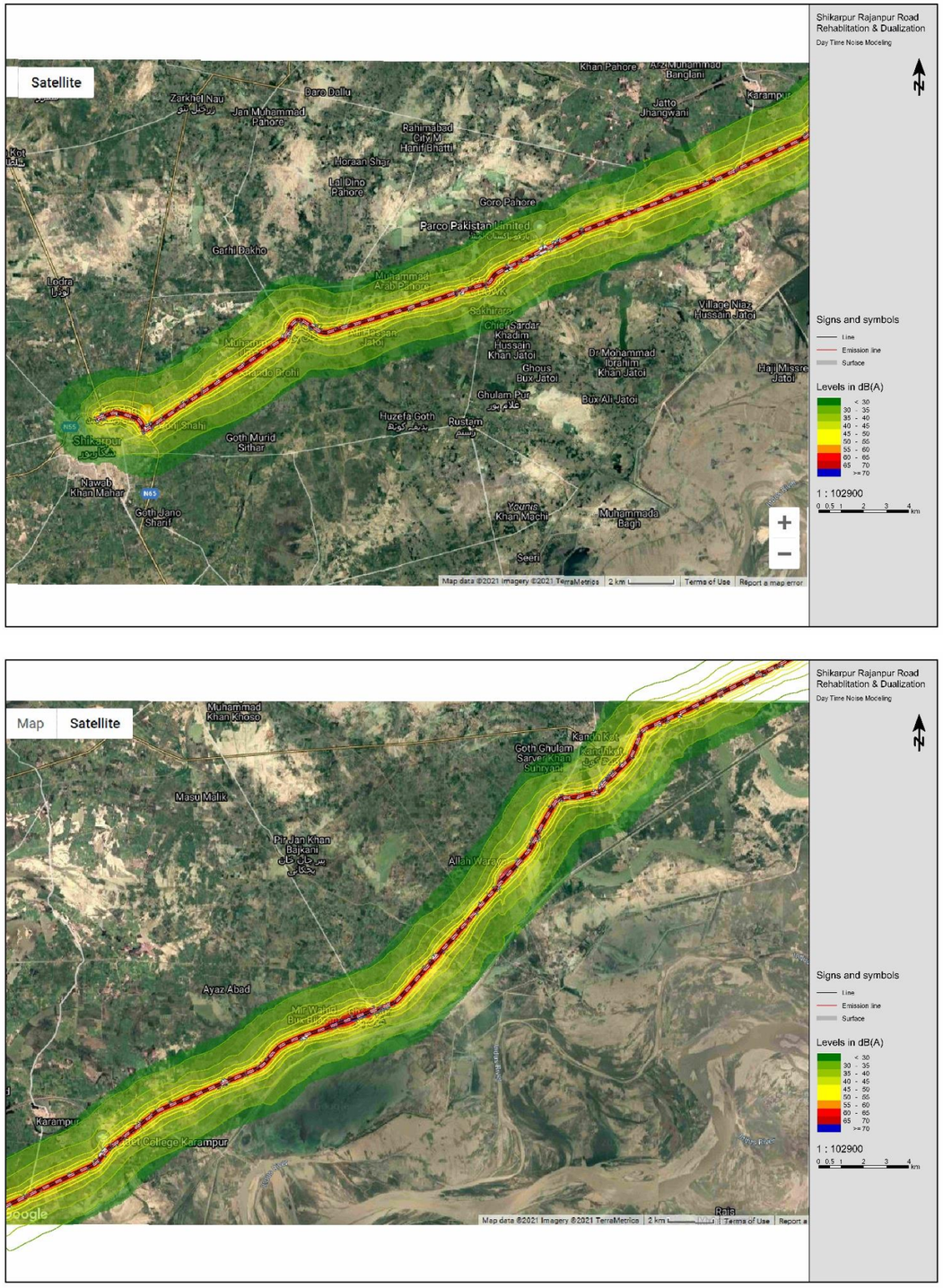
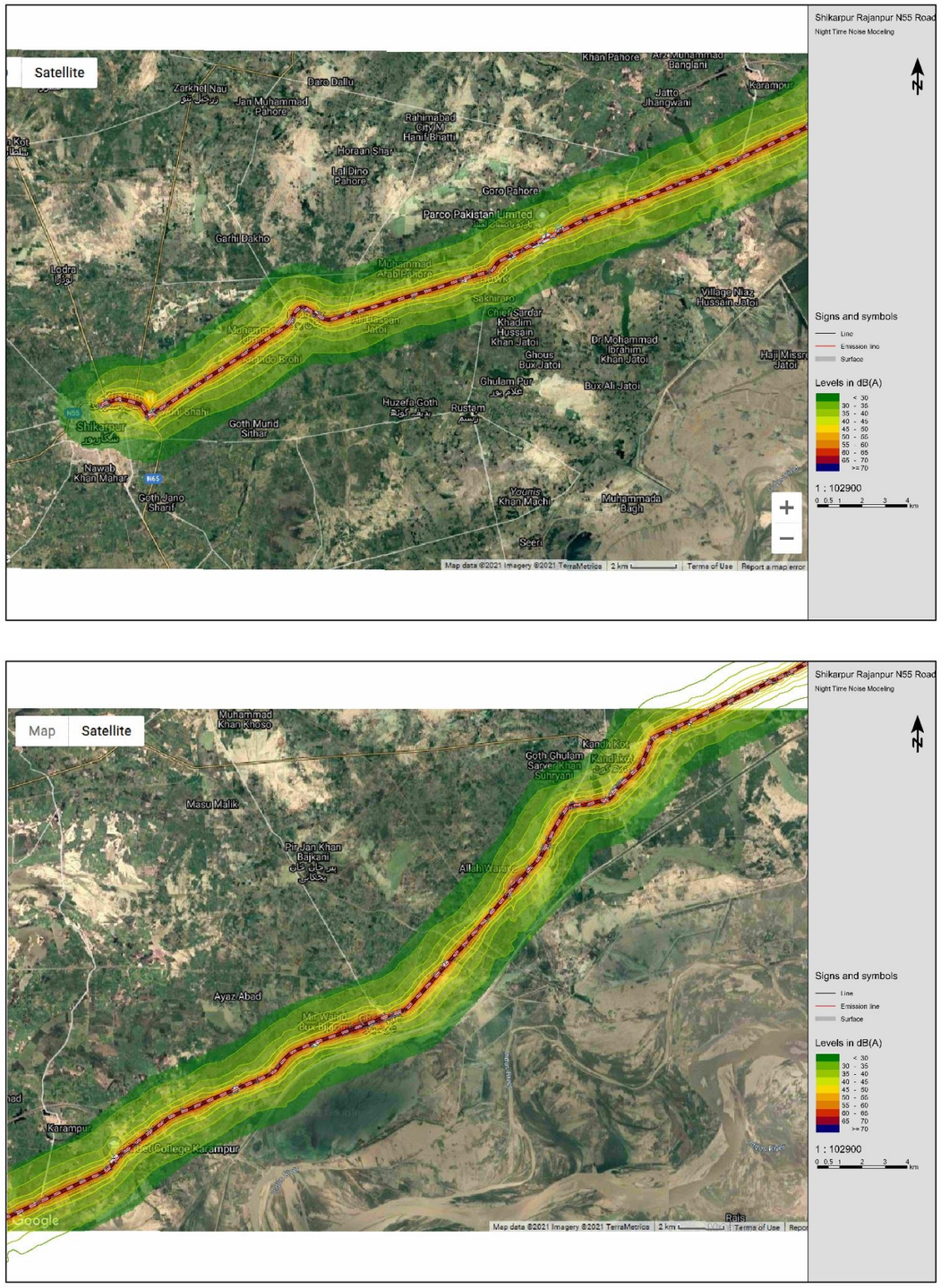


Figure 0.2: Night Time Grid Noise Map

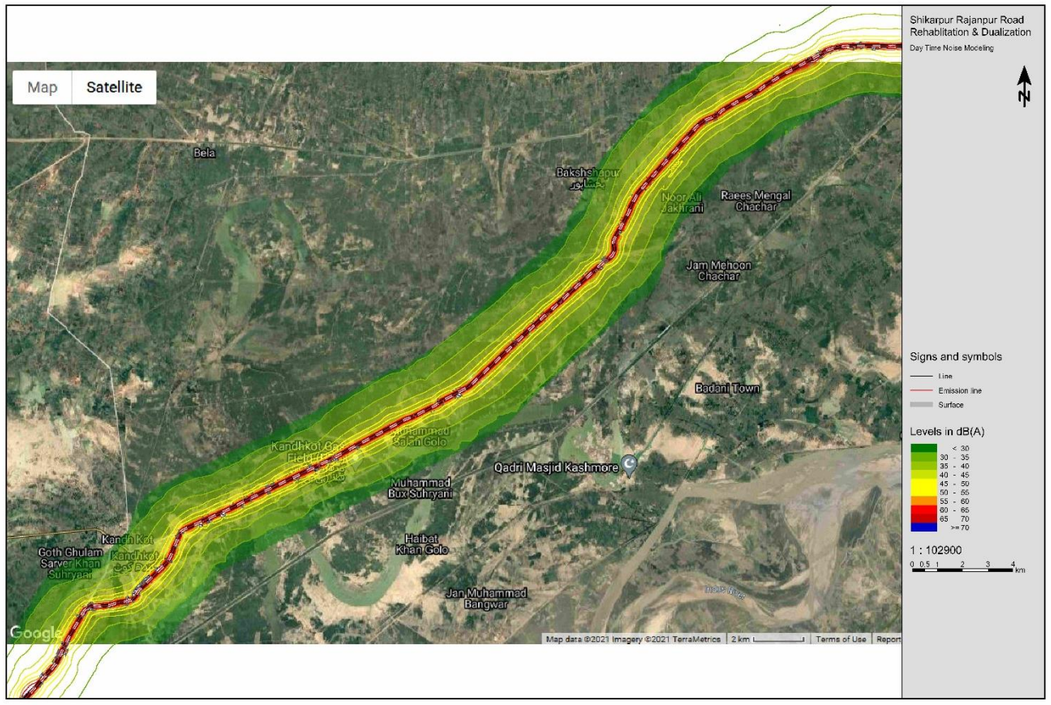
DAY TIME

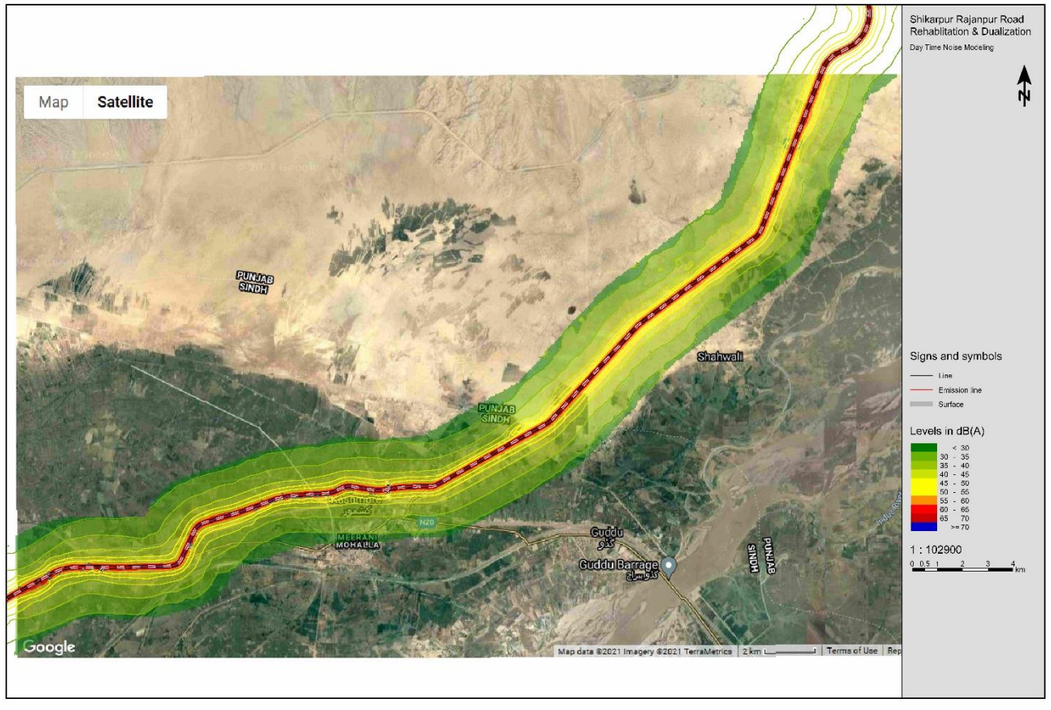


NIGHT TIME

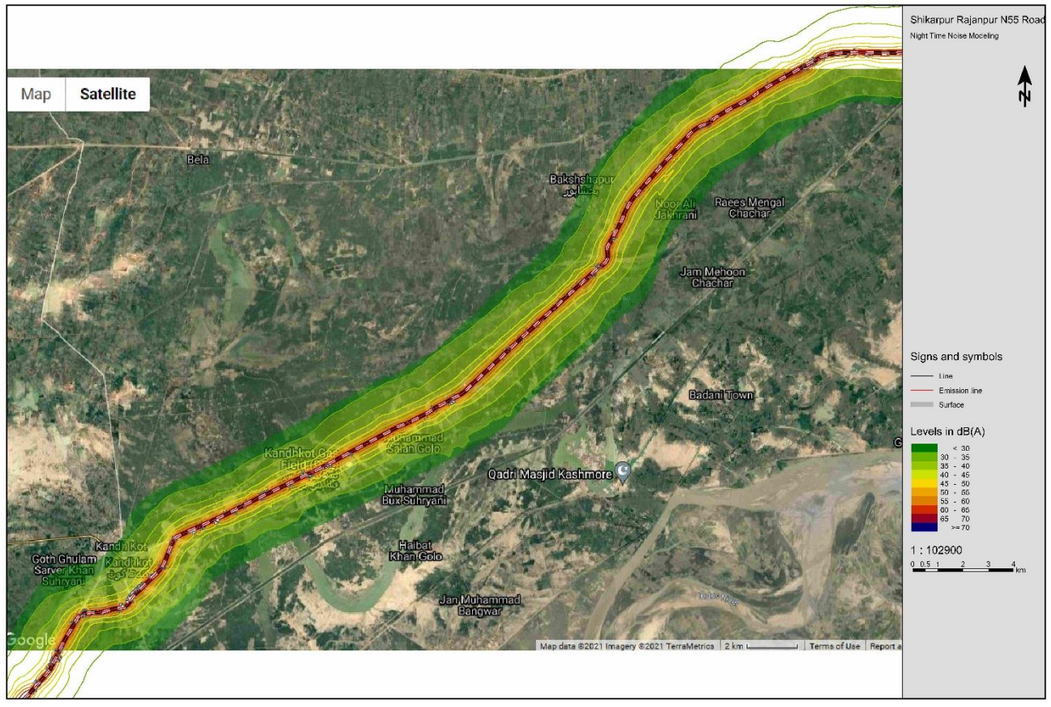


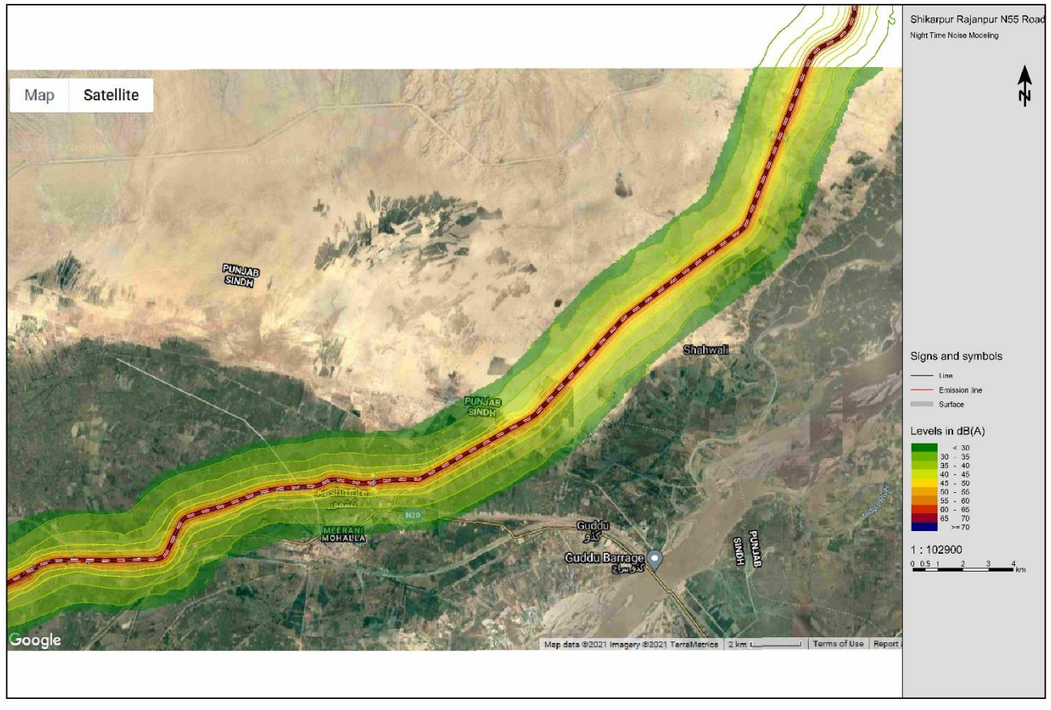
DAY TIME



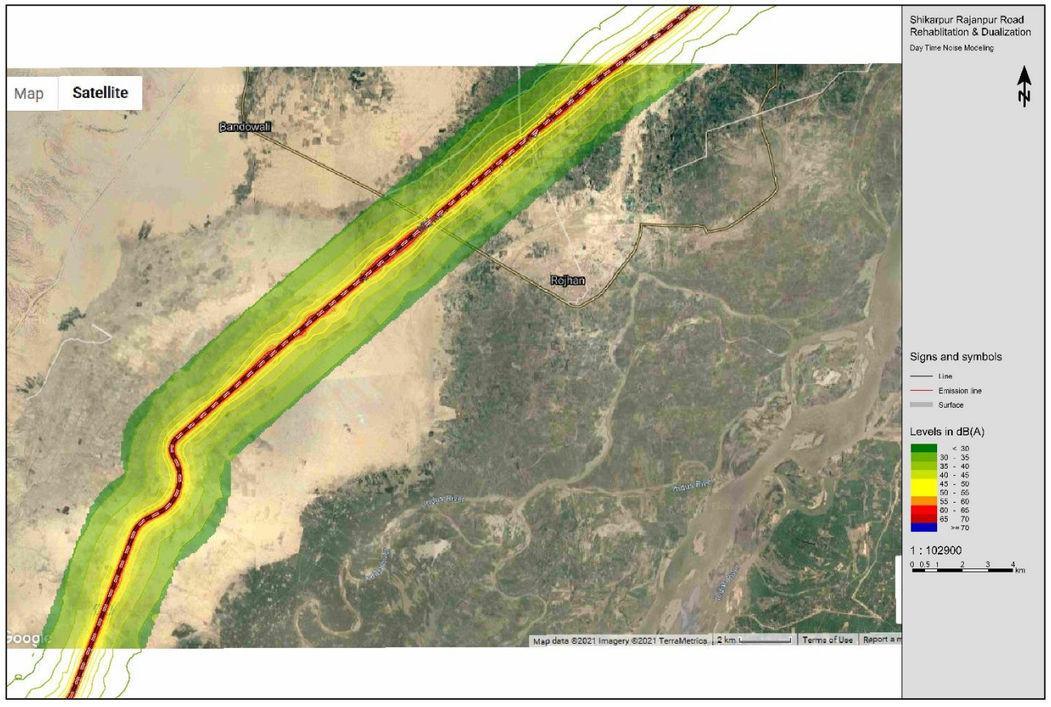


NIGHT TIME

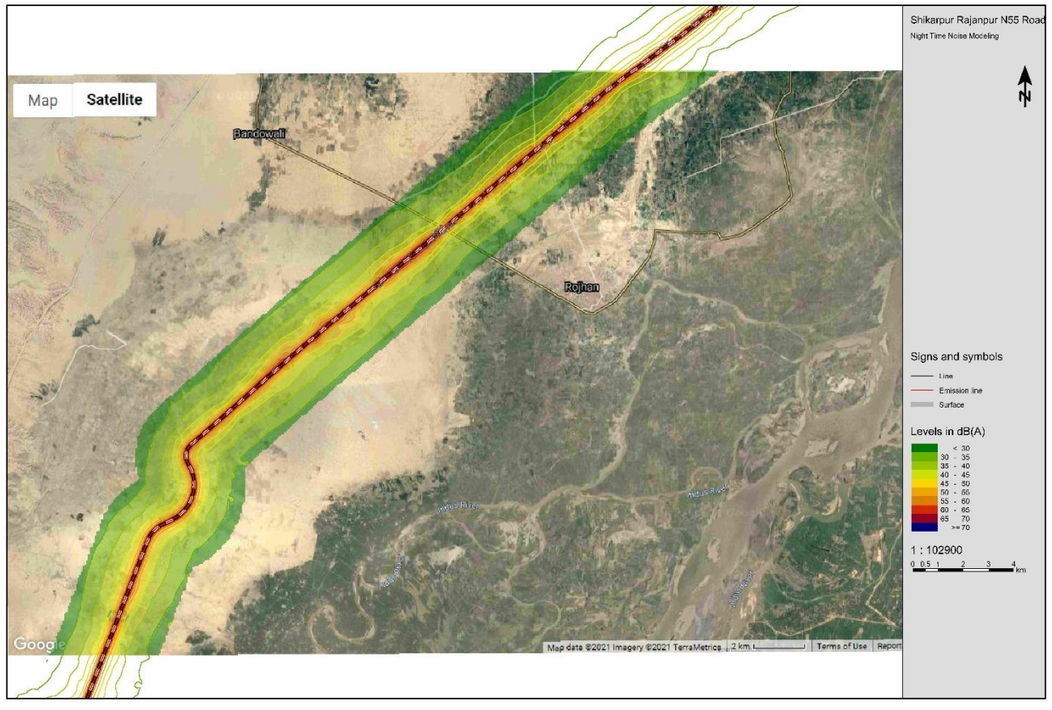


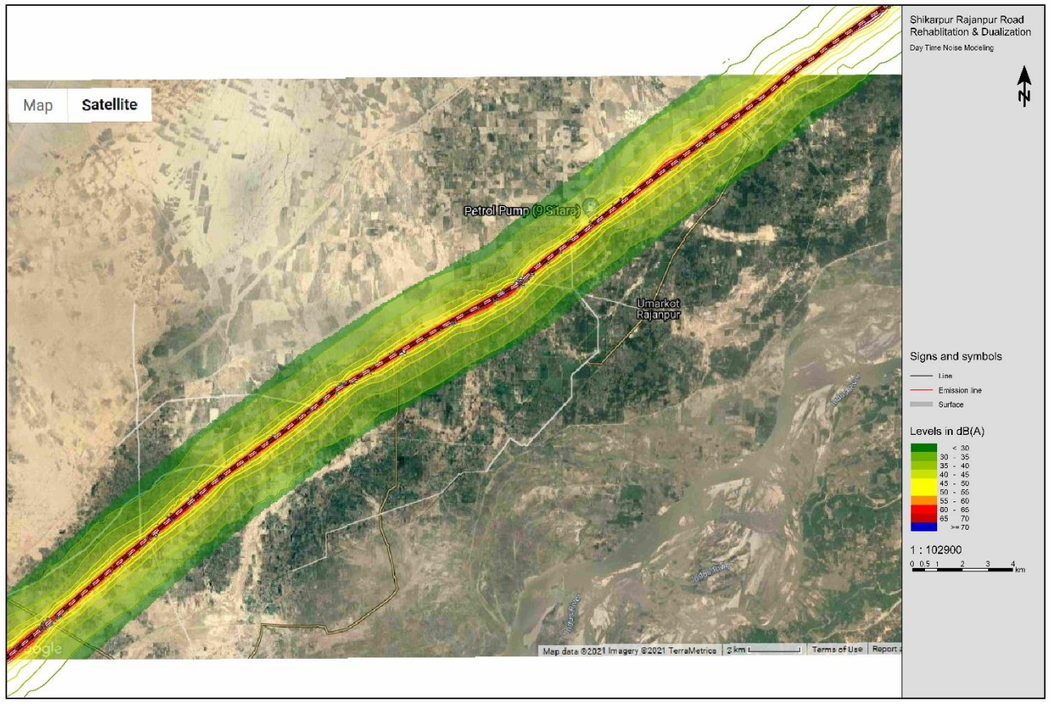


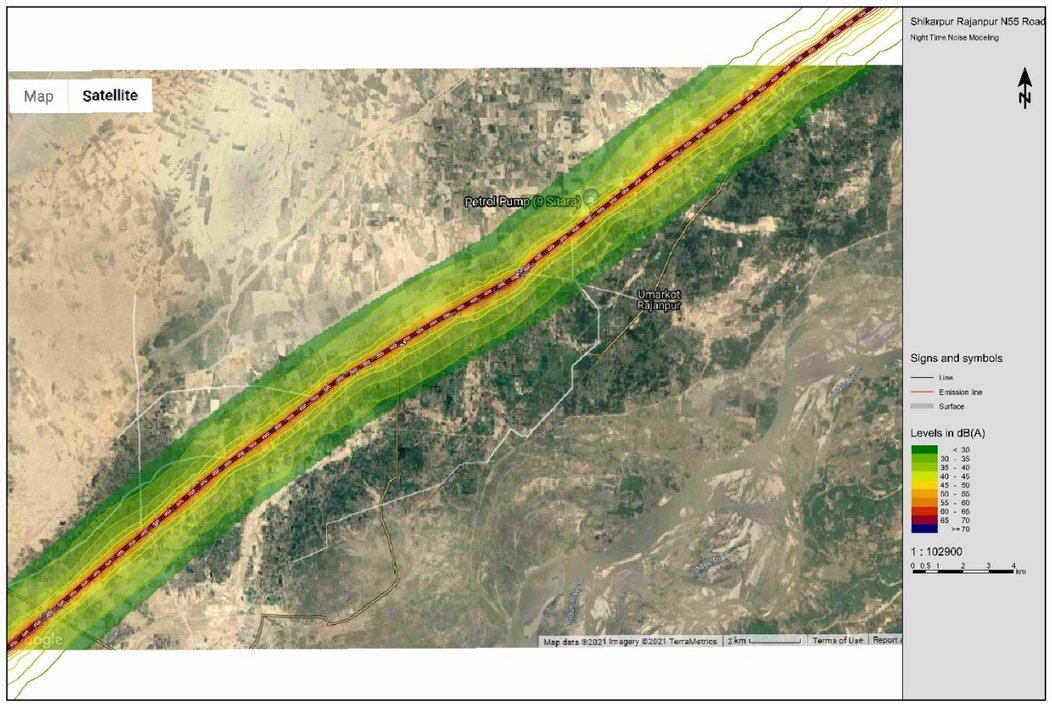
DAY TIME



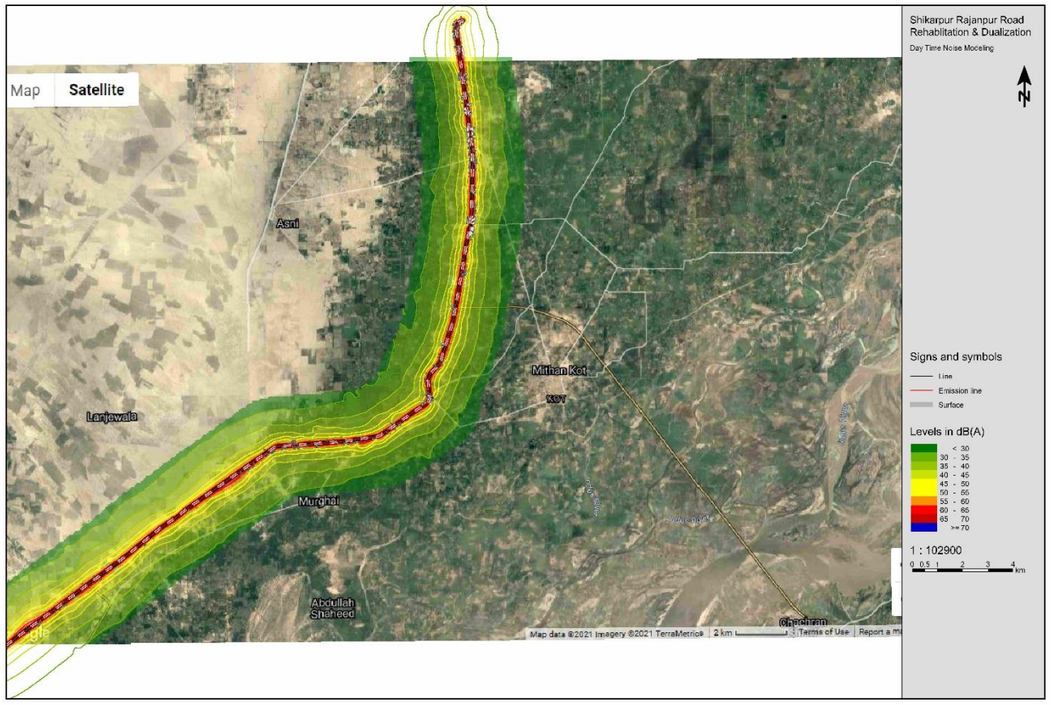
NIGHT TIME

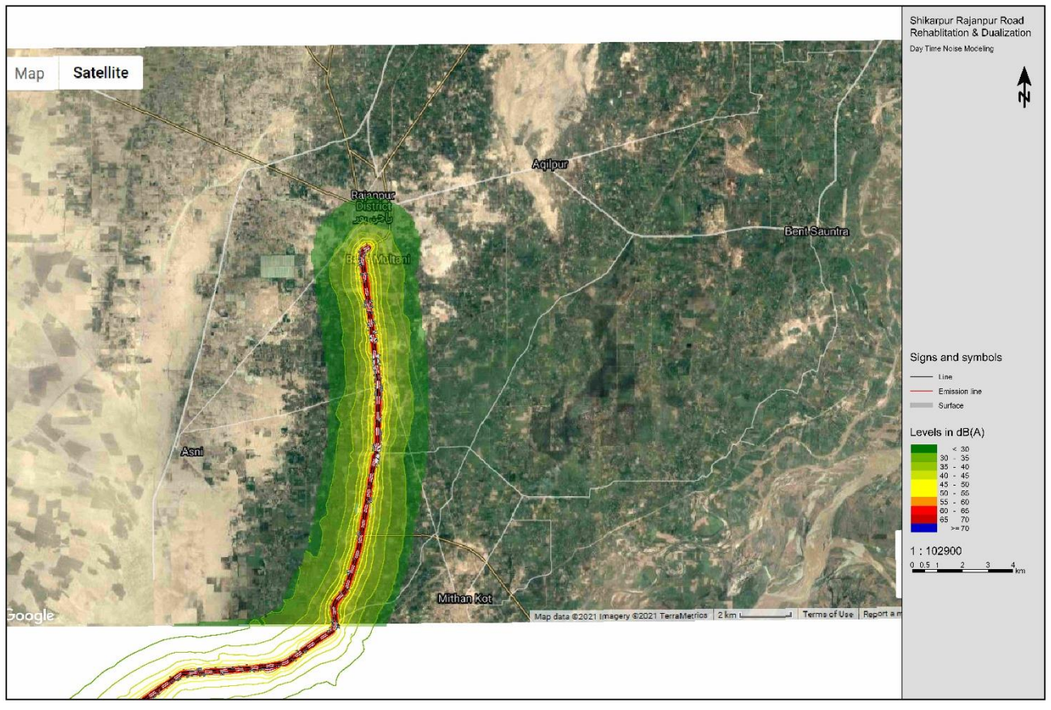




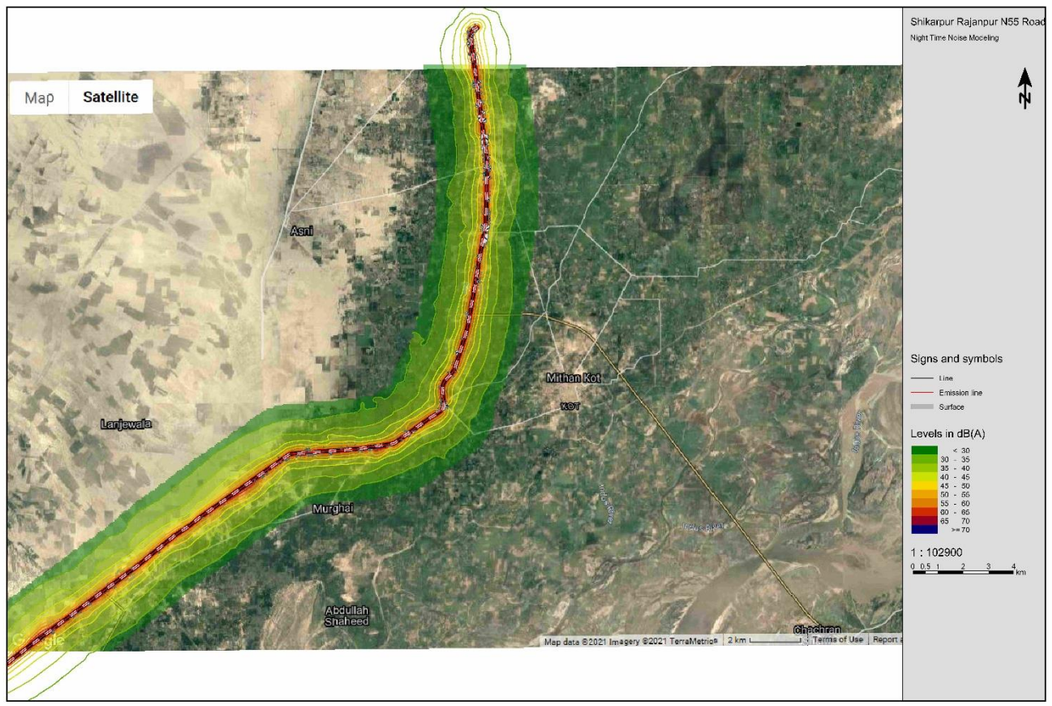


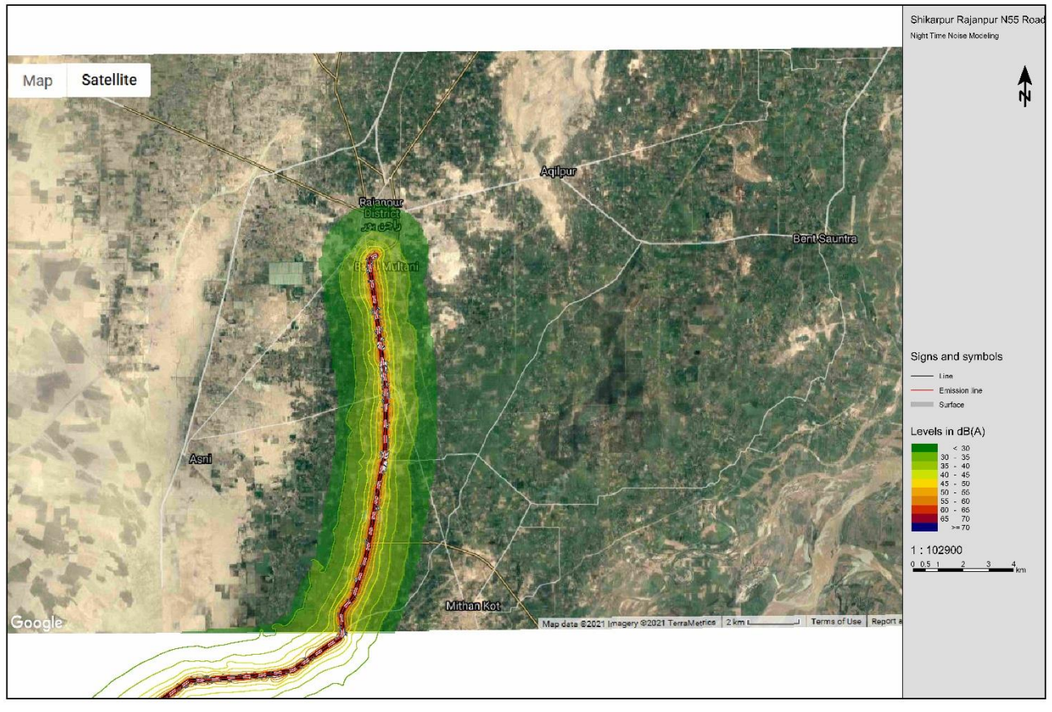
DAY TIME





NIGHT TIME





Noise Assessment with Mitigations, Scenario 2

276. The mitigated scenario was conducted by considering seven (07) meter noise protection wall as a barrier between road traffic and settlements/sensitive receptors. After considering 7m noise protection wall, modeling of the mitigated scenario revealed that only 9% and 24% values for day and night time are higher than permissible limits mentioned in PEQS and SEQS respectively (which can also be seen from the respective grid noise maps).

277. Outputs of the model for mitigated scenario in the forms of grid noise maps are presented in **Figure 7.3** and **Figure 7.4** for day and night time respectively. The detailed stretch wise noise modeling maps are also provided hereafter.

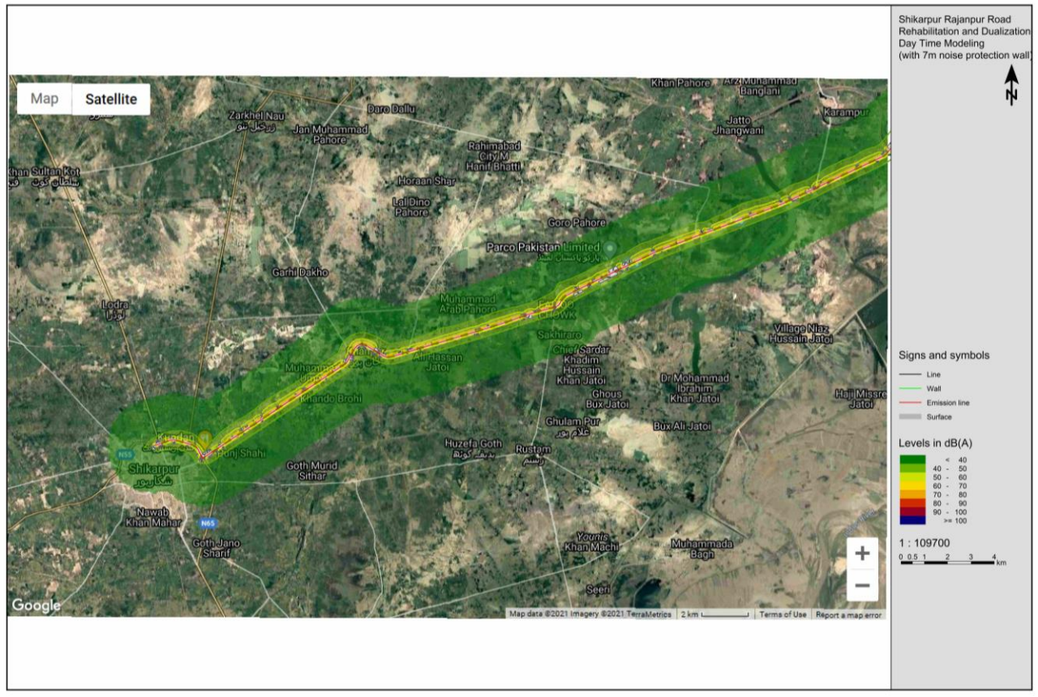
278. The input data of proposed Project used for SoundPlan essential 5.1 is attached as **Annex V**. The model output comprises both the noise grid map and noise levels at individual receptors, located on ground or on various floors of the buildings for unmitigated and mitigated scenarios as well. The detailed outcome of the model in tabular form is attached as **Annex V**.

279. This impact is permanent and medium negative.

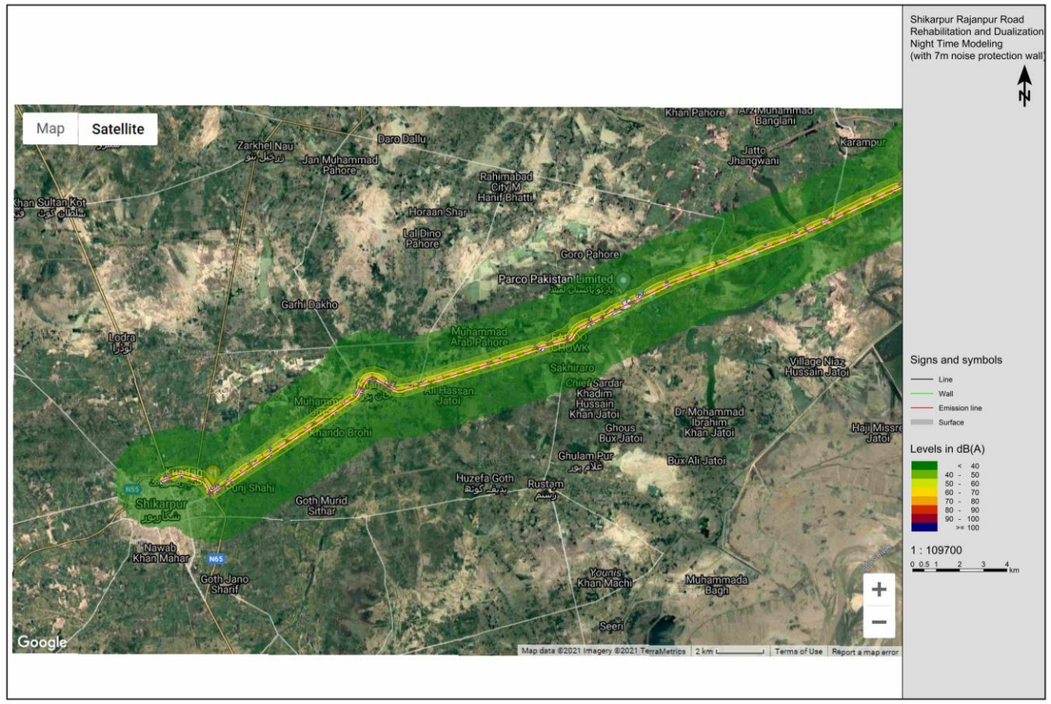
Figure 0.3: Day Time Grid Noise Map with 7m Noise Protection Wall

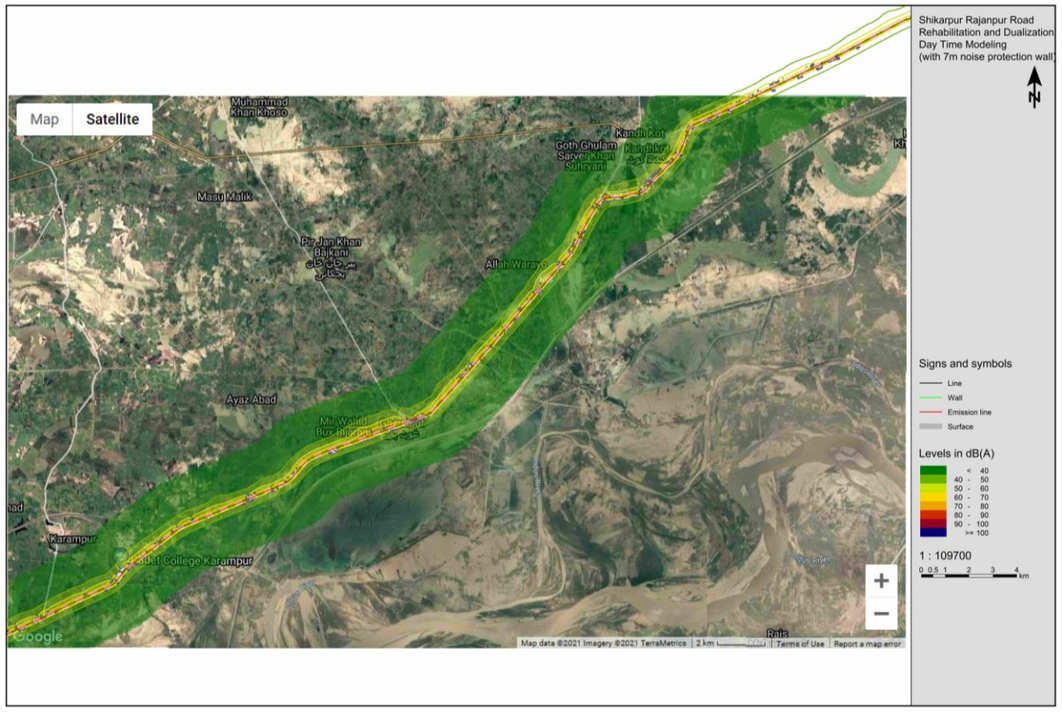
Figure 0.4: Night Time Grid Noise Map with 7m Noise Protection Wall

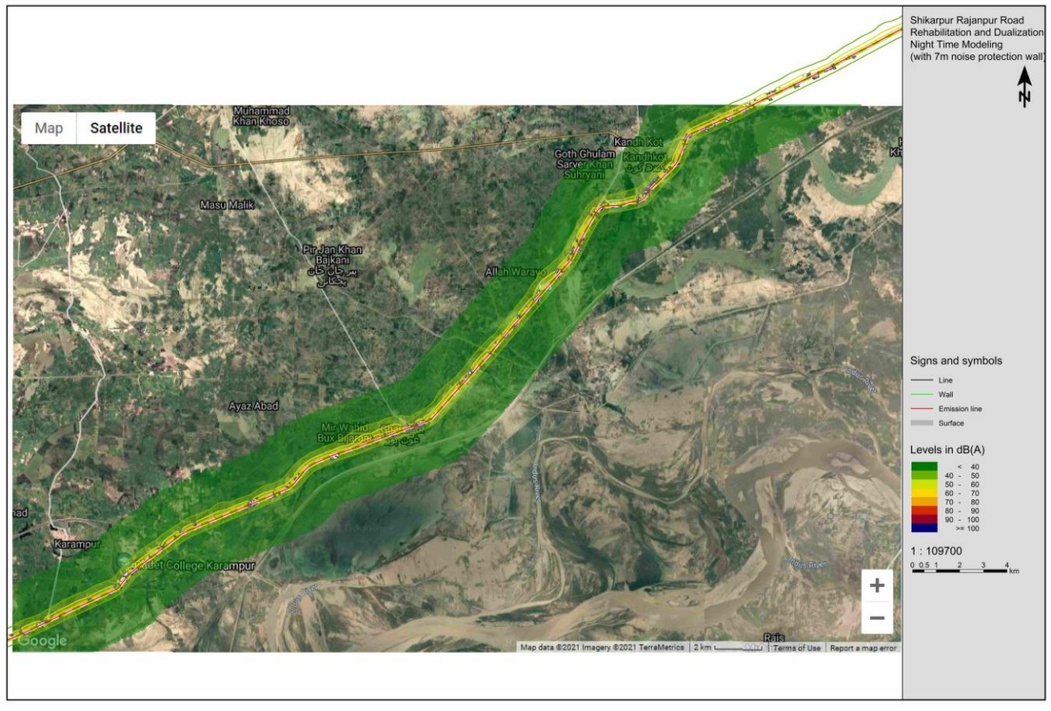
DAY TIME (7M NOISE PROTECTION WALL)



NIGHT TIME (7M NOISE PROTECTION WALL)







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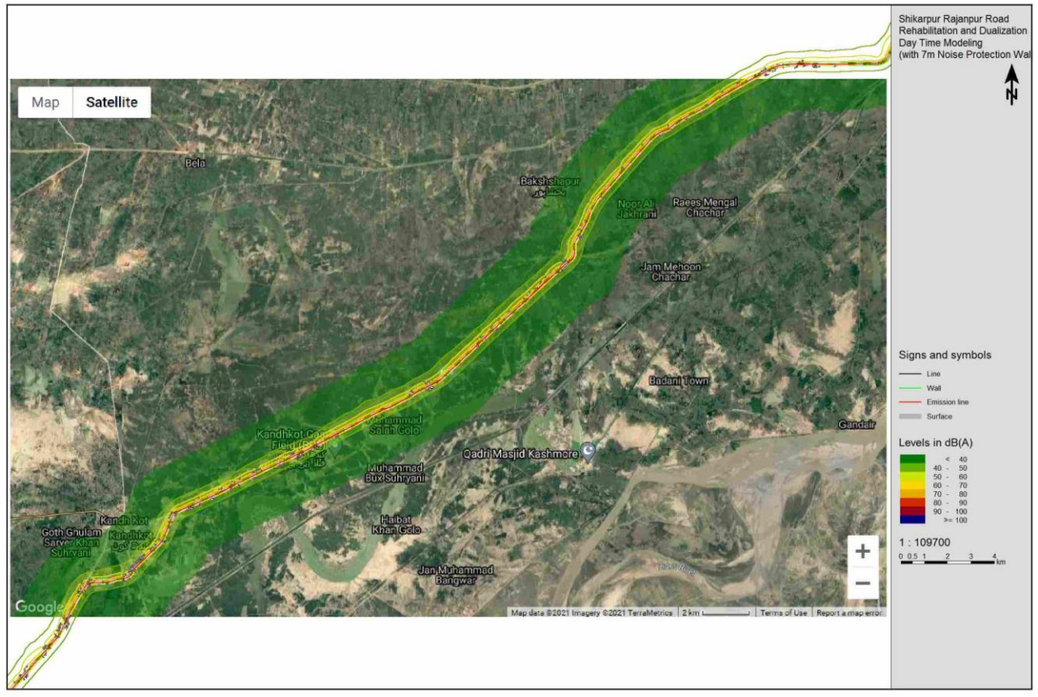

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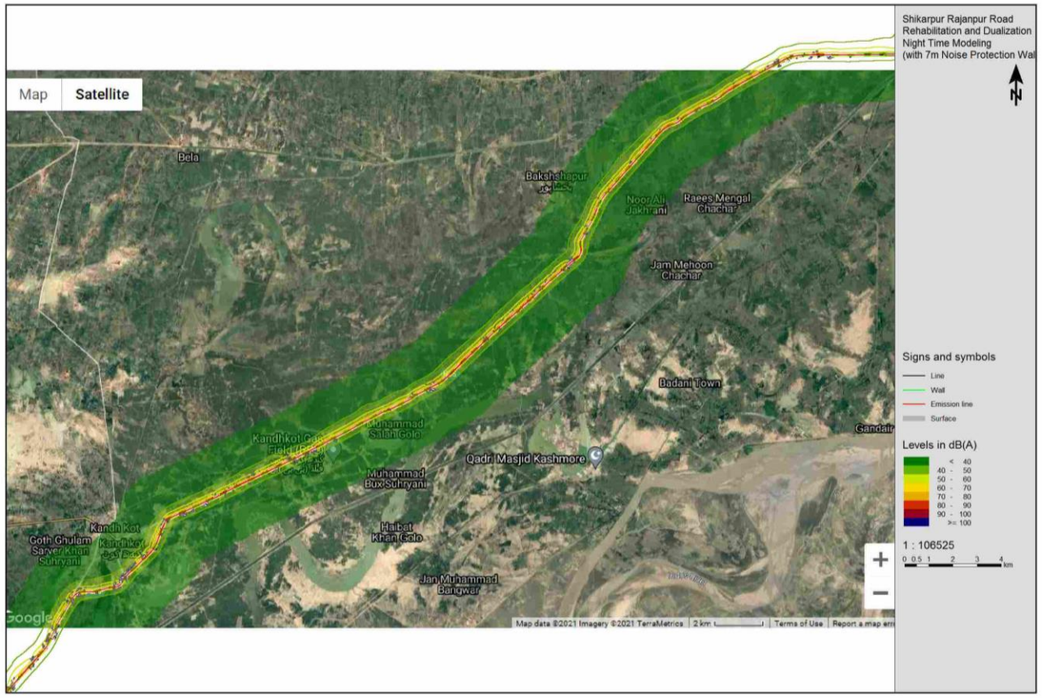

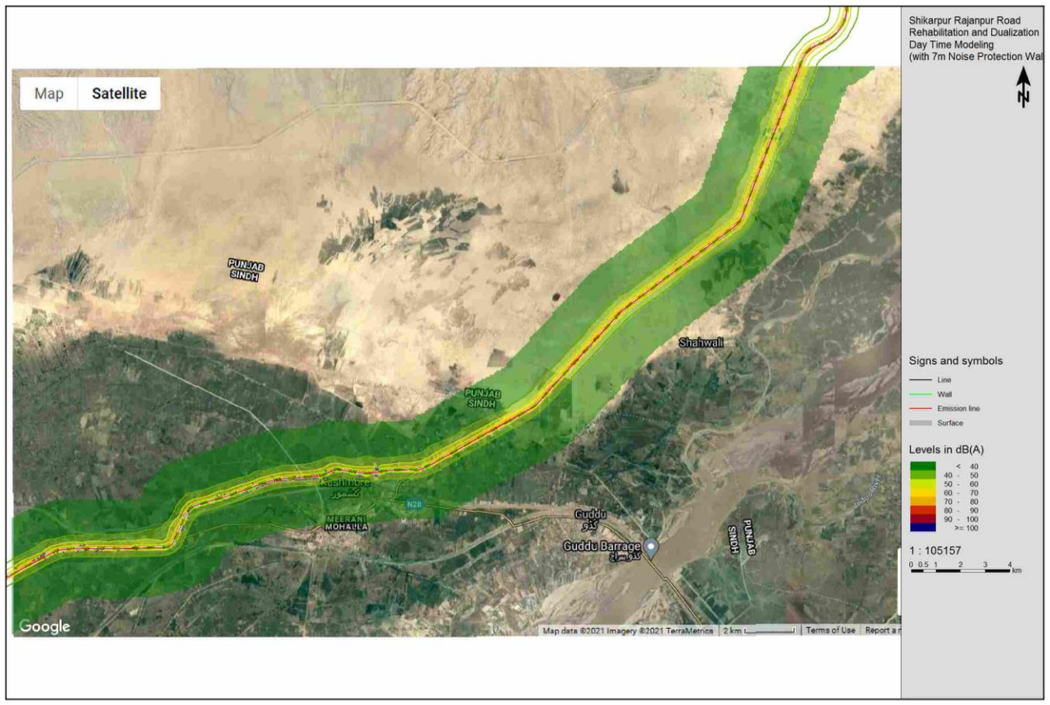

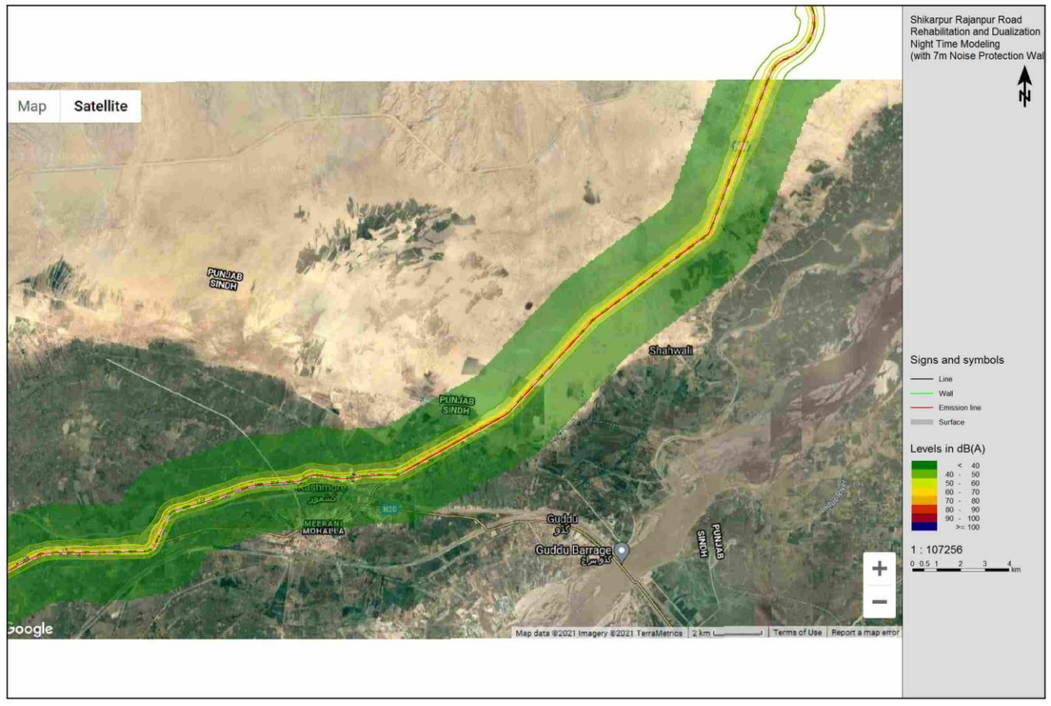

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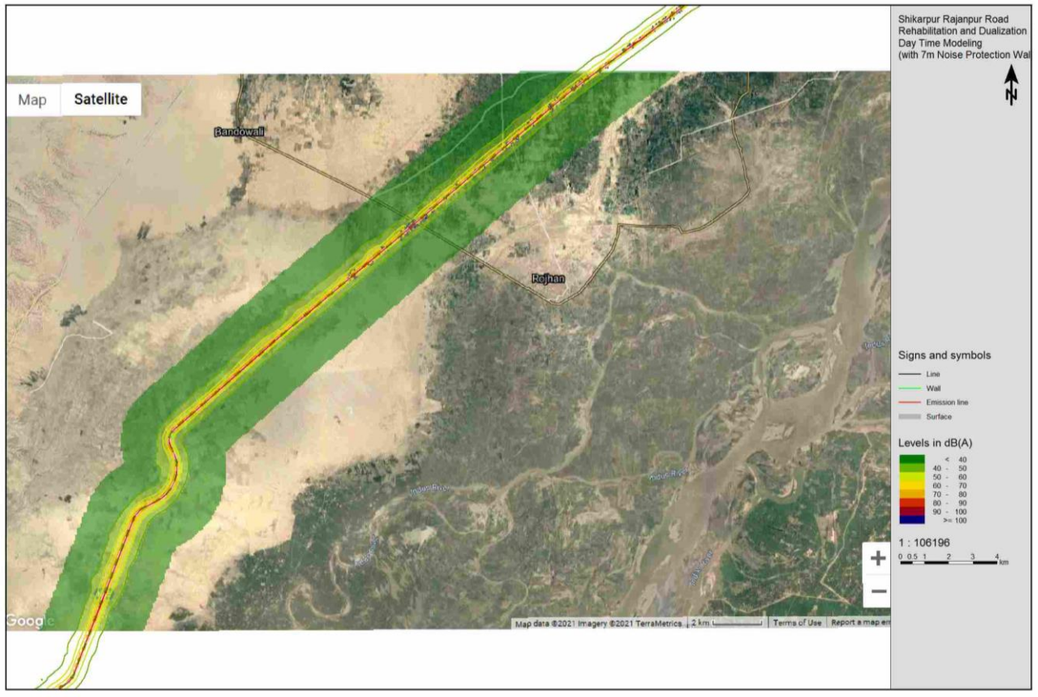

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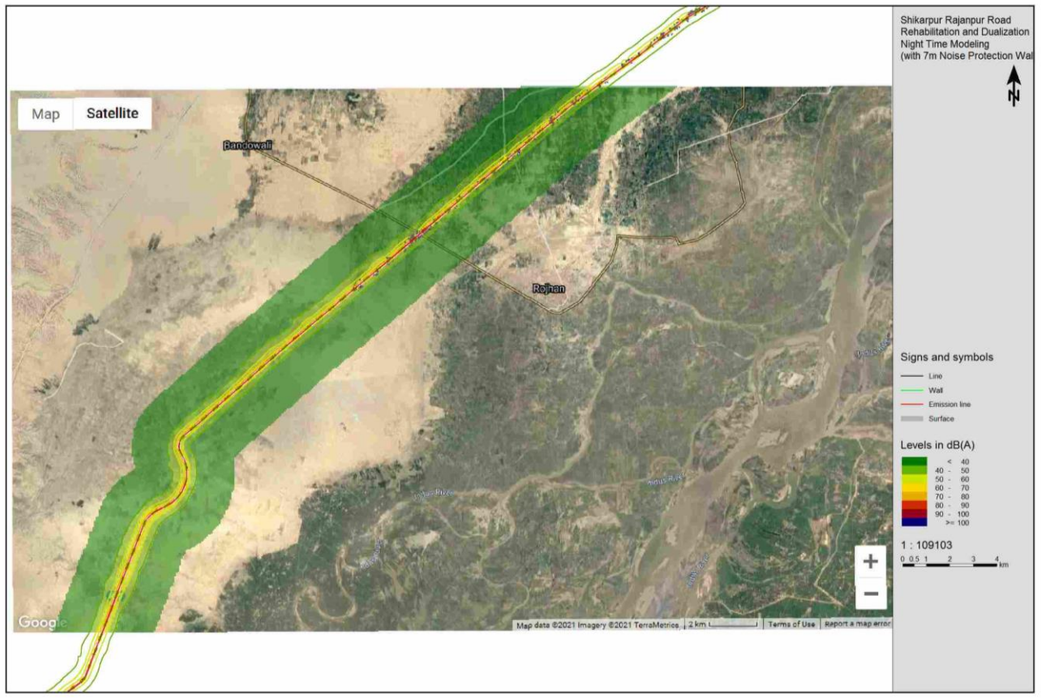

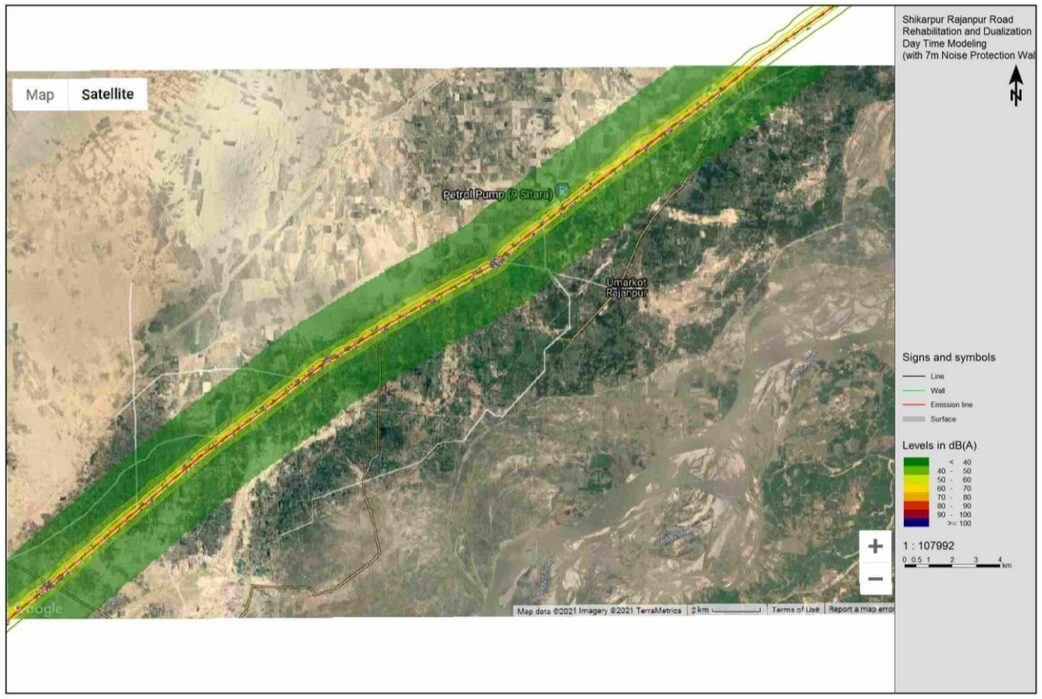

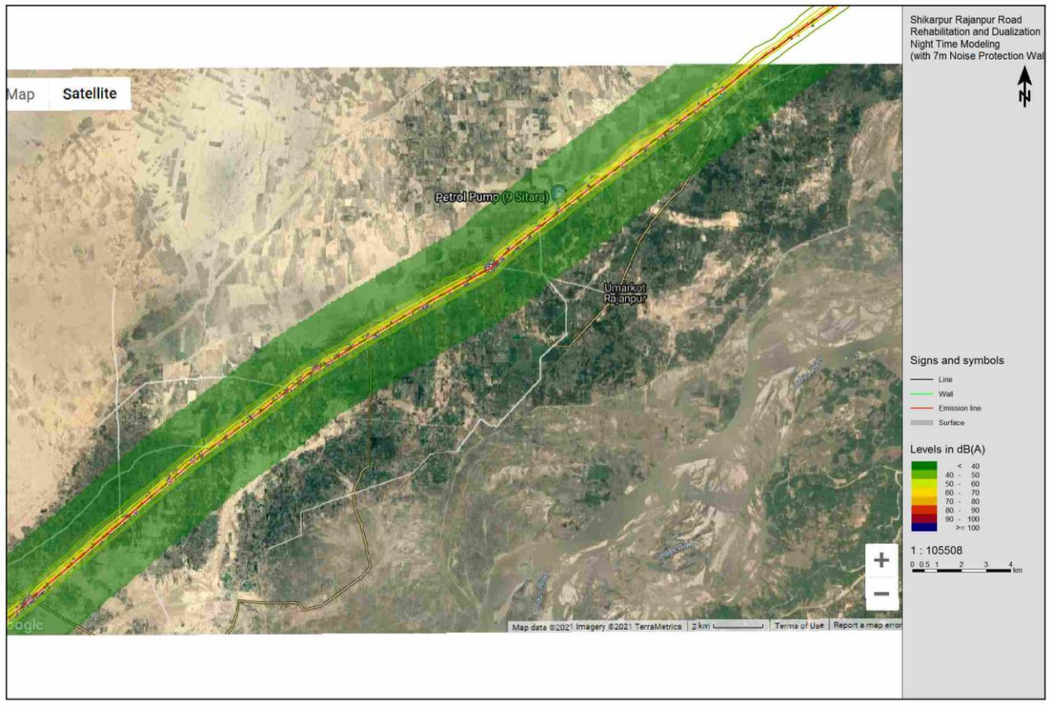

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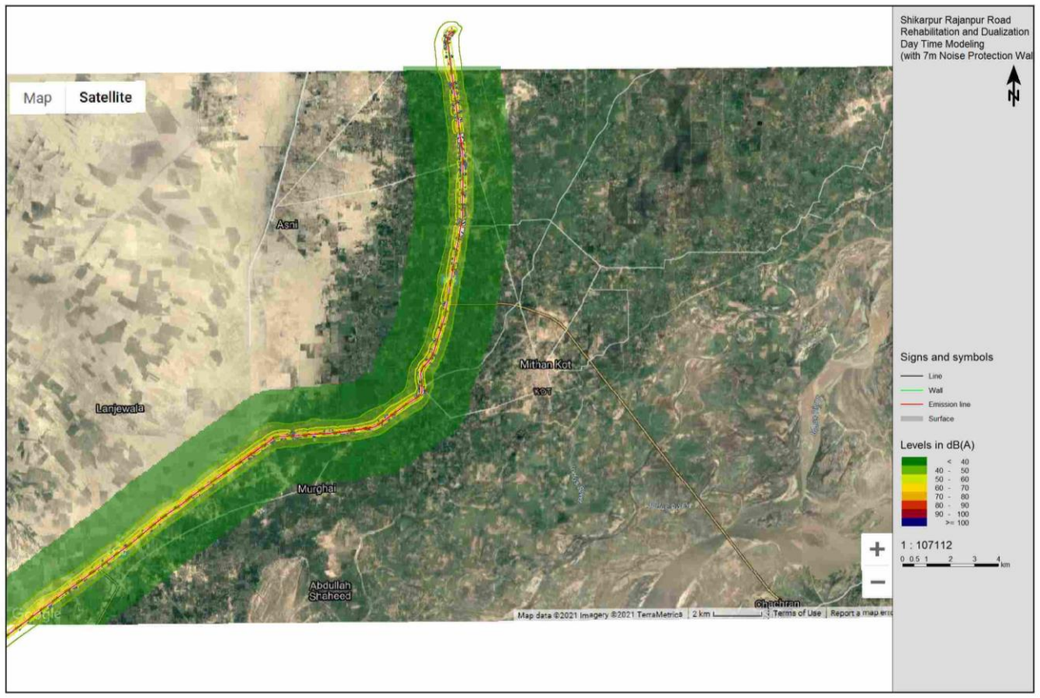

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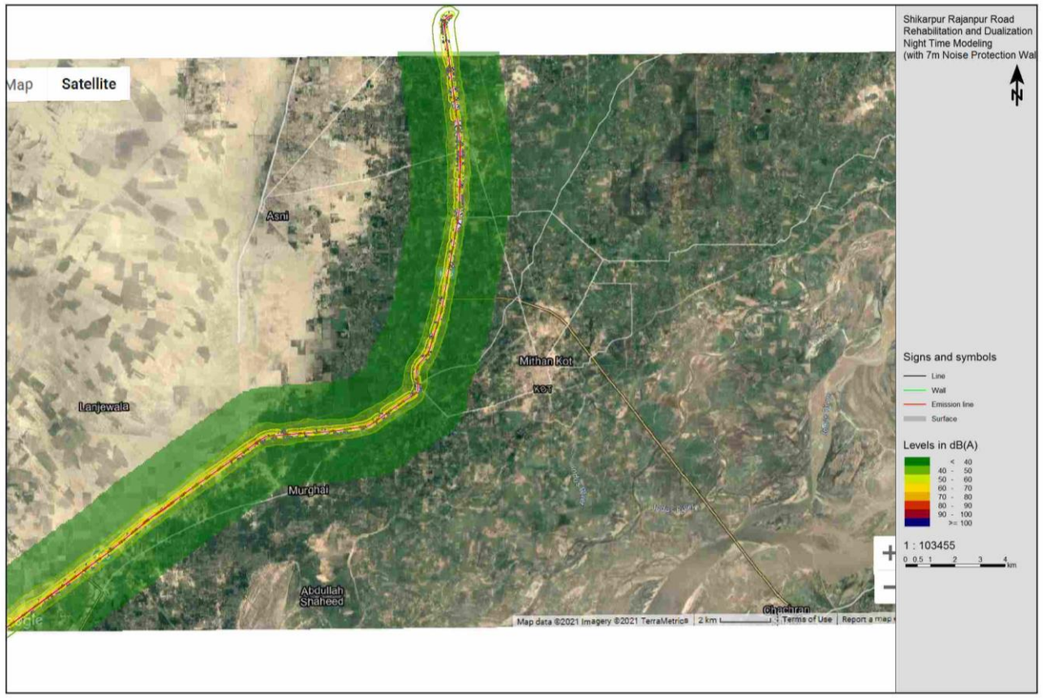
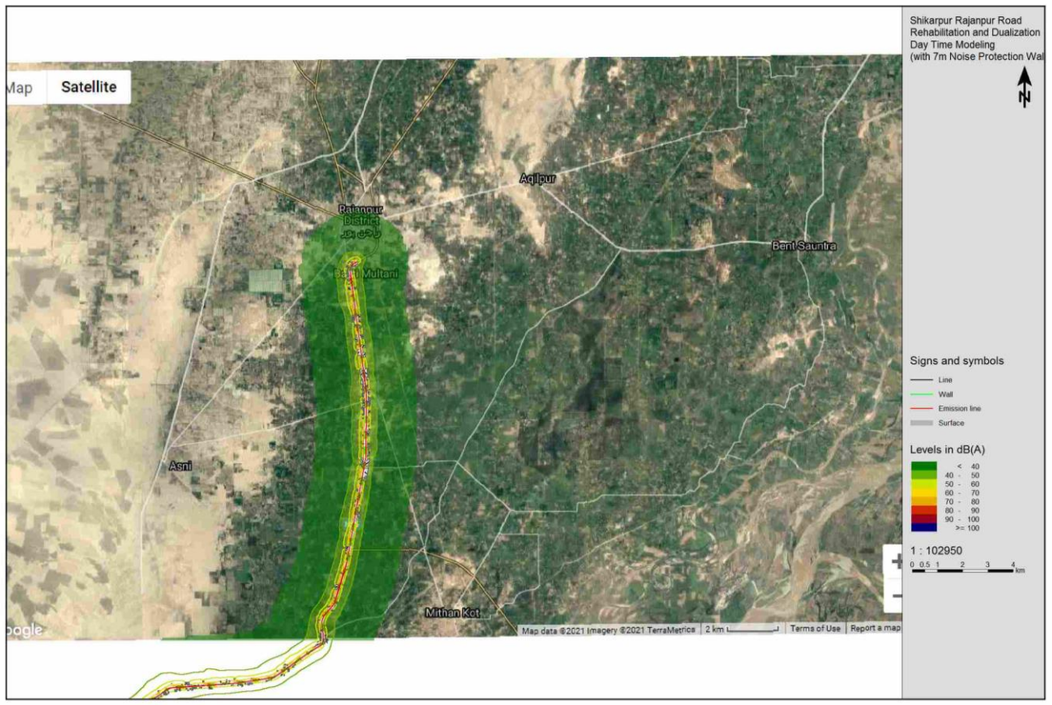
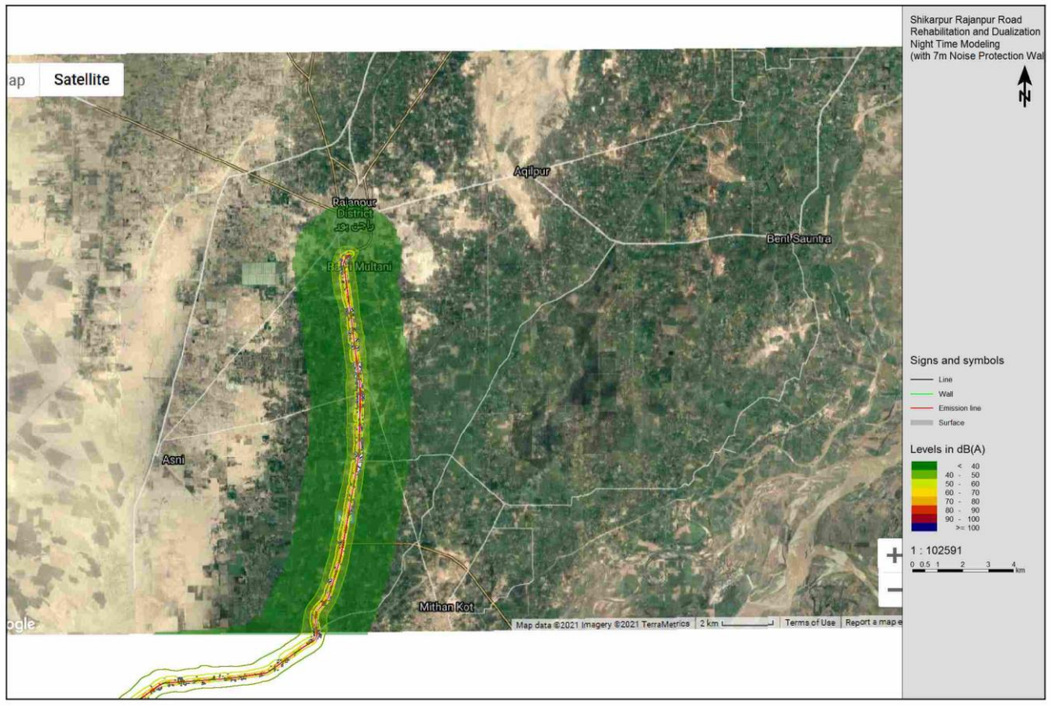
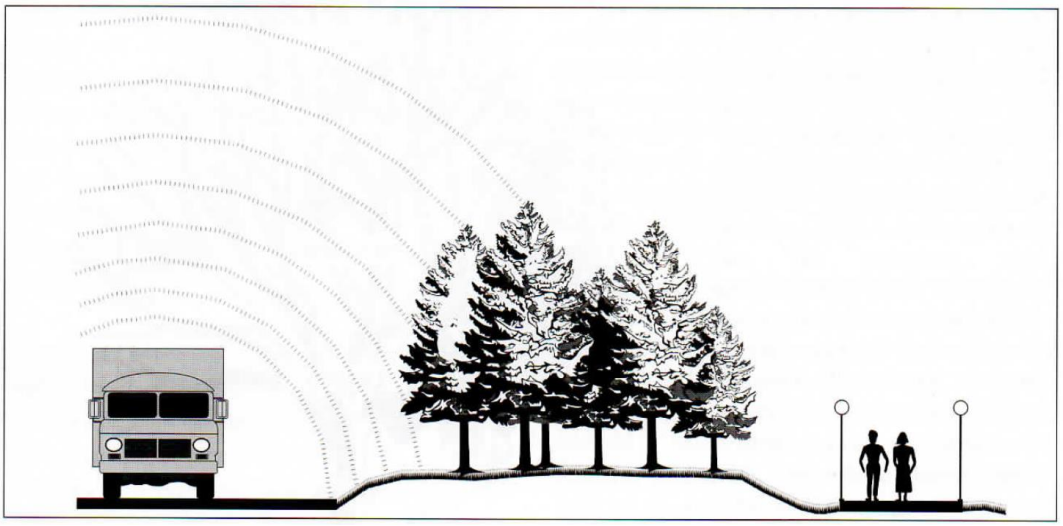






280. Mitigation measures will include:

- A 7m noise wall (also called noise barrier or sound barrier) is proposed for the project to reduce the noise levels at the receptors. Noise walls can be made from many different materials. The most common materials are concrete, brick, earthwork, metal (steel or aluminum), wood, or synthetic material such as plastics, PVC, or acrylic. In urban setting of the Project, transparent wall with metal supports are recommended;
- There is practical limit to height of noise walls. Free-standing noise walls reported in Europe are typically 3-5 m high. A 7-m high wall is relatively rare. Higher walls, up to 20 m are reported, but they need elaborate structural support. Therefore, 7m is considered as the practical limit to long noise walls;
- Research has indicated that trees and shrubs can make a contribution to noise reduction. Usually, comparisons have been made between noise propagated over a grass surface and noise propagated through trees and shrub belts which reveals noise reduction directly due to tree and shrub barriers[22]. A visual barrier between the noise source and the receiver may help to reduce the perception of noise (Source: Grey & Deneke, 1986). A conceptual view of noise reduction due to tree barrier is provided in below figure:



- Provision of adequate noise barriers such as hedges and indigenous tree species or other noise protection walls, etc. will reduce the noise. Further improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate;
- Signs for sensitive zones e.g. health centers / educational institutions etc. to disallow the use of pressure horns;
- Speed limit enforcement and penalties against traffic rules violators;
- Ban on the burning of crop residues such as rice and wheat husk along the road to avoid trees from catching fire and driving hazard; and
- Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate.

7.6.1.3 Wastes/ Hazardous Waste

281. During operation phase, Non-hazardous waste may be generated from road sweepings or small quantities of municipal waste from highway offices. No hazardous

[22] Dobson M. and Ryan J. Trees in Focus: Trees and Shrubs for Noise Control.

waste is expected to generate in operation phase except during road maintenance works. Transportation of hazardous waste is also expected and must be regulated.

282. Mitigation measures will include:

- Solid Waste generated from offices will be properly disposed off through local solid waste management system;
- Proper labelling of containers, including the identification and quantity of the contents, hazard contact information of containers will be checked at toll plazas;
- Providing the necessary means for emergency response on call 24 hours/day;
- Management of hazardous waste during road maintenance works will be similar as given for construction phase.

7.6.2 Ecological Environment

7.6.2.1 Biodiversity Conservation and Natural Resource Management

283. **Flora:** No negative impacts are envisaged on the flora of the area during the operational phase. However, improper maintenance of the saplings planted against the trees cut for the proposed Project may adversely affect the growth of those saplings which were planted to improve the environmental aesthetics of the project area. Raising of new trees shall render a positive impact on the flora of the area and will also cause a positive impact on the landscape of the area, which shall be of permanent in nature.

284. An awareness campaign targeted on the neighbourhood farmers will be run to popularize the planting of trees; and Organic manuring will be encouraged to minimize the use of pesticides.

285. **Fauna:** The Project activities will bring some negative impacts on the fauna of the project area such as the uneasiness of movement and increased probability of accidents, if the animals/ livestock approach the proposed Dual carriageway. This impact is permanent and minor negative in nature. Noise and air pollution caused due to heavy and fast traffic on Dual carriageway, shall be a source of disturbance to the fauna of the area and especially to the avifauna of the area, which is another minor negative impact.

286. Raising of dense plantation of shady trees on both sides of the Dual carriageway shall provide resting, nestling and roosting habitat to the fauna and especially to the avifauna which is a major positive impact.

287. Provision of underpasses and cattle creeps will facilitate animal movement across the road.

7.6.3 Social Environment

7.6.3.1 Road Safety

288. Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move.

289. Mitigation measure will include strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic) and enforcement of penalties for the violators.

7.6.3.2 Less Wear and Tear of Vehicles

290. During the operation of the proposed Dual carriageway, lesser wear and tear of the vehicles will occur and it will also result in lesser fuel consumption and decrease in operating cost. This impact is permanent and has a major positive impact.

7.6.3.3 Community Development

291. Improved communication infrastructure will promote new business opportunities. In addition, such an activity will also increase the land value that will benefit the local residents. This impact will be permanent and major positive in nature.

7.6.3.4 Accessibility

292. The road users will have difficulty to access the mosques, schools and land across the road, which was relatively easier with two lanes road. It may cause accident and may lead to serious implications. This impact is major negative and permanent.

293. Mitigation measures include facilitation of the public with underpasses and bridges to connect to various communities in the area as mentioned in **Table 4.1.**

SECTION 8: ENVIRONMENTAL MANAGEMENT PLAN

8.1 Environmental Management

294. The objective of the Environmental Management Plan (EMP) is to address all the major environmental issues and provide framework for the implementation of the proposed mitigation measures during the preconstruction, construction and operational phases of the proposed project. The proper implementation of the EMP will ensure that all the adverse environmental impacts identified in the IEE are adequately mitigated, either totally prevented or minimized to an acceptable level and required actions to achieve those objectives are successfully adopted by the concerned institutions or regulatory agencies. The implementation of EMP should be carefully coordinated with the design and construction program of the project to ensure that relevant mitigation measures are implemented at the appropriate stage and that adequate resources are properly allocated to achieve the desired results.

295. The Contractor will be responsible for the implementation of the proposed Project under the direction of "Supervision Consultant (SC)" and NHA (EALS). The Contractor should be bound to follow the provisions of the contract documents especially about environmental protection and apply good construction techniques and methodology without damaging the environment.

296. Obligation of the contractor, to safeguard, mitigate adverse impacts and rehabilitate the environment should be addressed through environmental provisions in the FIDIC conditions of contract for construction, MDB harmonized addition- June 2010 and special clauses included in the contract related to environment. FIDIC clause 4.18 (protection of environment), 4.8 (safety procedures), 6.4 (labor laws), 16.3 (cessation of work/ remedial work), 2.3 b (employers' personnel), 4.21 (progress report) are important in this regard.

8.2 Institutional Responsibilities

297. NHA (EALS) have separate environment section headed by Director Environment to overall mange the environment related tasks and to guide project preparation, project construction, operation and maintenance work. However, overall responsibility for implementation of EMP falls to the PIU for the Project

298. Institutions involved for the executing of EMP would involve: EALS (NHA), Environmental Unit of PIU headed by (GM) CAREC-MMF, Environmental Unit of CSC, Environmental Unit of Contractor, Independent environmental monitoring contractor and EPA Punjab and Sindh. The institutional framework is shown in **Figure 8.1**.

8.2.1 EALS (NHA)

299. The responsibilities of EALS, NHA as a borrower include:

- Ensuring the Implementation of agreed technical and institutional measures specified in safeguard management plans
- Monitoring and evaluation of environmental and social impacts and risks associated with the project
- Review of the safeguard monitoring reports submitted by PIU on the status of the implementation of agreed actions
- Ensuring the Project Implementation Unit (PIU) submits regular project progress reports to the ADB, with separate safeguards chapter
- Safeguard report is prepared based on the inputs by contractors and project consultants and PIU dedicated staff's observations
- Impose penalty and/ or require corrective action in case of non-compliance

- Semiannual reporting to ADB, or more frequently if new issues emerge, or sensitivities occur
- Reporting to EPA as per requirement of NOC
- In case the project is not incompliance with environment and social safeguard GM CAREC, can suspend work and employee the third parties to correct noncompliance.

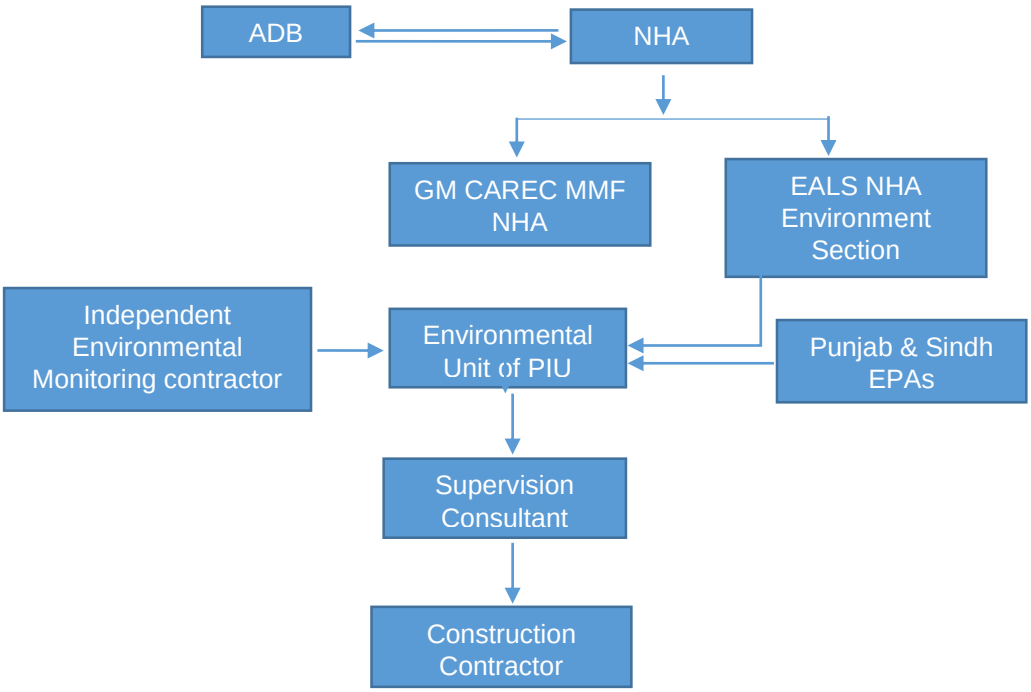


Figure8.1: Institutional framework for environmental management

8.2.2 Project Implementation Unit (PIU)

300. PIU will be responsible for:

- Depending on availability of environmental expertise in NHA, hiring of environmental specialists
- Ensuring environmental provisions and expertise are covered by supervision consultancy and construction contract
- Supervision and monitoring the implementation of EMP
- Establish regular reporting by supervision consultant and contractor and environmental safeguard as a part of progress report
- Undertaking regular visits to project sites and report to the Bank on the status and any new / unexpected issues
- Follow up with contractors and consultants on environmental compliance and ensure enforcement
- Submission of semi – annual monitoring reports to NHA EALS for review and onward submission to ADB

8.2.3 Asian Development Bank

301. Bank team is responsible for:

- Reviewing the status of implementation of EMP
- Assisting and guiding the Borrower in addressing the issues identified by the supervision
- Conducting periodic site visits and supervision mission for detailed review for projects with significant impacts

- Reviewing of environmental management plan
- The need to improve Borrower's capacity
- Reviewing the periodic safeguard monitoring reports to ensure compliance as planned
- Resolution of grievances, especially, directly received to ADB

8.2.4 Construction Supervision Consultant (CSC)

302. CSC would be responsible for:

- Review and endorsement of SSEMP, and giving the input, if required, to assist contractor
- Review of bi annual environmental monitoring reports by the third-party contractor (Labs)
- Prepare corrective action plan in case of non-compliance
- Review EMP every six month and updating, if required
- Supervision of implementations of EMP and supporting contractor for environmental compliance
- Checking and endorsement of environmental part of method statements
- Preparing the training material and assist or providing the training
- Responding to environmental incidents reported
- Setting Environmental Management and Monitoring System (EMMS) and insurance EMMS in place
- Review and assistance in preparation of bi annual report and all other reports
- Grant approval for all facilities (establishment of camp, asphalt and batching plants, borrow areas) in light of the EMP requirements.
- The CSC's Environment Officer must be hired before construction starts so that the SSEMP is prepared in time

8.2.5 Contractor

303. The contractor will be responsible for:

- Implementation of environmental mitigation measures at preconstruction and construction stage
- Preparation of CEMP describing the mechanism to comply with the EMP and get it approved from CSC Environmental unit and PIU Environmental unit prior to mobilization
- Frequent monitoring and reporting of compliance of EMP
- The Contractor's Environment Officer must be hired before construction starts so that the SSEMP is prepared in time.

8.2.6 Third Party Environmental Monitoring Contractors

304. Environmental monitoring contractor will be responsible to carry out testing for various environmental attributes including air, noise, and water quality on behalf of PIU**.** The monitoring would be carried out prior to start of work to establish the baseline conditions and the frequent monitoring as specified in the EMP during the construction.

8.3 Staffing Requirement

305. Environmental staff will be required by Contractor, CSC and PIU. GM CAREC will approve the hiring of environmental staff to ensure the hiring of competent staff. Following functionaries with the indicative level of effort (LoE) will be involved in the implementation of EMP during construction:

GM CAREC (Head of PIU)

Project Director (Timely implementation of Project)

EALS NHA

- Director Environment

Environmental Unit of PIU

- Environmental safeguard expert full time
- One additional staff member for each section full time

Environmental unit of CSC

- Team leader (International Environmental Specialist for 4 months on intermittent basis)
- Environmental Specialist for each section (03 Nationals expert full time)

Contractor

- Environment Specialist (Full time)
- HSE Specialist (Full time)
- Environmental Technician (03) (Full time)
- Environmental Management Training Consultant (may be through CSC environment unit or by independent through Lump Sum Contract)

8.4 Reporting and Feedback Mechanism

306. The contractor's environmental unit will manage the daily activities to be conducted in compliance with the EMP and will be responsible for weekly reporting while CSC would be responsible for monthly inspecting and monitoring report. CSC will draft the semiannual environmental monitoring report and finalize with the PIU. PIU will submit that report to EALS for onward submission to ADB (see Table). EALS would also submit the periodic reports to EPA as per conditions of environmental approval.

Table 8.1: Reporting Requirements

Reporting responsibility	Reporting Requirement	Report submitted to
Contractor	Weekly compliance report	CSC
Construction Supervision Consultant (CSC)	Monthly Environmental Compliance Report Semi Annual Environmental Monitoring Report	PIU
PIU	Semi Annual reports	EALS NHA
EALS NHA	Final Environmental report after completion of defect liability period.	ADB, EPA

8.5 Environmental Technical Assistance and Training Plan

307. To raise the level of professional and managerial staff, there is a need to upgrade their knowledge in the related areas. Director Environment (EALS) should play a key role in this respect and arrange the training programs.

308. Training would be required to all the three agencies including contractor, CSC, PIU, to build their capacity with the following objectives:

- Full understanding of the EMP
- Understanding of their responsibilities
- Enhance the capability to undertake their responsibilities

309. There will be three levels of trainings **(Table: 8.2)** and CSS will maintain the training register.

Table 8.2: Training of Institutions involved in Environmental Compliance

Level of Training	Responsibility	Contents
Project Induction	CSC	Overview of environmental policy of Project, Environmental approval conditions, response to environment incidents, PPEs, Environmental receptors, environmental conformances. Sanitation and Healthcare
Tool Box talks	Filed level by Contractor	Environmental aspect of managing waterways crossings, soil erosion and sedimentation control, dust & noise control, wild life protection, safety of workers, waste management etc.
Capacity Building of NHA, PIU, Contractor, and CSC national staff	International consultant to develop the training material and conduction	ADB safeguard Policy. Environmental laws, Monitoring & Evaluation of EMP, EHS guidelines, Standards, Institutional responsibilities, reporting & feed back

8.6 Summary of Environmental Management Plan

310. **Table 8.3** provides the framework for the implementation of environmental management plan during different phases of the proposed project. It portrays impacts, mitigations measures and the responsible organizations for the implementation of the mitigation measures. Where additional costs are required for any mitigation measure it is given in the table:

Table 8.3 Environmental Management Plan

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
Pre- Construction						
Dust and Noise	Entire Road	Consultation with representatives from villages, mosques, schools for the timings to avoid significant impact	Prior to construction Activity	Included in Construction contract cost	Contractor	NHA/ CSC
Flooding	All bridges and culverts especially bridge on Canal emerging from Guddo barrage near Kashmore	All bridges and culverts to be designed not less than the current the current capacity	Prior to construction Activity	Included in Construction contract cost	Design team	NHA
CEMP	Entire road	CEMP Need to be prepared	Prior to construction Activity	Included in Construction contract cost	Contractor	NHA/CSC
Biodiversity Conservation	Entire road	Identification and labelling of tree in RoW to be uprooted and obtain necessary approval	Prior to construction Activity	Included in Construction contract cost	Contractor	
Disposal of excavation spoil and waste pavement	Proposed Disposal Sites	Before starting excavation work and removal of pavement seek approval from CSC of disposal sites meeting the following criteria: Located at distance of 50 m from watercourses No chances for the sedimentation and blockage of nearby water courses for example due to slope failure Not causing damage to crops/ productive area Prefer the sites needs to be improved by filling such as for school, universities, play grounds etc.	Prior to construction Activity	Included in Construction contract cost	Contractor CSC	NHA

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
Procurement of material from illegal source	Source of construction material	Contractor will ensure that construction material such as sand, gravel, aggregates, will be obtained from approved quarries. NHA also listed the approved quarries in provinces in Composite Schedule of Rates (CSR 2014).	Prior to construction Activity			
Identification of site for construction camps, asphalt & batching plant and crushers		Follow the following criteria for selection of sites: Site must be 0.5 km away from the localities & cultural sites and 100m away from the existing road; Asphalt, batching and crushing plants must be installed in the downwind direction of residential areas.	Prior to construction at each section		Contractor	NHA/ CSC
Land Acquisition	Throughout the alignment	Mitigation measures will involve careful alignment and route selection by the designer to minimize the impact; and Adequate budget will be provided in the Project cost for the compensation to the affected people as per Land Acquisition Act, 1894 and ADB Safeguard Policy Statement 2009.	Prior to Constructio n	PKR 2200 M Given in PC-1	Design team	NHA (EALS)
Alignment selection for Bypass		Avoid sharp curves/turns in the design; Assure minimum tree cutting and vegetation clearance during alignment selection; and Selection of the route with minimum dislocation/ resettlement of the structures/residents.	Prior to Constructio n	Included in detail design cost	Design team	NHA
Construction Stage						
Air Pollution	Entire road and related facilities particularly	Asphalt plants and batching plants to located at downwind & minimum distance to nearest dwelling of 500 meters and must be equipped with	Throughout construction	PKR 1800, 000/-	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
	sensitive areas as mentioned below: Residential Areas near Shikarpur, Kashmore, Rojhan Rajanpur, Khanpur, Kandhkot, etc. Rural Health Centre near Khanpur and Rojhan Masjid Ali-ul-Murtaza at Kandhkot, Jamia Masjid Qadria near Kashmore and Noorani Masjid near Rajanpur, etc.	controlling devices such as Electrostatic Precipitator (EP), bughouse filters Generators to be equipped with emission controlling devices and well-maintained generator ad machinery Material transport. Dumper trucks carrying earth fill, sand, gravels covered with tarpaulins or other suitable cover Speed limits of 20 km/ hour all kind of vehicles through administrative control and engineering control (signs, bumps, barriers etc.) Debagging of cement in a sheltered area Stockpiles management: Covering/ shading of stock piles and if needed water spraying especially at crusher sites Construction Site management: watering of dusty construction site and material handling routs and demolition work such as trimming activities by using breaker Clean Up: contractor will immediately clean up dusty material or mud left on or around the public road such as by tractor mounted vacuum cleaner		For Monitoring Cost for other measures included in contract		
Water Quality and Quantity	Construction sites adjacent to water bodies and water source for construction e.g. Nullah Crossing (Meeral), Begari Canal Crossing (Kandhkot), Nearby	Don't disturb the streams recharging the community water, or used for community Consult with residents to identify well or water source within 50 m project road and demarcation to avoid the damage by machinery To limit the spill of material into water bodies no construction material including soil, spoil,	Throughout construction	PKR 270,000/- For surface water quality Cost for other measures included in contract	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
	Water Pond (Kandhkot and Bakshapur), Pat Feeder Distributary Crossing (Kashmore), Pat Feeder Canal Crossing (Kashmore), Matwah Distributary Crossing near Rojhan and Kadra Canal Crossing Near Kot Mithan etc.	aggregates, chemicals or other material will be stored within 50 meter of the water body				
Water Pollution Control	Construction camps and active sites especially near sensitive receptors mentioned in water quality and quantity section	Wastewater from workshops: 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; Sanitary wastewater: Sanitary wastewater should be treated through buried septic tank and the capacity of the septic tank should be three times than the generated effluent per day. Manholes onsite should be covered and sealed. Guidelines for sanitary wastewater from IFC/ World Bank may be consulted. Public Roads: around the site entrance and site hoardings should be kept clean and free of muddy water Road drainage: provision of retention pound with cascading to drain the road surface runoff.	Throughout construction	PKR 540,000/- For wastewater testing Cost for other measures included in contract	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		Water ponding at Batching Plants: Stored water for batching plants should be used or drained during shut of as this will cause water ponding leaving the scum at the top serving as a habitat for mosquitoes and vectors. Canal Water: construction debris should not find its way in to canals and washing machinery with the canal water should be prohibited.				
Noise Control	Key noise receptor along the road alignment particularly sensitive areas as mentioned below: Residential Areas near Shikarpur, Kashmore, Rojhan Rajanpur, Khanpur, Kandhkot, etc. Rural Health Centre near Khanpur and Rojhan Masjid Ali-ul-Murtaza at Kandhkot, Jamia Masjid Qadria near Kashmore and Noorani Masjid near Rajanpur, etc.	Source Control: well-maintained machinery with exhaust system, enclosures for stationary equipment and operate generators, compressors with door closed, reduce speed limits, turning off or throttled down idle equipment, Timings: Adjust operation timings between 8 a.m. to 6 p.m. Notification: Provide advance warning to community on timings of noisy activities and strictly comply that GRM: establish the mechanism to handle the complaints from communities, maintain register for complaints on sites, and seek suggestions from community	Throughout construction	PKR 576,000/- For noise monitoring	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
Waste Management	Entire Road, camp sites, Workshops, Related facilities	Waste Minimization: Procure the material which have less packaging and the quantity required, recycle and reuse of construction waste material as fill material, concrete meeting grading requirements for drainage layer etc. Good housekeeping practices. Storage and Containments: Provided containers in appropriate size and numbers for construction and hazardous waste Chemical& hazardous Waste: Proper storage and labelling according to hazardous substance rule 2003. Disposed of by licensed contractor, provision of drip trays for oil drum, clean up the spill immediately, store on hardened surface, proper storage of oil rags, Used Tires: Used tires to be sold out to licensed contractor to avoid becoming the habitat for mosquitoes, Spoil and inert Waste: Spoils and inert waste to be disposed of on approved site by CSC in accordance with aggregate. Spoil will not be disposed of to disturb vegetation, rehabilitate and restore the spoil disposal site with agreed plan Municipal Waste: provided the bins to worker for recycling of the MSW and the food waste should not be stored for more than two days and disposed of the nearest dumping site through TMA.	Throughout construction	Included In construction cost	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		Administration: Prohibit the burning of waste & spill from containers and ban the entry of scavengers				
Storage of Chemicals and dangerous goods	Hazardous Material Storage Site	Access control: Locking of hazardous material storage place and clear instruction on the door based on MSDS and applicable laws. Spill control: secondary containment for oil spillage (drip trays), provision of spill kit/ sand/ saw dust/ for absorbing spill Surface: Storage on hardened/ non permeable surfaces	Throughout construction	Included In construction cost	Contractor	PIU/ CSC
Fire Prevention/ Emergency Preparedness	Active Sites, Workshops, Campsites and related facilities	Fire Extinguishers: Placement and maintenance of fire extinguishers with trainings to use them Accident/ Incident Reporting: system should be in place and reviewed time to time for corrective & preventive actions. Escape Route: Escape route and gathering area should be mapped, displayed, demarcated and not blocked/ obstructed. Emergency Contact Detail: Contact detail for Fire department along with emergency services such as 1122, Edhi Ambulance services, bomb disposal team, police etc. with in-house emergency team should be displayed	Throughout construction	Included In construction cost	Contractor	PIU/ CSC
Protection of Cultural and religious sites	Near the cultural and religious sites	Access: Access for the religious site should not be disturbed due to construction activities as there are many mosques along the road and community should be consulted for extra measures during prayer timings.	Throughout construction	Included I n construction cost	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		No listed or protected cultural heritage site is being affected; however, there are some in the vicinity, the access of the locals and visitors coming from far should not be blocked.				
Resource Conservation		Water Conservation: through recycling for dust suppression, prevention of pipe leakages and wastages,	Throughout construction	Included In construction cost	Contractor	PIU/ CSC
Energy Conservation		Energy Conservation: adopting energy conservation best practices, shutting of diesel power plants and equipment while not in use, locating the raw material source to the minimum distance, use gas cylinder to avoid timber, control fuel spill and leakages through piping system, Raw material: Prevent the deterioration and wastage by covering, separation of different raw materials, and regular quantification by track record	Throughout construction	Included In construction cost	Contractor	PIU/ CSC
Occupational Health & Safety	Worksites, Batching plants & Asphalt Plants, Quarry Area, campsite, subcontractor campsite	Workplace Structure: campsites, workshops, semi-finished product area etc. should be structurally stable and to meet severe climatic conditions Lighting: workplace should be properly illuminated with lightening arrangement at place (Minimum Workplace illumination Intensity by IFC/ WB) Safe work Instruction: workplace safety instruction should be at place of work/ workstation according to nature of work Signboards: signboards must be at place for electrical devices, compressors material, emergency exit, pipe color coding, labels according to international standards	Throughout construction	Included In construction cost	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		Electrical Hazard: All electrical cords, cables and hand power tool free from fray or exposed cords and protected from traffic by shielding or suspending above traffic areas. There should be approach zone established around or under high voltage power lines. Drinking and Potable Water: provision of clean drinking water to both direct and contractual labor at all sites in the form of dispensers or in coolers. Potable water must be available in good quantity and quality for all the workers Eating Area: Clean eating area should be available, with gas cylinders, stoves for both direct and contractual labor Lavatories & Showers: There should be sufficient lavatories and showers with reasonable quantity of water. Waste water must be discharged through septic tanks First Aid: provision of first aid kit and arrangements for medical practitioner and ambulance and emergency numbers displayed Air supply and temperature: fan/ cooler/ heaters should be available for all the works according to the weather conditions and nature of work Safe Access: safe access to workers for work and mean of egress in case of emergency and restricted access for trespassers Communication & Trainings: provide OHS training, visitor orientation, New task employee training, Area signage, labeling of equipment, ad communicate hazard codes				

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		Physical hazards: revolving shift of workers in case of repetitive motion/annual lifting, elimination of hazards due to working at height, slip & falls, struck by objects and moving machinery by using of scaffolding, full body harness for height more than 2-meter, warning taps and barricading Chemical hazards: oil/ chemical spill control and capping of contaminated land with at least 1-meter clean soil Biological hazards: Avoid the unhygienic conditions to fight with epidemic diseases such as dengue fever etc. PPEs: workers should have available and trained to use the PPEs for head protection, eye protection, face protection, body protection, feet protection, hand protection, based on nature of work. For wielding/ hot work welder goggles/ full face eye shield must be provided with fire extinguisher at place Fuel Storage Area: Fuel storage area should be covered and tanks must be buried or placed on built frame				
Community Prevention, Health and Safety	Active and abandoned site, campsite, Batching and Asphalt Plants	Disease Control: Avoid water poundings creating habitat for mosquitoes breeding, safe measure against vector born/ communicable disease among workers and communities Access restriction: No trespassing and access restriction by combination of institutional and administration control by signage and fencing, locking of hazardous material, demarcating/ fencing of restricted area, avoid interaction of	Throughout construction	Included In construction cost	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		pedestrian and machinery, No grazing animals onsite Load on Infrastructure: avoid use of community road for use of heavy vehicles and repair the damage caused immediately, the use of sewerage system, electricity and gas should not put extra load on community such as load shedding and boiling of gutters Water quality and quantity: Don't disturb the quality and quantity of community water by over extraction and contamination of wells, Uncovered Openings and Abandoned Structures: Cover the openings and trenches creating fall hazards Traffic control: awareness and campaign against road related accidents, flagman, traffic diversion plan on print and live media and signage &illumination, don't leave partially demolished structures GRM: Effective GRM should be at place to resolve grievances of community Business loss: Avoid the business loss by provision of access to exiting gas stations and other commercial and industrial businesses.				
Socioeconomic Issues		Avoid the incidence of conflicts of transitive workforce with community, damage to crops and community structures, cutting the links between communities. Hiring of locals for labors and short contracts such as for plantation, transportation of material etc. Avoid any activity causing access restriction and pay the judicial payments for	Throughout construction	Included In construction cost	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		leased area and restoration of the leased area to original shape during the demobilization.				
Climate Change		Effects of climate change: Pavement design and material selection taking in to account changes climate variable such as temperature, precipitation and soil moisture. Adequate drainage structures to be resistant to extreme flooding events Effects on Climate: Measures to reduce GHG emissions and fugitive dust. Controlling devices for asphalt and batching plants. avoid wastage of raw material, least material transport distance, green infra-structure including landscape, eye lands, trees	Throughout construction	Included In construction cost	Contractor	PIU/ CSC
Protection of Flora and Fauna		Tree Identification: label all the trees which need to be removed Good Practices: For each removed tree, compensatory trees need to be replanted taking in to account some trees would die during initial growing period; Existing nurseries along the road may be contacted for sapling; otherwise, nurseries may be developed near to alignment through local contractors; The community shall be consulted in each community for the type of trees and appropriate season; Sapling Aftercare: engage persons from the community to aftercare the sapling particularly in dry season. The plantation should be started during the construction- not all at the end of construction phase	Throughout construction	Included In construction cost	Contractor	PIU/ CSC

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
Ecological Displacement		Prevention of displacement of valuable flora from the compensatory land: The land given in compensation to acquired land should not be in area with natural vegetation. The land should be from already cleared off agriculture area.	Throughout construction	-	Contractor	PIU/ CSC
Traffic Management	Throughout construction site	Traffic Management Plan: A traffic diversion plan will be set out how the traffic on road and access to highway would be maintained with proper signage. In case of diversions, the speed limits and signs should be mentioned well ahead to guide the road users resulting in smooth traffic flow Speed Limit: At construction the maximum allowable limit should not exceed than 20 km/hr.	Throughout construction	Included In construction cost	Contractor	PIU/ CSC
Operation Phase						
Noise Levels & Air Pollution	Main Entry Points/ Interchanges Near noise sensitive receptors as mentioned above in construction phase	Emission standards: Vehicle with black smoke from exhaust should not allow to enter the road. Vehicle must meet the emission standard of EPA	During operation		NHA	NHA
Road Maintenance & Drainage	Throughout the alignment	Drainage Management: Monitor and maintain drainage structures and ditches including culverts. Clean out culverts and side channels when they begin to fill with sediment and lose their effectiveness; Ensure oil and debris should not reach nearby water bodies by using screens, sediment traps, and oil sumps and retrofitting barriers	During operation		NHA	NHA

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		Potholes and mud holes: Fill mud holes and potholes with good quality gravel; remove fallen trees and limbs obscuring roadways; and use water from settling basins and retention ponds for road maintenance.				
Accidents of hazardous material	Throughout the alignment	In case of any accidental spill, there should be a relevant department in NHA dealing with it in accordance with emergency plan; and A road administration department should be established after the completion of the project which will administrate the transport of hazardous substances.	During operation		NHA/Highway police	NHA
Use and maintenance of equipment	Throughout the alignment	Install concrete pads, drains, and oil/water pits in areas where vehicle and equipment maintenance and fueling will occur regularly along the highway	During operation		NHA /Highway police	NHA
Collusion with pedestrian & animals	Throughout the alignment	Collusion with pedestrians: Pedestrian bridges would be provided and barriers at medians would be provided in urban areas to restrict the pedestrian to come on the road Animal vehicle Collusions: Assigning the animal crossing areas and provision of speed reduction devices with warning signs	During operation		NHA	NHA
Road Safety	Throughout the alignment	Enforcement of speed limits, installation of speed guns and speed checking by motorway police with enforcement of penalties for the violators.	During operation		Highway Police	NHA
Embankment & ROW protection	Throughout the alignment	Road Inspection: regular inspection of road and ancillary structure	During operation		Maintenance department of NHA	NHA

Issue	Location	Mitigation Measure	Timings	Estimated Cost	Implemented by	Supervised/ Approved by
		Prevent plantation within 5 meters of the outer edge of the road shoulder and/ or within 5 meters of the base of slope Prevent the construction of any permanent or temporary structure within 10 meters of the outer edge of the unpaved shoulder and/or within 10 m of the base of any embankment Implement the NHA bylaws for permitting system to protect and manage land use within legal ROW (Regulatory framework and SOPs for preservation and commercial use of ROW 2004)				

8.7 Environmental Monitoring Requirements

311. The Environmental Mitigation and Monitoring Plan provides the framework for the implementation of the mitigating measures and monitoring during the preconstruction, construction and operation phases of the proposed project **(Table 8.4)** whereas **Table 8.5** gives estimate for monitoring of the environmental quality parameters during construction phases of the proposed project.

8.7.1 Pre-construction Ambient Environment Monitoring

312. Environmental Monitoring locations have been identified for Ambient Air, Noise and Water Quality monitoring. The criteria for selection of monitoring locations along with map showing environmental monitoring and sampling points are attached in Section 5.1.3. Environmental monitoring has been conducted in July, 2020 and results of ambient air, noise monitoring and water testing are provided as **Annex III**.

Table 8.4: Ambient Environment Baseline Sampling

Item	Sampling Parameter
Surface Water	Temperature, pH, TDS, BOD, COD, Phenols, Chloride, Copper, Lead, Manganese, Sulphate, Zinc, Silver, Boron, Barium, Iron
Air Quality	CO, NOx, SOx, $PM_{10,}$
Noise	Equivalent Noise Levels in dB (A)
Drinking Water	Color, pH, Turbidity, Total Hardness, TDS, Antimony, Barium, Chloride, Fluoride, Nitrate, Nitrite, Odor & Taste, Arsenic, Total Coliforms, Fecal Coli forms (E.Coli).

Table 8.5: Environmental Monitoring Plan

Environmental Control	Location	Means of Monitoring	Frequency	Responsibility	
				Implementation	Monitoring
Preconstruction – Before Site Preparation					
Initial Community Meetings	Along the Highway & Ancillary sites areas	Method: Consultation & observations Parameters: Consult village leaders, communities, affected people and observe the requirement for signboards required for contract details, contacts of PIU and GRM details	Before site preparation and as required	Contractor	CSC PIU
CEMP by Contractor		Visual checks CSC Records	Before site preparation	Contractor	CSC PIU
Contractor coordinates with Utility Companies	Affected sites	NOCs, Affected communities Interviews	As required Before site preparation	Contractor	CSC PIU
Tree Removal		Labeling of trees to be uprooted- only necessary NOC if required	Before site preparation	Contractor	CSC PIU
Preconstruction – Baseline Monitoring (Project Specific)					
Air Quality	Key Sensitive receptors along the corridor	Method: establish baseline conditions by measuring criteria pollutants Duration: 24 hours continuous monitoring	Once before site Preparation	Contractor will hire an independent certified lab	PIU/ CSC
Water Quality and Quantity	500 meters upstream and 500 meters downstream of major water body crossings	Method: establish baseline conditions Parameters: Temperature, pH, TDS, BOD, COD, Phenols, Chloride, Copper, Lead, Manganese, Sulphate, Zinc, Silver, Boron, Barium, Iron	Once before site preparation	-do-	PIU/ CSC
Noise	Key Noise Sensitive Receptor	Method: Establish project specific baseline conditions at key Noise receptors inside and outside for equivalent noise levels dB (A). Duration: 24 hours continuous monitoring	Once before site Preparation	-do-	PIU/ CSC
Construction Stage – Impact Offset					

Environmental Control	Location	Means of Monitoring	Frequency	Responsibility	
				Implementation	Monitoring
Community Discussion	Communities	Minutes	Every three months	Contractor	PIU/ CSC
Interview with affected people	Where required along the entire strip	Non-Compliance Notices (if any) to the Contractor by CSC after consultation	When required or quarterly	CSC	PIU
Site Preparation & Vegetation Clearance	Construction Corridor (All along the highway)	Visual inspection of loss of vegetation, soil erosion & instability, surface water pollution	Daily or Weekly when required	Contractor	PIU/CSC
Erosion Control	Side slopes of embankments and Stockpiles	Visual inspection of: Occurrence of erosion Drainage arrangements Landscaping & plantation Covered stockpile and dust cover on trucks Complaints log Interviews	At the end of filling activity	Contractor	PIU/CSC
Operation of Borrow and Quarry site	Barrow pits Quarry Area	Visual inspections of: Quarry sites/ borrow areas for change in landscape and creation of water ponds. Fertile layer conservation Photographs (area specified for borrow pits) Complaints and interview with nearby communities about blasting effects on buildings and movement of heavy machinery on public roads	Once before operation for photographs and then on monthly basis	Contractor	PIU/CSC
Material Supply	Material Supply Sites	Inspection of possession of: official approval or valid operating license of primary suppliers (asphalt, cement, quarry and borrow material) Haulage distance Recycling/ reuse	Before the agreement for supply of material is finalized.	Contractor	PIU/CSC
Storage and Handling of materials	Material storage yard/Work area and Construction camps	Visual Inspection of Covered storage facilities Iron bar/ cast Iron placement stands	Monthly	Contractor	PIU/CSC

Environmental Control	Location	Means of Monitoring	Frequency	Responsibility	
				Implementation	Monitoring
Traffic Safety	Entire road, Haul roads	Visual inspection of: Signage Safety barriers Flagmen Temporary bypasses Complaints log Accident records Interview	Weekly and as needed	Contractor	PIU/CSC
Air Pollution Control	Active site near sensitive sites and settlements, Storage Yards Asphalt and Batching Plants	Air Quality Monitoring Mobile Lab Duration: 24 hours continuous monitoring Visual inspection of: Fugitive dust Open burning Sprinkling/ dust suppression techniques Truck covering Covered Stockpiles Visual inspection to ensure asphalt plant equipped with dust controlling devices and located >500 m from residential areas. Dark smoke Speed limits Stockpiles covered	Quarterly	Contractor	PIU/CSC
Noise Control	Near the sensitive sites and settlements	Noise meters Duration: 24 hours continuous monitoring	Quarterly	Contractor	PIU/CSC
	Construction sites	Visual inspection of conditions of equipment, Enclosures Generators and compressors operate with door closed	Weekly	Contractor	PIU/CSC
Wastewater Pollution Control	Active site & Campsite	Visual inspection of Septic tanks and untreated discharge of wastewater to storm water (color, litter, foam)	Weekly	Contractor	PIU/CSC

Environmental Control	Location	Means of Monitoring	Frequency	Responsibility	
				Implementation	Monitoring
		Septic Tank testing (BOD, COD, N, P, Oil & Grease) Kitchen water Washing bays Silt removal facilities Covering of manholes Stagnant water at Batching plants & Asphalt plant			
Surface Water Quality	500 meters upstream and 500 meters downstream of major Water body crossings	Water quality monitoring Parameters: TSS, Temperature, BOD, COD, oil & grease, Turbidity, Lead, Zn, Iron, Nitrate, Phosphate	Quarterly during bridge construction	Contractor	PIU/CSC
Drainage & Sedimentations	Entire road, culverts & drains	Visual inspection	Monthly After precipitation	Contractor	PIU/CSC
Fire Prevention	Active site and camp sites	Visual inspection of Fire extinguishers Escape routes Marked assembly area Displaying of emergency contact detail	Weekly and as required	Contractor	PIU/CSC
Climate Change Resilience	Entire Project	Inspection of: Energy conservation Techniques Emission controlling devices Wastage of raw material Leakages of oil, water, fuel Efficient use of machinery Material resistant to extreme weather Least material transport distance Drainage/ high Risk flooding areas, ponds, wetlands Green Infrastructure; eye lands, Trees, landscape,	Monthly	Contractor	PIU/CSC
Resource Conservation	Active site and campsite workshop, filling station	Visual inspection of: Equipment not in use shut off Oil, fuel, water leakages Gas cylinders to avoid timber Wastage of raw materials Recycling/ Reuse	Monthly	Contractor	PIU/CSC

Environmental Control	Location	Means of Monitoring	Frequency	Responsibility	
				Implementation	Monitoring
Storage of Chemicals and Dangerous Goods	Filling area Workshops Store rooms	Visual inspection of: Storage with License conditions Labelling, Sealed containers, Suitable trucks for haulage Chemical spillage Spill kit/sand/ saw dust Secondary containment Locks MSDS Training records	Weekly or as required	Contractor	PIU/CSC
Waste Management	Active Construction site and camp sites, toilet, kitchen, runoff	Visual Inspection of: Clean, tidy, litter free Housekeeping Separate bins/ containers Removal of construction waste Litter, foam in nearby drains Collection Contractor Licensee Oil rags/used tires/contaminated soil Scum over stored water Disposal site Interviews	Daily	Contractor	PIU/CSC
Workers Health & Safety	Worksites Batching & Asphalt Plants Campsite (water quality)	Visual Inspection of: Detours and dust suppression lavatories & shower's water availability Onsite traffic control First aid kit, eyewash station, Medical Practitioner& ambulance Ambience and illumination PPEs issued/ used Barricading Drinking water Testing Eating area Training Records Workplace safety instruction and signboards Pipe color coding Trespassing	Weekly Drinking water quality testing once before start and annually at campsites	Contractor	PIU/CSC

Environmental Control	Location	Means of Monitoring	Frequency	Responsibility	
				Implementation	Monitoring
		Water poundings Fuel storage area- buried tanks Workers behavior			
Community safety	Entire Project Area Barrow pits Quarry Areas Asphalt & batching Plants	Complaints register Traffic related accidents record Traffic Diversions Deterioration of existing roads Water ponding Access restriction to camps Uncovered openings/ open trenches Abandoned structures/ Partially demolished Complaints related to vector born disease Interviews with workers & locals	Monthly	Contractor	PIU/CSC
Protection of Fauna & Flora	In the project area	Visual inspection of: Sheep and grazing animals in campsite Use of timber Crops along corridor Animal Corridors Plantation work	Daily	Contractor	PIU/CSC
Cultural and archeological sites	At work sites or graveyards (if shifting required)	Visual inspection & records	Daily, weekly as required	Contractor	PIU/CSC
Socio-economic Issues	Entire project Area	Visual inspection of existing roads deterioration Utilities related complaints Record of conflict incidents Damage to crops and structures Access restriction Leased areas	Monthly	Contractor	PIU/CSC
Training	Entire Project	Training records Interviews with workers Topics: OHS and Emergency Response, Community information	6-Monthly	Contractor	PIU/ CSC

Environmental Control	Location	Means of Monitoring	Frequency	Responsibility	
				Implementation	Monitoring
Reinstatement of work-related sites, demobilization, Works Contract Signoff & Handover		Visual inspection of: Clear sites Construction waste disposal Site safety Drainage Landscaping Comparing ancillary site area with photographs taken before start of work	Once before sign off	Contractor	PIU/ CSC

8.8 Environmental Management Plan Indicative Cost

313. The cost for compliance of EMP and its operation is estimated in the **Table 8.6.**

Table 8.6: Environmental Management Plan Indicative Cost

Item	Cost USD	Remarks
Mitigation Cost		
Environmental Monitoring		
Environmental Monitoring (air, noise and water for baseline) at key points	5,000	Once for air, noise and water for baseline
Environmental Monitoring (air, noise and water during construction stage) at key points	60,000	Quarterly for air, noise and water for 3 years
Training Arrangements (Training will be carried out by CSC)	50,000	Contractor will pay for the Arrangements
Hiring of Staff		
Contractor Environment Specialist	195,000	39 Person months
CSC Environment Specialists (1 International + 3 National)	(130,000 +189000) 319,000	4 person months for international + 26 person months for 3 position[23]
PIU Environment Staff PIU Grievance Redress Staff	156,000 39,000	39-man months 39-man months
Vehicles	100,000	Lumpsum
Fire extinguishers	4,500	Lumpsum
PPEs	700,000	Lumpsum
Drinking water facilities	5,000	Lumpsum
First Aid	300,000	Lumpsum
Tarpaulin	10,000	Lumpsum
Borrow pits	-	Included in project cost
Disposal area	-	Included in project cost
Subtotal	1,943,500	
Contingency (10 % of total cost)	194,350	
Total Cost	2,137,850	
Note: Environmental Mitigation Cost of PKR 300 M (2.14 M) is included in PC-1		

[23]TOR for consultancy services (T-II) Projects

SECTION 9 PUBLIC PARTICIPATION, CONSULTATION AND INFORMATION DISCLOSURE

9.1 Stakeholder Identification and Analysis

314. The stakeholders of a project can vary depending on the details of project. During the field survey, significant efforts were made to identify different stakeholders, both project-affected parties and other interested parties. They included local communities / general public, national and local authorities, neighboring and non-governmental organizations and vulnerable community (women, poor & indigenous) etc. Based on identification, all those stakeholders (individuals & groups) had different concerns and priorities about project impacts, mitigation mechanisms and benefits, and also required different, or separate, forms of engagement.

9.2 Methods Adopted for Stakeholder Engagement

315. The following methods were applied for engagement with project stakeholders in order to capture their concerns, potential risks and priorities regarding project implementation.

- **Interview Survey**
  (A structured set of questions from representative sample of PAPs)

- **General / Public Meetings**
  (Discussion with community, religious leaders, local government representatives, civil society representatives, politicians and teachers etc.)

- **Rapid Participatory Appraisal**
  (Site visit by a multidisciplinary team consisting environmental engineer, environmental scientist, social scientist, ecologist and local community representatives to gather information regarding project site)

- **On-Site Meetings**
  (Other interested parties including project proponent or contractor)

9.3 Stakeholder's Concerns and Priorities

316. The first round of stakeholder consultations was conducted in 2018. Identified stakeholders were consulted and their concerns were documented with pictures. Meetings were held with project-interested parties including project staff, government officials, and local communities to predict the nature and scale of risks, challenges and perceived impacts of project. Table 9.1describes the details of general / public meetings and series of focused group discussions held with different categories of the stakeholders at various locations along with their concerns & priorities raised about proposed project. The pictorial evidences for the consultation is shown in **Plate 9.1**.

Table 9.1: Public Involvement Process

Sr. No.	Date	Venue	Stakeholder Category	No of Participants	Concerns & Comments Raised	Response to Comments
01	17-09-2018	Dhakan Bangla Village	Local & Farming Community	09	It is a good project and it would decrease traffic congestion and facilitate the local inhabitants to cone with other areas. Requested for technical and non-technical employment opportunities to the locals Community representatives were afraid that their businesses may be affected by the proposed development during construction Community representatives were afraid that their existing livelihood may be affected during construction	Contractor will be advised to hire local force on preference basis during construction. Construction activity may be restricted during peak hours of business activity.
02	17-09-2018	Karampur City	Fruit Seller, Shopkeepers, Residents	12	Travelling time to approach other areas will be minimized due to widening of road After its completion, suitable place to be provided for the local inhabitants who are involved in running business of hotels and shops Ensure the other possible suitable locations to run business along the Indus Highway Privacy of local people will be disturbed due to construction work	Compensation to be paid in a timely manner to manage the business and for relocation, if requires
03	18-09-2018	Ghoospur Village	Farmers, laborer	11	Impacts on health due to exposure of noise and dust particles	Project site will be fenced with corrugated iron sheets/

Sr. No.	Date	Venue	Stakeholder Category	No of Participants	Concerns & Comments Raised	Response to Comments
					Livelihood will be disturbed, in case of loss of agriculture land and businesses around the Indus highway Affected structures to be compensated prior to the construction activities Alternative routes or designed to be changed at areas where structures and mosques are falling within the dualized sections.	temporary noise barriers to minimize the level of noise and dust near the mosques. Construction machinery will be parked in adequate locations away from the sensitive areas to minimize the impacts related to the noise. Prayer timings would be consulted with the communities Efforts would be made to avoid graveyards, shrines, and religious or cultural sites if any close to alignment
04	18-09-2018	Shikarpur City	Local Community	15	Farmers will have better and rapid access for transportation of their agricultural products Existing cropping patters will be disturbed due to intervention of construction machinery and labors Orchard growing areas adjacent to the existing alignment will be affected, which is currently the only source of income of inhabitants Contractors should manage to facilitate the water supply lines during construction.	There will be provision of fair replacement cost if any of land or land based asset will be disturbed owing to project implementation. Contractor will be responsible for not interrupting the water supply lines of communities during construction activity.
05	20-9-2018	Karachi Office-EPA	Director, EPA	02	Emphasis to ensure EMP implementation during the entire life cycle of the proposed project, while ensuring that they comply with all	Contractor will be responsible to comply the EMP implementation under the contract agreement.

Sr. No.	Date	Venue	Stakeholder Category	No of Participants	Concerns & Comments Raised	Response to Comments
					relevant legislative requirements applicable on the proposed project. Technical and non-technical employment opportunities for the locals to be reserved.	

Figure 9.1: Public Involvement Process

317. A second round of consultations was planned for January 2020. However, due to the current lock down situation due to the Pandemic (Covid-19), following the Governments directives and SOPs it is not possible to personally visit the stakeholders and conduct consultation meetings. Therefore, different stakeholders have been

contacted via letters to conduct consultations keeping social distancing through phone calls, conference calls, skype call utilizing the e-media. The response from these organizations is given in **Table 9.2.** A sample letter is attached as **Annex VIII.**

318. List of departments / NGOs to which letters are dispatched and contacted for this purpose is provided below:

- District Office Environment, Rajanpur
- Forest Department, Sindh
- Forest, Wildlife & Fisheries Department, Punjab
- Agriculture Department, Punjab
- Social Welfare and Bait-ul-Maal, Punjab
- District Office, Social Welfare & Baitul Maal, Rajanpur
- AL-Noor Development Social Welfare Association-ANDSWA
- Idara-e-Taleem-o-Aagahi (ITA), Shikarpur Office
- SRSO Unit Office, Shikarpur
- Kainaat Development Association [KDA], Kandhkot
- Tameer Development Organization (TDO), Kandhkot, Sindh
- RDPI-Rural Development Policy Institute Rajanpur
- Sayya,Kotla Naseer, Rojhan
- Punjab Goods and Transport Association
- Karachi Goods Transport Association

Table 9.2: Departmental Consultation

Sr. No.	Department	Concerns/Observations	Response
1.	**Environmental Protection Department** Mr. Arif Hussain (Field Assistant) Contact No. 0333-6762527	The official appreciated the efforts of IEE team for stakeholder consultations even in this COVID-19 pandemic scenario.	All concerns and suggestions are noted and incorporated in report.
		He also praised the efforts of Govt. for dualization of the N-55 road section because road dualization will reduce the accident risks in the area.	
		Road should be designed by considering flood discharge in the area so that road would not be damaged in flood seasons.	
		Proper sprinkling should be done during construction phase of the project.	
		He insisted the team to provide necessary data and information regarding the area and its surroundings.	
2.	**Irrigation Department** Mr. Ghulam Akbar (Sub Engineer) Contact No. 0334-8180300	The official of Irrigation Department acknowledged the process of consultation with the respective stakeholders to incorporate their concerns and feedback in the report.	All concerns and suggestions are noted and incorporated in report.
		He was also of the view that irrigation structures need to be extended at canal	

Sr. No.	Department	Concerns/Observations	Response
		crossings for dualization of the N-55 road section.	
		Diversions should be established by considering flood flows in the area.	
3.	**Idara –e- Taleem O Aagahi** Jalaldin Jamali (District Coordinator) Contact No. 03313474940	He also praised the efforts of Govt. for dualization of the N-55 road section and acknowledged that project is really needed in the area.	All concerns and suggestions are noted and incorporated in report.
		Due to poor road condition and over speeding lot of accidents are observed in the area. Hence, animal crossings/cattle creep must be provided	
		Plantation must be done on both sides of Road.	
4.	**Kainat Development Association** Ahmed Buksh Channa (CEO) Contact No. 0333734428 0722572186	He appreciated the project and stakeholder consultations and indicated that the project is really needed in the area.	All concerns and suggestions are noted and incorporated in report.
		Numerous accidents are observed which not only results in loss of precious lives but also leave socio economic implications for the grieved members of family. Thus, the road needs to be dualized with proper crossings for both humans and animals	
		The material used shall be of good quality as previous structures are easily damaged/not well maintained	
		As a social activist he indicated that the project is a dire need and demand of people of Kashmore and Shikarpur. Moreover, it will help improve socioeconomic conditions of the area.	
5.	**Karachi Goods Transport Association** Ghulam Muhammad Afridi General Secretary Contact No. 03003499322	He indicated that traffic issues are really serious in the area. In addition to road accidents, theft activities are also faced along the road.	All concerns and suggestions are noted and incorporated in report.
		Efforts shall be made to control theft activities	
6.	**SAYYA Micro Finance Company** Atiq Ur Rehman	Road side safety for the different hazards shall be considered. e.g: flash floods	All concerns and suggestions

Sr. No.	Department	Concerns/Observations	Response
	(Programme Manager) Contact No. 03326265980	Green belts and plantation shall be considered on road sides	are noted and incorporated in report.
7.	**Sindh Forest and Wild Life Department** (Divisional Forest officer) Contact No. 03332688310	If the proposed road passes through any reserved forest, It must be notified to the department for the purpose of transportation/road.	The area does not pass from reserve forest area.
		If trees are damaged due to project. Compensatory plantation must be carried out.	
8.	**Punjab Fisheries Department** Muhammad Raza (AD) Contact No. 03336445202	He appreciated the project and affirmed that no major fisheries assets will be disturbed.	-
9.	**Sindh Rural Support Organisation** Dr. Shahid Ahmed Lakh (District Manager) Contact No. 03023129198	It is good project providing easy access to the public especially the commuters of 3 the districts. It will also reduce the travelling time.	All concerns and suggestions are noted and incorporated in report.
		Kashmore bypass is the dire need of the area.	
		Plantation shall be done on both sides of the road	
		Overhead bridges shall be provided where road crosses the big cities.	
10.	**Social Welfare and Bait ul Mal, Rajanpur** Tehmina Dilshad (Deputy Director) Contact No. 03331615996	Plantation and green belts is very necessary	All concerns and suggestions are noted and incorporated in report.
		Crossings for hill torrents must be considered	
11.	**Tameer Development Organisation** Nazir Ahmed Somroo 03003297884	Judicial compensation to the affected people shall be granted.	All concerns and suggestions are noted and incorporated in report.
		The project will benefit the locals and uplift the socioeconomic status of the area.	
12.	**Al Noor Development Social Welfare**	Several accidents are observed on the road; hence the project is need of the area.	All concerns and

Sr. No.	Department	Concerns/Observations	Response
	Asif Ali Somroo (President) Contact No. 03003106602	The project must be implemented as soon as possible	suggestions are noted and incorporated in report.

Note: Response from some departments are not received yet. They will be included in the final IEE.

9.4 Information Disclosure

319. In line with ADB's Access to Information Policy (AIP)relevant information about social and environmental safeguard issues will be made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation.

320. Initial Environmental Examinations will be posted on ADB's website after approval and semiannual EMRs will be posted after approval every six (6) months. It will also be posted on NHAs website.

321. The IEE Report will be accessible to interested parties on request and the report will be available in the national library. In addition to it, brochures describing project information and its environmental impacts and mitigation measures in local language will be available at the project's site office and district administration offices where they are easily accessible to the local population.

9.5 Grievance Redress Mechanism (GRM)

322. The purpose of the GRM is to receive, review and resolve grievances from people and thereby resolve the community concerns raised during execution of project works. The GRM will remain intact throughout project implementation period to address the community concerns and issues arising during execution of project works.

323. The formal GRM proposed and provided for this project has a three-tiered structure including: first at local/village level set-up through community involvement; second at PIU level where a formal GRC is established and operational and third at NHA (PMU/EALS) level. This will enable to resolve simpler and less complex grievances at local and project level by mobilizing local recourse and provide a higher-level review system to look into and address more difficult and complex issues that are not resolved at the PIU or local level. To ensure that all geographic reaches and relevant administrative units involved in the project are covered under the GRM, it will include (i) first level of GRM consisting of the Displaced Person Committees (DPCs) as a grievance redress focal points for each affected village; and (ii) a project based grievance redress committee (GRC) at PIU level and the iii) the PMU/ELAS level grievance redress focal points. The functions and responsibilities for each level of GRM are explained below.

9.5.1 First Level of GRM

324. The first level of grievance redress system includes the village level displaced person committee (DPC) selected and nominated by the displaced person from each affected village/settlement located along the project road alignment. The DPC will be presided by its president who will be selected by the committee members nominated by the displaced persons. These DPCs will be a formal node for coordination and

communication with the project execution authorities and are required to act as local node for recording and redress of grievances as per their local customs and practices. The project LAR units and the technical staff will maintain a close liaison with the DPCs to guise and assist them in recording and resolution of grievances as per provision of this LARP/EMP. In this regards, the Environmental specialist/resettlement specialist and social mobilizers will closely coordinate and work together with the DPC members and the local community to ensure grievances are recorded, investigated and discussed during DPC's meetings and guide them to explore and recommend remedial measures at their level in accordance with provisions of the resettlement plan. They will also liaise with the counterpart engineering staff, and contractors to ensure implementation of the DPC's recommendations and/or raising the complaint to sub-project GRC for review and redress if the issues are not resolved at DPC level.

9.5.2 Second Level of GRM

325. If the grievance is not resolved at village DPC level, it shall be raised to formal grievance redress mechanism which is first level of GRM. A formal complaint will be tendered with the Project GRC by the aggrieved persons or through the social mobilizers. A complaint register will be maintained by the GRC through DD/AD (land management, implementation and social) to record the complaints received covering complaint receipt date, name and address of the complainant, gist of complaint, gist of field report, decision of GRC with its communication date to the DPs and decision implementation status or elevating the complaint to next level of GRM in case of disagreement by the aggrieved Persons.

326. Once the complaint is submitted with the Project GRC, it shall record it in complaint register and send acknowledgement to the affected person without delay; and initiate the process of investigation within 7 days through its technical and resettlement/environment field teams. After receipt of directions of GRC, the field teams including resettlement/environment specialist and Land Staff will coordinate with complainant and complete its investigation of facts in consultation with aggrieved person, DPC representatives and local community and submit its fact-finding report and recommendations to the GRC within 15 days from the receipt of complaint. Upon receipt of the fact finding report, the GRC will summon and hear the aggrieved person and decide the complaint in light of EMP and communicate its decision to the PMU and aggrieved persons within next 15 days. On an overall basis, the GRC will decide the grievances within 30 days of receipt of complaint in GRC. If the final decision made by GRC is not acceptable to the DPs they may advise GRC for elevation of their grievance to next higher level of GRM. However, the project based GRM will not bar aggrieved persons to avail remedies available under the court of law and they will be at liberty to approach the court of law as and when they wish to do so.

9.5.3 Third Level of GRM

327. In case the aggrieved person is unsatisfied with GRC decision, he himself or through GRC can elevate his complaint to third level of GRM i.e. at PMU/EALS in NHA HQ, within 7 days after GRC decision on complaint. Once the complaint is received at PMU/EALS along with GRC proceedings, it will be registered and the complainant will be informed accordingly. The GRC record and complainants' claim will be scrutinized and the complainant will be advised to produce any additional record in favour of his claim. After thorough review and scrutiny of the available record PMU/ EALS can visit the field to meet the complainant, collect additional information and evidence if required. Once the investigations are completed the PMU/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. Moreover, the aggrieved person/party (s) is free to go to the Court of Law as and when desired.

9.5.4 Constitution and Function of the GRC

328. The project based GRC will be a public forum for raising concerns and invoking conflict resolution system available within the project for addressing LAR related and other social or environmental issues adequately. The GRCs will continue to function, for the benefit of the DPs/aggrieved persons, during and after implementation of LARP/EMP till completion of the project.

329. The GRC will be headed by the Project Director, including DD/AD (land) or AD (environment) as member and focal person for social and environmental grievances, the Land Acquisition Collector and resettlement /environment Specialist mobilized through supervisions consultants as members. Besides, the GRC may also include one representative form District Revenue Office and Village level Displaced Persons Committees (DPCs).

330. For redress of grievances, the GRC will meet at least once in a month. For the purpose of social safeguards, the GRC will review grievances involving all resettlement issues including, compensation, relocation, and other assistance. GRC will perform following functions:

- Record grievances; categorize and acknowledge the complainants about receipt of grievances; investigate the issue and summon aggrieved persons/parties to produce the evidence and explain their claims; and resolve the grievances within stipulated time frame preferably in 30 days;
- Communicate its decisions and recommendations on all resolved disputes to Project executors and the aggrieved persons for implementation and follow the implementation progress;
- Forward the un-resolved cases, at its own or as required by the unsatisfied aggrieved parties, to PMU (second level of GRM) within an appropriate time frame with reasons recorded and its recommendations for review and resolution at second level of GRM;
- Develop an information dissemination system and acknowledge the aggrieved parties about the development regarding their grievance and decision of PIU and PMU level;
- Maintain a complaint register accessible to the all stakeholders with brief information about complaints and GRC decision with status report; and
- Maintain complete record of all complaints received by the GRC with actions taken.

331. The flow chart of the proposed redress mechanism is shown below in **Figure 9.2.**

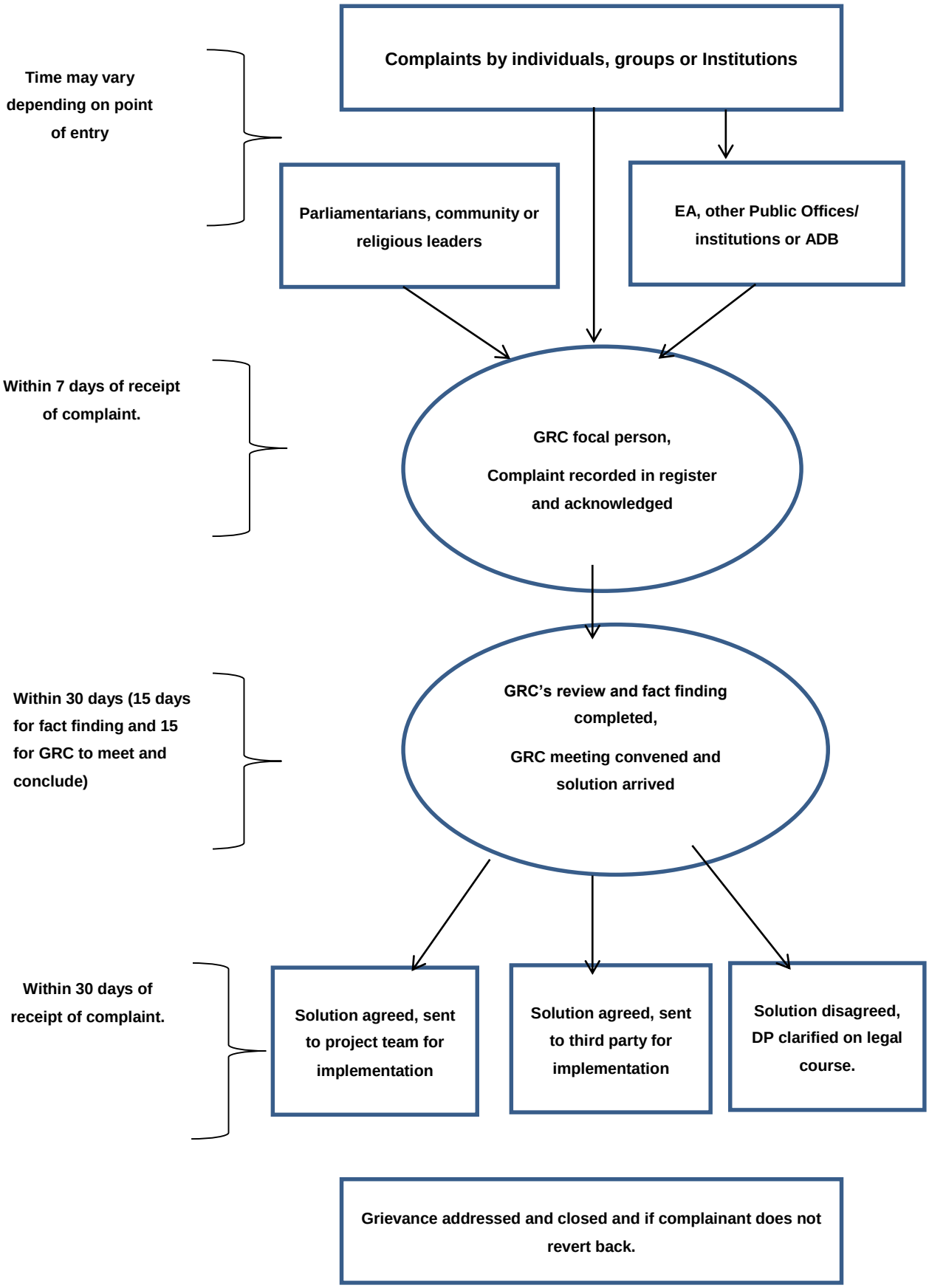


Figure 9.2: Flow Chart of the Proposed Grievance Redress Mechanism

9.5.5 Type of Grievances to be Expected

332. The following are some of the environmental issues could be subject for grievance from the affected people, concerned public and NGOs.

- Dust, noise and air pollution during construction activities
- Nuisance
- Intensive schedule of construction activities
- Inappropriate timing of construction vehicle flow
- Traffic Movement
- Water Pollution
- Waste disposal
- Disturbances to flora and fauna
- Health and safety
- Criminal activities
- Failure to comply with standards or legal obligations

SECTION 10 CONCLUSION

333. Conclusively, the proposed development will enhance the trade activities on regional basis and provide smooth and safe road corridor linking with the Central Asian States. This will involve some potential adverse environmental impacts of low to moderate level, which are mostly related to construction stages of the Project and are however manageable by properly implementing the EMP and meaning full and timely consultation with the community. No long-term and significant adverse environmental impacts are however envisaged for the operation stage of the Project.

Annex I: IFC Guidelines and NEQS

Table: IFC/WHO standards for Air Quality

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Source:
https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

Table: IFC/WHO standards for Noise

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

Source:
https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

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GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT

NOTIFICATION
(124 of 2016)

12th August 2016.

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Drinking Water is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

Government of the Punjab
Environment Protection Department

NOTIFICATION: No. SO(G)/EPD/7-26/2013 – In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), the Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Drinking Water:

Punjab Environmental Quality Standards for Drinking Water

Properties/Parameters	Standard Values	WHO Standards	Remarks
[redacted]			
All water intended for drinking (E. Coli or Thermo-tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.	Most Asian countries also follow WHO standards
[redacted]			
Colour	≤15 TCU	≤15 TCU	
Taste	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Odour	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Turbidity	<5 NTU	<5 NTU	

Properties/Parameters	Standard Values	WHO Standards	Remarks
Total hardness as $CaCO_3$	< 500 mg/l	---	
TDS	<1000	< 1000	
pH	6.5 – 8.5	6.5 – 8.5	
[redacted]			
Essential Inorganic	mg/Litre	mg/Litre	
Aluminum (Al) mg/l	≤0.2	0.2	
Antimony (Sb)	≤0.005 (P)	0.02	
Arsenic (As)	≤0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl^-)	<250	250	
Chromium (Cr)	≤0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	mg/l	mg/l	
Cyanide (CN)	≤0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤1.5	1.5	
Lead (Pb)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤0.001	0.001	
Nickel (Ni)	≤0.02	0.02	
Nitrate (NO_3)*	≤50	50	
Nitrite (NO_2)*	≤3 (P)	3	
Selenium (Se)	0.01(P)	0.01	

Properties/Parameters	Standard Values	WHO Standards	Remarks
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	-	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries
Organic			
Pesticides mg/l			PSQCA No. 4639- 2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.**
Phenolic compounds (as Phenols) mg/l		[redacted]	
Poly-nuclear aromatic hydrocarbons (as PAHs) g/l		0.01 (By GC/MS method)	
[redacted]			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

* Indicates priority health related inorganic constituents, which need regular monitoring.

** PSQCA: Pakistan Standards Quality Control Authority.

(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

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GOVERNMENT OF THE PUNJAB
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NOTIFICATION
(122 of 2016)

12th August 2016.

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Ambient Air is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

Government of the Punjab
Environment Protection Department

NOTIFICATION: No. SO(G)/EPD/7-24/2013. – In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Ambient Air:

Punjab Environmental Quality Standards for Ambient Air

Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
Sulfur Dioxide (SO_2)	Annual Average*	80 µg/m^3	Ultraviolet Fluorescence method
	24 hours**	120 µg/m^3	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	40 µg/m^3	
Oxides of Nitrogen as (NO_2)	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	80 µg/m^3	
Ozone (O_3)	1 hour	130µg/m^3	Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	360µg/m^3	High Volume Sampling, (Average flow rate not less than 1.1 m^3/min).
	24 hours**	500µg/m^3	
Respirable Particulate Matter PM_{10}	Annual Average*	120µg/m^3	Preferably β-Ray absorption method
	24 hours**	150µg/m^3	
Respirable Particulate Matter $PM_{2.5}$	Annual Average*	15µg/m^3	Preferably β-Ray absorption method
	24 hours**	35µg/m^3	

Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
	1 hour	15µg/m^3	
Lead (Pb)	Annual Average*	1 µg/m^3	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5µg/m^3	
Carbon Monoxide (CO)	8 hours**	5 mg/m^3	Non Dispersive Infra Red (NDIR) method
	1 hour	10 mg/m^3	

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly /8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.

(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

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GOVERNMENT OF THE PUNJAB
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NOTIFICATION
(121 of 2016)

12th August 2016

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Noise is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

Government of the Punjab
Environment Protection Department

NOTIFICATION: No. SO(G)/EPD/ 7-26 **/2013.** In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), the Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Noise:

Punjab Environment Quality Standards for Noise

No.	Category of Area/Zone	Effective from 1st July, 2010		Effective from 1st July, 2013	
		Limits in dB(A) Leq*			
		Day Time	Night Time	Day Time	Night Time
1	Residential Area (A)	65	50	55	45
2	Commercial Area (B)	70	60	65	55
3	Industrial Area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45

Note:

1. Day time hours; 6:00am to 10:00pm.
2. Night Time hours; 10:00 pm to 6:00 am.
3. Silence Zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospital, educational institutions and courts
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority

* dB(A) Leq: Time weighted average of the level of sound in decibel on scale A which is relatable to human hearing.

(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

SEQS, 2016

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KARACHI THURSDAY JANUARY 28, 2016

PART-I

GOVERNMENT OF SINDH
SINDH ENVIRONMENT PROTECTION AGENCY

NOTIFICATION

NO.EPA/TECH/739/2014:- In exercise of the powers conferred under clause (g) of sub-section (1) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context –

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.

L iv-158 Ext -I-8 (23) Price Rs. 70.00

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)

S. No.	Parameter	Standards		
		Into Inland Waters	Into Sewage Treatment [2]	Into Sea [1]
1	2	3	4	5
1.	Temperature 40^0C or Temperature Increase *	$\leq 3^0C$	$\leq 3^0C$	$\leq 3^0C$
2.	pH value (H^+)	6-9	6-9	6-9
3.	Biochemical Oxygen Demand (BOD)5 at 20^0C [1]	80	250	80**
4.	Chemical Oxygen Demand(COD) [1]	150	400	400
5.	Total Suspended Solids (TSS)	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500
7.	Oil and Grease	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chloride (as Cl^-)	1000	1000	SC***
10.	Fluoride (as F^-)	10	10	10
11.	Cyanide (as CN^-) total	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS)[2]	20	20	20
13.	Sulphate (SO_4^{2-})	600	1000	SC***
14.	Sulphide (S^{2-})	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40
16.	Pesticides [3]	0.15	0.15	0.15
17.	Cadmium [4]	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent [4])	1.0	1.0	1.0
19.	Cooper [4]	1.0	1.0	1.0
20.	Lead [4]	0.5	0.5	0.5
21.	Mercury [4]	0.01	0.01	0.01
22.	Selenium [4]	0.5	0.5	0.5
23.	Nickel [4]	1.0	1.0	1.0
24.	Silver [4]	1.0	1.0	1.0
25.	Total toxic metals	2.0	2.0	2.0
26.	Zinc	5.0	5.0	5.0
27.	Arsenic [4]	1.0	1.0	1.0
28.	Barium [4]	1.5	1.5	1.5
29.	Iron	8.0	8.0	8.0
30.	Manganese	1.5	1.5	1.5
31.	Boron [4]	6.0	6.0	6.0
32.	Chlorine	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
3. Pesticides include herbicides, fungicides, and insecticides.
4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
5. Applicable only when and where sewage treatment is operational and BOD5=80mg/l is achieved by the sewage treatment system.
6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than 3^0C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

** The value for industry is 200 mg/l

*** Discharge concentration at or below sea concentration (SC).

Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment,

2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/Nm^3, UNLESS OTHERWISE DEFINED)."

S. No.	Parameter	Source of Emission	Standards
1	2	3	4
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringleman Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces	
	(1)	(i) Oil fired	300
		(ii) Coal fired	500
		(iii) Cement Kilns	300

		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas	500
3.	Hydrogen Chloride	Any	400
4.	Chlorine	Any	150
5.	Hydrogen Fluoride	Any	150
6.	Hydrogen Sulphide	Any	10
7.	Sulphur Oxides [2][3]	Sulfuric acid/ Sulphonic acid plants	
		Other Plants except power Plants operating on oil and coal	1700
8.	Carbon Monoxide	Any	800
9.	Lead	Any	50
10.	Mercury	Any	10
11.	Cadmium	Any	20
12.	Arsenic	Any	20
13.	Copper	Any	50
14.	Antimony	Any	20
15.	Zinc	Any	200
16.	Oxides of Nitrogen	Nitric acid Manufacturing unit.	3000
	(3)	Other plants except power plants operating on oil or coal:	
		Gas fired	400
		Oil fired	600
		Coal fired	1200

Explanations:-

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent Sulphur content in fuel oil. Higher content of Sulphur will case standards to be pro-rated.
3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to Standards specified above, comply with the following standards:-

A. **Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter (ug/m^3) Standards.

Background Air Quality (SO_2 Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO_2 Emission (Tons per Day Per Plant)	Criterion II Max. ground level increment to ambient (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

* For intermediate values between 50 and 100 ug/m^3 linear interpolations should be ured.
** No projects with Sulphur dioxide emissions will be recommended.

B. Nitrogen Oxide

Ambient air concentrations of Nitrogen oxides, expressed as NO_x should not be exceed the following:-

Annual Arithmetic Mean $100ug/m^3$ (0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram (10^0-gram) per joule of heat input:

Liquid fossil fuel	130
Solid fossil fuel..	300
Lignite fossil fuel	260

Note:- Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

Sindh Environmental Quality Standards for Motor Vehicle Exhaust and Noise

(i) **For in-use Vehicles**

S. No.	Parameter	Standards (maximum permissible limit)	Measuring Method	Applicability
1	2	3	4	5
1.	Smoke	40% or on the Ringleman Scale during engine acceleration mode	To be compared with Ringleman Chart at a distance of 6 meters or more.	Immediate effect
2	Carbon Monoxide	6 %	Under idling conditions: Non-dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)	Sound-meter at 7.5 meter from the source.	

For new Vehicles

EMISSION STANDARDS FOR DIESEL VEHICLES

(a) For passenger Cars and Light Commercial Vehicles (g/Km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8
Passenger Cars.	M 1: with reference mass (RW).	Pak-II, IDI	1.0	0.7	0.08		All imported and local manufactured
	up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II DI	1.0	0.9	0.10	NEDC (ECE 15+ EUDCL)	Diesel vehicles with effect from 01-07-2012
Light Commercial Vehicles	NI-I (RW<1250 Kg)	Pak-II IDI	1.0	0.70	0.08		
		Pak-II DI	1.0	0.90	0.10		
	NI-II(1250kg< RW < 1700 Kg)	Pak-II IDI	1.25	1.0	0.12		
		Pak-II DI	1.25	1.3	0.14		
	NI-III(RW< 1700 Kg)	Pak-II IDI	1.50	1.2	0.17		
		Pak-II DI	1.50	1.6	0.20		

Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the source

(b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Catogry/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8	9
Heavy Duty Diesel Engines	Turks and Buses	Pak-II	4.0	1.1	7.0	0.15	ECE-R-49	All Imported and local manufactured diesel vehicles with the effect 1-7-2012
Large goods Vehicles	N2(2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	

Parameter Standards (maximum permissible limit) Measuring method

Noise 85 db (A) Sound-meter at 7.5 meters from the Source

Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/ Class	Tier	Co	HC+ NOx	Measuring Method	Applicability
1	2	3	4	5	6	7
Passenger Cars.	M 1; with reference mass (RW), upto 2500 kg. Cars with RW over 2500 kg, to meet N1 Category standards	Pak-II	2.20	0.5	NEDC (ECE 15+ EUDC)	All imported and new models locally manufactured petrol vehicles with effect from 1st July, 2009**

Light Commercial Vehicles	NI-I (RW<1250 kg) NI-NI-II (1250kg> kg RW < 1700 Kg)	Pak-II	2.20	0.5	
		Pak-II	4.0	0.65	
		Pak-II	5.0	0.08	
	NI-III(RW> 1700 kg)				
Motor Rickshaws & Motor Cycles	2,4 strokes < 150 cc	Pak-II	5.5	1.5	ECER 40
	2,4 strokes > 150cc	Pak-II	5.5	1.3	

Parameter Standards (maximum permissible limit) Measuring method

Noise source	85 db (A)	Sound-meter at 7.5 meters from the

Explanations:

DI:	Direct Injection.
IDI:	Indirect Injection.
EUDCL:	Extra Urban Driving Cycle.
NEDC:	New European Driving Cycle.
ECE:	Urban Driving Cycle.
M:	Vehicles designed and constructed for the carriage of passenger and Comprising no more than eight seats in addition to the driver's seat.
N:	Motor vehicles with at least four wheels designed and constructed for the carriage of goods.
*	New model means both model and engine type change.
**	The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30th June, 2012.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

Pollutants	Time-weight average	Concentration in Ambient Air	Method of measurement
Sulphur Dioxide(SO2)	Annual Average*	80 µg/m³	Ultraviolet Fluorescence method
	24 hours**	120 µg/m³	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m³	Gas Phase Chemiluminescence
	24 hours**	40 µg/m³	
Oxides of Nitrogen as (NO2)	Annual Average*	40 µg/m³	Gas Phase Chemiluminescence
	24 hours**	80 µg/m³	
O³	1 hour	130 µg/m³	Non dispersive U/V absorption method
Suspended Particulate Matters(SPM)	Annual Average*	360 µg/m³	High Volume Sampling (Average flow rate not less than 1.1 to 3/minutes)
	24 hours**	500 µg/m³	
Respirable Particulate Matter PM10	Annual Average*	120 µg/m³	ß Ray absorption method
	24 hours**	150 µg/m³	
Respirable Particulate Matter PM2.5	Annual Average*	40 µg/m³***	ß Ray absorption method
	24 hours**	75 µg/m³	
Lead Pb	Annual Average*	1 µg/m³	ASS Method after sampling using EPM 2000 or equivalent filter paper
	24 hours**	1.5 µg/m³	
Carbon Monoxide(CO)	8 hours**	5 mg/m³	Non Dispersive Infra Red(NDIR) method
	1 hours**	10 mg/m³	

*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

** 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

***Annual Average limit of 40µg/m³ or background annual average concentration plus allowable allowance of 9µg/m³, whichever is lower.

Sindh Standards for Drinking Water Quality

Properties / Parameters	Standard Values for Sindh	WHO Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Most Asian countries also follow WHO standards
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non	Non	

	objectionable/Acceptable	objectionable/Accep table
Turbidity	(5 NTU	(5 NTU
Total hardness as $CaCO_3$	< 500 mg/l	---
TDS	(1000	(1000
pH	6.5 - 8.5	6.5 - 8.5
Chemical		
Essential Inorganic	***mg/Litre***	***mg/Litre***
Aluminium (Al) mg/l	≤ 0.2	0.2

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium(Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	***mg/Liter***	***mg/Litre***	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Nitrate (NO_3)	< 0.50	50	
Nitrite (NO_2)	< 3 (P)	3	
Selenium (SE)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	—	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Organic			
Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted ***	Annex II
Phenolic compounds (as Phenols) mg/L		< 0.002	
Polynuclear aromatic hydrocarbons (as PAH g/L)		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority

Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum

products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

Sindh Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1st Jan, 2015		Effective from 1st January, 2015	
		Limit in dB(A) Leq *			
		Day Time	Night Time	Day Time	Night Time
1.	Residential Area (A)	65	50	55	45
2.	Commercial Area (B)	70	60	65	55
3.	Industrial Area (C)	80	75	75	65
4.	Silence Zone (D)	55	45	50	45

Note: 1. Day time hours: 6:00 a.m to 10:00 p.m

2. Night time hours: 10:00 p.m to 6:00 a.m

3. Silence zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts

4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.

* dB(A) Leq: Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

3. **Repeal and Savings.**

(1) The provisions of the Statutory Notification dated 10th August, 2000 and 18th October, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.

(2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION AGENCY

Karachi: Printed at the Sindh Government Press
28-1-2016

Annex II: Environmental Monitoring Criteria

ENVIRONMENTAL MONITORING CRITERIA

Objectives:

Following are the objectives of the environmental monitoring, sampling and testing:

- Establish baseline environmental conditions of ambient air, noise and water quality in and around the COI of the alignment; and
- This will also provide the basis for impact assessment and compliance monitoring during various phases of the proposed Project.

Environmental Monitoring Criteria:

Following criteria was considered for the selection of environmental monitoring locations along the road alignment:

- Major surface water crossings e.g. canals, distributaries, nullahs, etc. and nearby water ponds along road alignment are considered for selection of surface water sampling locations;
- Nearby sensitive receptors e.g. educational institutions, mosques, health facilities, residential areas, etc. have been given due importance for the selection of ambient air and noise monitoring points; and
- Pumps/hand pumps/tube wells along road alignment being used to fulfil the drinking water requirements of major residential areas, education institutions, mosques, health facilities, etc. have been considered for ground water sampling.

Based on the above criteria, about eight (08) number of surface/wastewater sampling points have been selected whereas about six (06) number of ground water sampling points have been selected. Ambient air and noise monitoring will be conducted at six (06) locations along the road alignment. Tentative monitoring/sampling points along with parameters are provided in below table:

Item	Sampling Parameter
Surface Water	Temperature, pH, TDS, BOD, COD, Phenols, Chloride, Copper, Lead, Manganese, Sulphate, Zinc, Silver, Boron, Barium, Iron
Air Quality	CO, NOx, SOx, $PM_{10,}$
Noise	Equivalent Noise Levels in dB (A)
Drinking Water	Color, pH, Turbidity, Total Hardness, TDS, Antimony, Barium, Chloride, Fluoride, Nitrate, Nitrite, Odor & Taste, Arsenic, Total Coliforms, Fecal Coli forms (E.Coli).

Reasons/criteria for selection of each sampling, monitoring point is provided in below table:

Sampling/Monitoring Point	Reason of Selection	Location
	Surface Water (SW) Sampling	
SW-01	Nullah Crossing	Meeral
SW-02	Begari Canal Crossing	Kandhkot
SW-03	Nearby Water Pond	Kandhkot
SW-04	Nearby Water Pond	Near Bakshapur
SW-05	Pat Feeder Distributary Crossing	Kashmore
SW-06	Pat Feeder Canal Crossing	Kashmore
SW-07	Matwah Distributary Crossing	Near Rojhan
SW-08	Kadra Canal Crossing	Near Kot Mithan
	Ground Water (GW) Sampling	
GW-01	Kundan Mosque & Residential Area	Shikarpur
GW-02	Govt. Higher Secondary School & Residential Area	Khnapur
GW-03	Cadet College	Kandhkot
GW-04	Masjid-e-Bilal & nearby Residential Area	Kashmore
GW-05	Rural Health Centre & Residential Area	Rujhan Chowk
GW-06	Mushtaq Hotel & nearby Residential Area	Rajanpur
	Ambient Air & Noise (A&N) Monitoring	
A&N-01	Residential Area	Shikarpur
A&N-02	Rural Health Centre & Residential Area	Khanpur
A&N-03	Masjid Ali-ul-Murtaza & Residential Area	Kandhkot
A&N-04	Jamia Masjid Qadria & Residential Area	Kashmore
A&N-05	Rural Health Centre & Residential Area	Rojhan
A&N-06	Noorani Masjid & Residential Area	Rajanpur

Map showing ambient air & noise monitoring and surface/ground water sampling points is also provided above.

Annex III. Lab Results

Integrated Environment Laboratory

AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KS-PiENW01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan, District Rahim Yar Khan
Monitoring Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	ACM65, Serial # 1310
Location:	Rojhan, District Rahim Yar Khan		
GPS Coordinates:	28° 42' 54.566" N 69° 54' 2.354" E		

Sr. No.	Time	Parameters	Results (Average 24 Hrs)
	Hours	PM_{10} (µg/m³)	PM_{10} (µg/m³)
25.	11:30 A.M	101.31	104.161
26.	12:30 P.M	105.52	
27.	01:30 P.M	109.31	
28.	02:30 P.M	120.61	
29.	03:30 P.M	124.93	
30.	04:30 PM	119.18	
31.	05:33 PM	120.17	
32.	06:30 PM	122.25	
33.	07:30 PM	109.12	
34.	08:30 PM	102.70	
35.	09:30 PM	101.61	
36.	10:30 PM	102.05	
37.	11:30 PM	99.14	
38.	12:30 AM	96.19	
39.	01:30 AM	97.92	
40.	02:30 AM	93.43	
41.	03:30 AM	89.99	
42.	04:30 AM	88.11	
43.	05:30 AM	87.61	
44.	06:30 A.M	85.97	
45.	07:30 A.M	89.21	
46.	08:30 A.M	108.21	
47.	09:30 A.M	110.52	
48.	10:30 A.M	112.71	
PEQSAA			150 (µg/m³)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were µg/m³ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst:

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Integrated Environment Laboratory

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Shikarpur
Monitoring Date:	02-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Shikarpur		
GPS Coordinates:	27° 58' 3.920" N 68° 38' 19.672" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	09:00 A.M	1.03	13.34	15.76	16.81
2	10:00 A.M	1.2	13.9	16.12	14.7
3	11:00 A.M	1.18	14.3	16.77	14.05
4	12:00 P.M	1.13	13.61	17.12	15.01
5	01:00 P.M	1.38	15.09	17.6	13.07
6	02:00 P.M	1.26	14.87	17.77	14.45
7	03:00 P.M	1.1	14.63	16.57	12.85
8	04:00 PM	1.15	14.58	16.81	13.7
9	05:00 PM	1.04	14.1	14.1	13.75
10	06:00 PM	1.1	13.41	14.45	13.7
11	07:00 PM	1.12	13.22	15.12	13.78
12	08:00 PM	1.08	13.9	14.88	13.48
13	09:00 PM	1.07	12.91	13.87	14.14
14	10:00 PM	1.06	12.78	13.85	13.74
15	11:00 PM	1.06	13.1	14.1	13.46
16	12:00 AM	1.07	12.88	14.36	13.05
17	01:00 AM	1.06	13.14	14.13	13.45
18	02:00 AM	1.08	14.22	13.88	13.7
19	03:00 AM	1.07	14.1	14.17	12.85
20	04:00 AM	1.06	14	13.68	13.18
21	05:00 AM	1.06	14.44	13.88	12.48
22	06:00 A.M	1.09	13.21	13.74	12.64
23	07:00 A.M	1.1	13.63	13.42	12.85
24	08:00 A.M	1.08	12.1	13.78	13.59
Average Concentration		**1.10**	**13.72**	**14.9**	**13.68**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Monitoring Date:	03-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Khanpur, District Shikarpur		
GPS Coordinates:	28° 0' 5.916" N 68° 43' 27.962" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	10:00 A.M	0.74	11.45	14.87	16.32
2	11:00 A.M	0.91	12.01	15.23	14.21
3	12:00 P.M	0.89	12.41	15.88	13.56
4	01:00 P.M	0.84	11.72	16.23	14.52
5	02:00 P.M	1.09	13.2	16.71	12.58
6	03:00 P.M	0.97	12.98	16.88	13.96
7	04:00 PM	0.81	12.74	15.68	12.36
8	05:00 PM	0.86	12.69	15.92	13.21
9	06:00 PM	0.75	12.21	13.21	13.26
10	07:00 PM	0.81	11.52	13.56	13.21
11	08:00 PM	0.83	11.33	14.23	13.29
12	09:00 PM	0.79	12.01	13.99	12.99
13	10:00 PM	0.78	11.02	12.98	13.65
14	11:00 PM	0.77	10.89	12.96	13.25
15	12:00 AM	0.77	11.21	13.21	12.97
16	01:00 AM	0.78	10.99	13.47	12.56
17	02:00 AM	0.77	11.25	13.24	12.96
18	03:00 AM	0.79	12.33	12.99	13.21
19	04:00 AM	0.78	12.21	13.28	12.36
20	05:00 AM	0.77	12.11	12.79	12.69
21	06:00 A.M	0.77	12.55	12.99	11.99
22	07:00 A.M	0.8	11.32	12.85	12.15
23	08:00 A.M	0.81	11.74	12.53	12.36
24	09:00 A.M	0.79	10.21	12.89	13.1
Average Concentration		**0.81**	**11.83**	**14.10**	**13.19**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kashmore, District Kashmore
Monitoring Date:	05-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Kashmore, District Kashmore		
GPS Coordinates:	28° 26' 10.003" N 69° 34' 46.810" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	11:30 A.M	0.91	12.38	15.55	17.15
2	12:30 P.M	1.08	12.94	15.91	15.04
3	01:30 P.M	1.06	13.34	16.56	14.39
4	02:30 P.M	1.01	12.65	16.91	15.35
5	03:30 P.M	1.26	14.13	17.39	13.41
6	04:30 PM	1.14	13.91	17.56	14.79
7	05:33 PM	0.98	13.67	16.36	13.19
8	06:30 PM	1.03	13.62	16.6	14.04
9	07:30 PM	0.92	13.14	13.89	14.09
10	08:30 PM	0.98	12.45	14.24	14.04
11	09:30 PM	1.0	12.26	14.91	14.12
12	10:30 PM	0.96	12.94	14.67	13.82
13	11:30 PM	0.95	11.95	13.66	14.48
14	12:30 AM	0.94	11.82	13.64	14.08
15	01:30 AM	0.94	12.14	13.89	13.8
16	02:30 AM	0.95	11.92	14.15	13.39
17	03:30 AM	0.94	12.18	13.92	13.79
18	04:30 AM	0.96	13.26	13.67	14.04
19	05:30 AM	0.95	13.14	13.96	13.19
20	06:30 A.M	0.94	13.04	13.47	13.52
21	07:30 A.M	0.94	13.48	13.67	12.82
22	08:30 A.M	0.97	12.25	13.53	12.98
23	09:30 A.M	0.98	12.67	13.21	13.19
24	10:30 A.M	0.96	11.14	13.57	13.93
Average Concentration		**0.98**	**12.7**	**14.7**	**14.02**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
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Signature of Analyst

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kund Kot, District Kashmore
Monitoring Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Kund Kot, District Kashmore		
GPS Coordinates:	28° 14' 3.525" N 69° 11' 14.139" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	11:00 A.M	1.1	13.12	15.7	17.48
2	12:00 P.M	1.27	13.68	16.06	15.37
3	01:00 P.M	1.25	14.08	16.71	14.72
4	02:00 P.M	1.2	13.39	17.06	15.68
5	03:00 P.M	1.45	14.87	17.54	13.74
6	04:00 PM	1.33	14.65	17.71	15.12
7	05:00 PM	1.17	14.41	16.51	13.52
8	06:00 PM	1.22	14.36	16.75	14.37
9	07:00 PM	1.11	13.88	14.04	14.42
10	08:00 PM	1.17	13.19	14.39	14.37
11	09:00 PM	1.19	13	15.06	14.45
12	10:00 PM	1.15	13.68	14.82	14.15
13	11:00 PM	1.14	12.69	13.81	14.81
14	12:00 AM	1.13	12.56	13.79	14.41
15	01:00 AM	1.13	12.88	14.04	14.13
16	02:00 AM	1.14	12.66	14.3	13.72
17	03:00 AM	1.13	12.92	14.07	14.12
18	04:00 AM	1.15	14	13.82	14.37
19	05:00 AM	1.14	13.88	14.11	13.52
20	06:00 A.M	1.13	13.78	13.62	13.85
21	07:00 A.M	1.13	14.22	13.82	13.15
22	08:00 A.M	1.16	12.99	13.68	13.31
23	09:00 A.M	1.17	13.41	13.36	13.52
24	10:00 A.M	1.15	11.88	13.72	14.26
Average Concentration		**1.17**	**13.5**	**14.9**	**14.35**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan, District Rahim Yar Khan
Monitoring Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Rojhan, District Rahim Yar Khan		
GPS Coordinates:	28° 42' 54.555" N 69° 54' 2.354" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	11:30 A.M	1.08	11.98	15.83	17.29
2	12:30 P.M	1.25	12.54	16.19	15.18
3	01:30 P.M	1.23	12.94	16.84	14.53
4	02:30 P.M	1.18	12.25	17.19	15.49
5	03:30 P.M	1.43	13.73	17.67	13.55
6	04:30 PM	1.31	13.51	17.84	14.93
7	05:33 PM	1.15	13.27	16.64	13.33
8	06:30 PM	1.2	13.22	16.88	14.18
9	07:30 PM	1.09	12.74	14.17	14.23
10	08:30 PM	1.15	12.05	14.52	14.18
11	09:30 PM	1.17	11.86	15.19	14.26
12	10:30 PM	1.13	12.54	14.95	13.96
13	11:30 PM	1.12	11.55	13.94	14.62
14	12:30 AM	1.11	11.42	13.92	14.22
15	01:30 AM	1.11	11.74	14.17	13.94
16	02:30 AM	1.12	11.52	14.43	13.53
17	03:30 AM	1.11	11.78	14.2	13.93
18	04:30 AM	1.13	12.86	13.95	14.18
19	05:30 AM	1.12	12.74	14.24	13.33
20	06:30 A.M	1.11	12.64	13.75	13.66
21	07:30 A.M	1.11	13.08	13.95	12.96
22	08:30 A.M	1.14	11.85	13.81	13.12
23	09:30 A.M	1.15	12.27	13.49	13.33
24	10:30 A.M	1.13	10.74	13.85	14.07
Average Concentration		**1.15**	**12.36**	**15.06**	**14.16**
PEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rajanpur, District Rajanpur
Monitoring Date:	08-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Rajanpur, District Rajanpur		
GPS Coordinates:	29° 2' 25.884" N 70° 19' 57.962" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	09:00 A.M	0.98	12.5	15.7	16.99
2	10:00 A.M	1.15	13.06	16.06	14.88
3	11:00 A.M	1.13	13.46	16.71	14.23
4	12:00 P.M	1.08	12.77	17.06	15.19
5	01:00 P.M	1.33	14.25	17.54	13.25
6	02:00 P.M	1.21	14.03	17.71	14.63
7	03:00 P.M	1.05	13.79	16.51	13.03
8	04:00 PM	1.1	13.74	16.75	13.88
9	05:00 PM	0.99	13.26	14.04	13.93
10	06:00 PM	1.05	12.57	14.39	13.88
11	07:00 PM	1.07	12.38	15.06	13.96
12	08:00 PM	1.03	13.06	14.82	13.66
13	09:00 PM	1.02	12.07	13.81	14.32
14	10:00 PM	1.01	11.94	13.79	13.92
15	11:00 PM	1.01	12.26	14.04	13.64
16	12:00 AM	1.02	12.04	14.3	13.23
17	01:00 AM	1.01	12.3	14.07	13.63
18	02:00 AM	1.03	13.38	13.82	13.88
19	03:00 AM	1.02	13.26	14.11	13.03
20	04:00 AM	1.01	13.16	13.62	13.36
21	05:00 AM	1.01	13.6	13.82	12.66
22	06:00 A.M	1.04	12.37	13.68	12.82
23	07:00 A.M	1.05	12.79	13.36	13.03
24	08:00 A.M	1.03	11.26	13.72	13.77
Average Concentration		**1.05**	**12.88**	**14.93**	**13.86**
PEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
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AMBIENT NOISE MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Shikarpur
Monitoring Date:	02-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Noise	**Monitoring**	Noise Meter-IEC651-
Location:	Shikarpur	**Instrument:**	Type-2
GPS Coordinates:	27° 58' 3.920" N 68° 38' 19.672" E		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	09:00 A.M	dB(A)	58.9	61.8	60.35
2.	10:00 A.M		58.7	61.6	60.15
3.	11:00 A.M		58.5	61.4	59.95
4.	12:00 P.M		58.3	61.2	59.75
5.	01:00 P.M		58	60.9	59.45
6.	02:00 P.M		57.8	60.7	59.25
7.	03:00 P.M		57.6	60.5	59.05
8.	04:00 PM		57.4	60.3	58.85
9.	05:00 PM		57.2	60.1	58.65
10.	06:00 PM		57	59.9	58.45
11.	07:00 PM		56.7	59.6	58.15
12.	08:00 PM		56.5	59.4	57.95
13.	09:00 PM		56.3	59.2	57.75
14.	10:00 PM		56.1	59	57.55
15.	11:00 PM		55.9	58.8	57.35
16.	12:00 AM		55.6	58.5	57.05
17.	01:00 AM		55.4	58.3	56.85
18.	02:00 AM		55.2	58.1	56.65
19.	03:00 AM		55	57.9	56.45
20.	04:00 AM		54.8	57.6	56.2
21.	05:00 AM		54.5	57.4	55.95
22.	06:00 A.M		54.3	57.2	55.75
23.	07:00 A.M		54.1	57	55.55
24.	08:00 A.M		53.9	56.8	55.35

SEQS limit : 70 dB Day Time
60 dB Night Time

SEQS: Sindh Environmental Quality Standards for Ambient Noise

Note:

- Selected measurement units were dB(A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
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- The report is not valid for court.

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

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AMBIENT NOISE MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Monitoring Date:	03-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Noise	**Monitoring**	Noise Meter-IEC651-
Location:	Khanpur, District Shikarpur	**Instrument:**	Type-2
GPS Coordinates:	28° 0' 5.916" N 68° 43' 27.962" E		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	10:00 A.M	dB(A)	60.8	63.7	62.25
2.	11:00 A.M		60.6	63.5	62.05
3.	12:00 P.M		60.4	63.3	61.85
4.	01:00 P.M		60.2	63.1	61.65
5.	02:00 P.M		59.9	62.8	61.35
6.	03:00 P.M		59.7	62.6	61.15
7.	04:00 PM		59.5	62.4	60.95
8.	05:00 PM		59.3	62.2	60.75
9.	06:00 PM		59.1	62	60.55
10.	07:00 PM		58.9	61.8	60.35
11.	08:00 PM		58.6	61.5	60.05
12.	09:00 PM		58.4	61.3	59.85
13.	10:00 PM		58.2	61.1	59.65
14.	11:00 PM		58	60.9	59.45
15.	12:00 AM		57.8	60.7	59.25
16.	01:00 AM		57.5	60.4	58.95
17.	02:00 AM		57.3	60.2	58.75
18.	03:00 AM		57.1	60	58.55
19.	04:00 AM		56.9	59.8	58.35
20.	05:00 AM		56.7	59.5	58.1
21.	06:00 A.M		56.4	59.3	57.85
22.	07:00 A.M		56.2	59.1	57.65
23.	08:00 A.M		56	58.9	57.45
24.	09:00 A.M		55.8	58.7	57.25

SEQS limit : 70 dB Day Time
60 dB Night Time

SEQS: Sindh Environmental Quality Standards for Ambient Noise

Note:

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AMBIENT NOISE MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kund Kot, District Kashmore
Monitoring Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Noise	**Monitoring Instrument:**	Noise Meter-IEC651-Type-2
Location:	Kund Kot, District Kashmore		
GPS Coordinates:	28° 14' 3.525" N 69° 11' 14.139" E		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	11:00 A.M	dB(A)	61.5	64.4	62.95
2.	12:00 P.M		61.3	64.2	62.75
3.	01:00 P.M		61.1	64	62.55
4.	02:00 P.M		60.9	63.8	62.35
5.	03:00 P.M		60.6	63.5	62.05
6.	04:00 PM		60.4	63.3	61.85
7.	05:00 PM		60.2	63.1	61.65
8.	06:00 PM		60	62.9	61.45
9.	07:00 PM		59.8	62.7	61.25
10.	08:00 PM		59.6	62.5	61.05
11.	09:00 PM		59.3	62.2	60.75
12.	10:00 PM		59.1	62	60.55
13.	11:00 PM		58.9	61.8	60.35
14.	12:00 AM		58.7	61.6	60.15
15.	01:00 AM		58.5	61.4	59.95
16.	02:00 AM		58.2	61.1	59.65
17.	03:00 AM		58	60.9	59.45
18.	04:00 AM		57.8	60.7	59.25
19.	05:00 AM		57.6	60.5	59.05
20.	06:00 A.M		57.4	60.2	58.8
21.	07:00 A.M		57.1	60	58.55
22.	08:00 A.M		56.9	59.8	58.35
23.	09:00 A.M		56.7	59.6	58.15
24.	10:00 A.M		56.5	59.4	57.95

SEQS limit : 70 dB Day Time
60 dB Night Time

SEQS: Sindh Environmental Quality Standards for Ambient Noise

Note:

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AMBIENT NOISE MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kashmore, District Kashmore
Monitoring Date:	05-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Noise	**Monitoring Instrument:**	Noise Meter-IEC651-Type-2
Location:	Kashmore, District Kashmore		
GPS Coordinates:	28° 26' 10.003" N 69° 34' 46.810" E		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	11:30 A.M	dB(A)	63.5	66.4	64.95
2.	12:30 P.M		63.3	66.2	64.75
3.	01:30 P.M		63.1	66	64.55
4.	02:30 P.M		62.9	65.8	64.35
5.	03:30 P.M		62.6	65.5	64.05
6.	04:30 PM		62.4	65.3	63.85
7.	05:33 PM		62.2	65.1	63.65
8.	06:30 PM		62	64.9	63.45
9.	07:30 PM		61.8	64.7	63.25
10.	08:30 PM		61.6	64.5	63.05
11.	09:30 PM		61.3	64.2	62.75
12.	10:30 PM		61.1	64	62.55
13.	11:30 PM		60.9	63.8	62.35
14.	12:30 AM		60.7	63.6	62.15
15.	01:30 AM		60.5	63.4	61.95
16.	02:30 AM		60.2	63.1	61.65
17.	03:30 AM		60	62.9	61.45
18.	04:30 AM		59.8	62.7	61.25
19.	05:30 AM		59.6	62.5	61.05
20.	06:30 A.M		59.4	62.2	60.8
21.	07:30 A.M		59.1	62	60.55
22.	08:30 A.M		58.9	61.8	60.35
23.	09:30 A.M		58.7	61.6	60.15
24.	10:30 A.M		58.5	61.4	59.95
SEQS limit : 70 dB Day Time 60 dB Night Time					

SEQS: Sindh Environmental Quality Standards for Ambient Noise

Note:

- Selected measurement units were dB(A) otherwise stated.
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AMBIENT NOISE MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan, District Rahim Yar Khan
Monitoring Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Noise	**Monitoring**	Noise Meter-IEC651-
Location:	Rojhan, District Rahim Yar Khan	**Instrument:**	Type-2
GPS Coordinates:	28° 42' 54.555" N 69° 54' 2.354" E		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	11:30 A.M	dB(A)	60.4	63.3	61.85
2.	12:30 P.M		60.2	63.1	61.65
3.	01:30 P.M		60	62.9	61.45
4.	02:30 P.M		59.8	62.7	61.25
5.	03:30 P.M		59.5	62.4	60.95
6.	04:30 PM		59.3	62.2	60.75
7.	05:33 PM		59.1	62	60.55
8.	06:30 PM		58.9	61.8	60.35
9.	07:30 PM		58.7	61.6	60.15
10.	08:30 PM		58.5	61.4	59.95
11.	09:30 PM		58.2	61.1	59.65
12.	10:30 PM		58	60.9	59.45
13.	11:30 PM		57.8	60.7	59.25
14.	12:30 AM		57.6	60.5	59.05
15.	01:30 AM		57.4	60.3	58.85
16.	02:30 AM		57.1	60	58.55
17.	03:30 AM		56.9	59.8	58.35
18.	04:30 AM		56.7	59.6	58.15
19.	05:30 AM		56.5	59.4	57.95
20.	06:30 A.M		56.3	59.1	57.7
21.	07:30 A.M		56	58.9	57.45
22.	08:30 A.M		55.8	58.7	57.25
23.	09:30 A.M		55.6	58.5	57.05
24.	10:30 A.M		55.4	58.3	56.85

PEQS limit : 70 dB Day Time
60 dB Night Time

PEQS: Punjab Environmental Quality Standards for Ambient Noise

Note:

- Selected measurement units were dB(A) otherwise stated.
- Quality was assured through self calibration of the instrument.
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Signature of Analyst

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AMBIENT NOISE MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rajanpur, District Rajanpur
Monitoring Date:	08-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Noise	**Monitoring Instrument:**	Noise Meter-IEC651-Type-2
Location:	Rajanpur, District Rajanpur		
GPS Coordinates:	29° 2' 25.884" N 70° 19' 57.962" E		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	09:00 A.M	dB(A)	63.4	66.3	64.85
2.	10:00 A.M		63.2	66.1	64.65
3.	11:00 A.M		63	65.9	64.45
4.	12:00 P.M		62.8	65.7	64.25
5.	01:00 P.M		62.5	65.4	63.95
6.	02:00 P.M		62.3	65.2	63.75
7.	03:00 P.M		62.1	65	63.55
8.	04:00 PM		61.9	64.8	63.35
9.	05:00 PM		61.7	64.6	63.15
10.	06:00 PM		61.5	64.4	62.95
11.	07:00 PM		61.2	64.1	62.65
12.	08:00 PM		61	63.9	62.45
13.	09:00 PM		60.8	63.7	62.25
14.	10:00 PM		60.6	63.5	62.05
15.	11:00 PM		60.4	63.3	61.85
16.	12:00 AM		60.1	63	61.55
17.	01:00 AM		59.9	62.8	61.35
18.	02:00 AM		59.7	62.6	61.15
19.	03:00 AM		59.5	62.4	60.95
20.	04:00 AM		59.3	62.1	60.7
21.	05:00 AM		59	61.9	60.45
22.	06:00 A.M		58.8	61.7	60.25
23.	07:00 A.M		58.6	61.5	60.05
24.	08:00 A.M		58.4	61.3	59.85
PEQS limit : 70 dB Day Time 60 dB Night Time					

PEQS: Punjab Environmental Quality Standards for Ambient Noise

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Shikarpur
Sampling Date:	02-07-2020	**Reporting Date:**	13-07-2020
Source:	Ground Water	**Monitoring**	APHA/USEPA Standard
Location:	Shikarpur	**Method:**	Methods
GPS Coordinates:	27° 57' 49.841" N 68° 39' 33.252" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	6.3
2	Taste & Odor	In-house	--	Non Objectionable	Salted
3	Color	APHA-2120 B/C	TCU	<15	8
4	Turbidity	APHA-2130 B	NTU	<5	5
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	861
8	Total Hardness	APHA-2340 C	mg/L	<500	119
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	4.7
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.06
11	Ammonia	APHA-4500-NH3-B	mg/L	---	0.58
12	Arsenic	APHA-3500As B	mg/L	<0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	102
16	Fluoride	APHA-4500F- C	mg/L	<1.5	0.49

SEQS: Sindh Environmental Quality Standards for Drinking Water **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Sampling Date:	03-07-2020	**Reporting Date:**	13-07-2020
Source:	Ground Water	**Monitoring**	APHA/USEPA Standard
Location:	Khanpur	**Method:**	Methods
GPS Coordinates:	28° 0' 8.283" N 68° 43' 25.503" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	5.9
2	Taste & Odor	In-house	--	Non Objectionable	Salted
3	Color	APHA-2120 B/C	TCU	<15	7
4	Turbidity	APHA-2130 B	NTU	<5	6
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	942
8	Total Hardness	APHA-2340 C	mg/L	<500	106
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	4.1
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.05
11	Ammonia	APHA-4500-NH3-B	mg/L	---	0.72
12	Arsenic	APHA-3500As B	mg/L	<0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	117
16	Fluoride	APHA-4500F- C	mg/L	<1.5	0.61

SEQS: Sindh Environmental Quality Standards for Drinking Water **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Sampling Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Ground Water	**Monitoring Method:**	APHA/USEPA Standard Methods
Location:	Niaz Hussain Jatoi		
GPS Coordinates:	28° 5' 13.150" N 68° 57' 32.143" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	6.9
2	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable
3	Color	APHA-2120 B/C	TCU	<15	5
4	Turbidity	APHA-2130 B	NTU	<5	3
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	289
8	Total Hardness	APHA-2340 C	mg/L	<500	59
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	3.3
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.0054
11	Ammonia	APHA-4500-NH3-B	mg/L	---	0.057
12	Arsenic	APHA-3500As B	mg/L	<0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	56
16	Fluoride	APHA-4500F- C	mg/L	<1.5	0.84

SEQS: Sindh Environmental Quality Standards for Drinking Water **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kashmore, District Kashmore
Sampling Date:	05-07-2020	**Reporting Date:**	13-07-2020
Source:	Ground Water	**Monitoring**	APHA/USEPA Standard
Location:	Kashmore	**Method:**	Methods
GPS Coordinates:	28° 26' 2.617" N 69° 34' 33.757" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	6.1
2	Taste & Odor	In-house	--	Non Objectionable	salted
3	Color	APHA-2120 B/C	TCU	<15	11
4	Turbidity	APHA-2130 B	NTU	<5	7
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	1068
8	Total Hardness	APHA-2340 C	mg/L	<500	122
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	6.7
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.91
11	Ammonia	APHA-4500-NH3-B	mg/L	---	1.8
12	Arsenic	APHA-3500As B	mg/L	<0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	202
16	Fluoride	APHA-4500F- C	mg/L	<1.5	0.98

SEQS: Sindh Environmental Quality Standards for Drinking Water **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan, District Rahim Yar Khan
Sampling Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Ground Water	**Monitoring**	APHA/USEPA Standard
Location:	Rojhan	**Method:**	Methods
GPS Coordinates:	28° 42' 55.473" N 69° 54' 1.071" E		

Sr. No.	Parameters	Analysis Method	Units	PEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	6.8
2	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable
3	Color	APHA-2120 B/C	TCU	<15	6
4	Turbidity	APHA-2130 B	NTU	<5	5
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	372
8	Total Hardness	APHA-2340 C	mg/L	<500	94
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	4.1
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.09
11	Ammonia	APHA-4500-NH3-B	mg/L	---	0.083
12	Arsenic	APHA-3500As B	mg/L	≤0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	72
16	Fluoride	APHA-4500F- C	mg/L	<1.5	0.91

PEQS: Punjab Environmental Quality Standards for Drinking Water **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rajanpur, District Rahim Yar Khan
Sampling Date:	08-07-2020	**Reporting Date:**	13-07-2020
Source:	Ground Water	**Monitoring Method:**	APHA/USEPA Standard Methods
Location:	Rajanpur		
GPS Coordinates:	29° 05' 14.150" N 70° 19' 30.944" E		

Sr. No.	Parameters	Analysis Method	Units	PEQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	6.4
2	Taste & Odor	In-house	--	Non Objectionable	Salted
3	Color	APHA-2120 B/C	TCU	<15	9
4	Turbidity	APHA-2130 B	NTU	<5	6
5	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	1094
8	Total Hardness	APHA-2340 C	mg/L	<500	267
9	Nitrate	APHA-4500NO3 B	mg/L	≤50	7.6
10	Nitrite	APHA-4500NO2 B	mg/L	≤3	0.85
11	Ammonia	APHA-4500-NH3-B	mg/L	---	1.94
12	Arsenic	APHA-3500As B	mg/L	<0.05	N.D.
13	Antimony	APHA-3500Sb B	mg/L	<0.005	N.D.
14	Barium	APHA-3500Ba B	mg/L	0.7	N.D.
15	Chloride	APHA-4500Cl- B	mg/L	250	194
16	Fluoride	APHA-4500F- C	mg/L	<1.5	1.1

PEQS: Punjab Environmental Quality Standards for Drinking Water **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Sampling Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring**	APHA/USEPA Standard
Location:	Niaz Hussain Jatoi	**Method:**	Methods
GPS Coordinates:	28° 3' 46.240" N 68° 54' 49.258" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	Temperature	--	°C	40	18
2	pH	APHA-4500H+ B	---	6-9	7.9
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	2130
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	103
5	Biological Oxygen Demand (BOD_5) at 20 °C	APHA, 5210	mg/L	80	76
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.003
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	110
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.040
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	0.25
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.037
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	114
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.089
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.02
15	Boron	APHA-4500B-C	mg/L	6.0	0.07
16	Barium	APHA-3500Ba B	mg/L	1.5	0.06

SEQS: Sindh Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

Note:

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- Quality was assured through self calibration of the instrument.
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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Sampling Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring Method:**	APHA/USEPA Standard Methods
Location:	Niaz Hussain Jatoi		
GPS Coordinates:	28° 4' 57.062" N 68° 57' 27.422" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	Temperature	--	°C	40	16
2	pH	APHA-4500H+ B	---	6-9	7.8
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	1934
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	127
5	Biological Oxygen Demand (BOD_5) at 20 ^{0}C	APHA, 5210	mg/L	80	83
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.07
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	129
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.41
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	0.33
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.046
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	122
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.092
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.04
15	Boron	APHA-4500B-C	mg/L	6.0	0.08
16	Barium	APHA-3500Ba B	mg/L	1.5	0.056

SEQS: Sindh Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

Note:

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- The report is not valid for court.

Signature of Analyst:

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kund Kot, District Kashmore
Sampling Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring**	APHA/USEPA Standard
Location:	Khandh Kot	**Method:**	Methods
GPS Coordinates:	28° 13' 39.558" N 69° 10' 37.332" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	Temperature	--	°C	40	18
2	pH	APHA-4500H+ B	---	6-9	8.1
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	2371
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	116
5	Biological Oxygen Demand (BOD_5) at 20 ^{o}C	APHA, 5210	mg/L	80	79
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.09
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	136
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.53
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	0.81
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.051
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	142
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.08
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.06
15	Boron	APHA-4500B-C	mg/L	6.0	0.16
16	Barium	APHA-3500Ba B	mg/L	1.5	0.049

SEQS: Sindh Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Bakshapur, District Kashmore
Sampling Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring**	APHA/USEPA Standard
Location:	Bakshapur	**Method:**	Methods
GPS Coordinates:	28° 21' 2.623" N 69° 22' 35.950" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	Temperature	--	°C	40	16
2	pH	APHA-4500H+ B	---	6-9	7.9
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	2087
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	128
5	Biological Oxygen Demand (BOD_5) at 20 ^{0}C	APHA, 5210	mg/L	80	81
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.06
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	149
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.51
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	0.73
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.067
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	162
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.09
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.05
15	Boron	APHA-4500B-C	mg/L	6.0	0.08
16	Barium	APHA-3500Ba B	mg/L	1.5	0.026

SEQS: Sindh Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Bakshapur, District Kashmore
Sampling Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring**	APHA/USEPA Standard
Location:	Bakshapur	**Method:**	Methods
GPS Coordinates:	28° 25' 35.551" N 69° 28' 22.012" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	Temperature	--	°C	40	15
2	pH	APHA-4500H+ B	---	6-9	7.8
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	1993
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	124
5	Biological Oxygen Demand (BOD_5) at 20 °C	APHA, 5210	mg/L	80	76
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.09
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	143
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.67
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	0.82
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.073
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	192
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.6
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.12
15	Boron	APHA-4500B-C	mg/L	6.0	0.08
16	Barium	APHA-3500Ba B	mg/L	1.5	0.034

SEQS: Sindh Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kashmore, District Kashmore
Sampling Date:	05-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring**	APHA/USEPA Standard
Location:	Kashmorer	**Method:**	Methods
GPS Coordinates:	28° 26' 46.258" N 69° 36' 26.018" E		

Sr. No.	Parameters	Analysis Method	Units	SEQS	Results
1	Temperature	--	°C	40	19
2	pH	APHA-4500H+ B	---	6-9	8
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	2167
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	116
5	Biological Oxygen Demand (BOD_5) at 20 °C	APHA, 5210	mg/L	80	73
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.08
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	152
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.82
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	0.93
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.087
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	167
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.7
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.09
15	Boron	APHA-4500B-C	mg/L	6.0	0.05
16	Barium	APHA-3500Ba B	mg/L	1.5	0.044

SEQS: Sindh Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan , District Rahim Yar Khan
Sampling Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring Method:**	APHA/USEPA Standard Methods
Location:	Rojhan		
GPS Coordinates:	28° 41' 35.757" N 69° 52' 8.585" E		

Sr. No.	Parameters	Analysis Method	Units	PEQS	Results
1	Temperature	--	°C	40	18
2	pH	APHA-4500H+ B	---	6-9	7.8
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	1854
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	127
5	Biological Oxygen Demand (BOD_5) at 20 ^{0}C	APHA, 5210	mg/L	80	69
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.06
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	272
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.97
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	1.03
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.093
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	142
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.9
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.06
15	Boron	APHA-4500B-C	mg/L	6.0	0..07
16	Barium	APHA-3500Ba B	mg/L	1.5	0.62

PEQS: Punjab Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

Note:

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WATER ANALYSIS REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rajanpur , District Rahim Yar Khan
Sampling Date:	08-07-2020	**Reporting Date:**	13-07-2020
Source:	Surface / Wastewater	**Monitoring Method:**	APHA/USEPA Standard Methods
Location:	Kot Mithan		
GPS Coordinates:	28° 57' 20.958" N 70° 18' 47.190" E		

Sr. No.	Parameters	Analysis Method	Units	PEQS	Results
1	Temperature	--	°C	40	16
2	pH	APHA-4500H+ B	---	6-9	7.9
3	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	3500	1963
4	Chemical Oxygen Demand (COD)	APHA-5220-D	mg/L	150	135
5	Biological Oxygen Demand (BOD_5) at 20 ^{0}C	APHA, 5210	mg/L	80	71
6	Phenolic Compounds as Phenols	APHA-5530 D	mg/L	0.1	0.08
7	Chloride (Cl^-)	APHA-4500Cl- B	mg/L	1000	261
8	Copper (Cu^+)	APHA-3500Cu B	mg/L	1.0	0.86
9	Total Iron (Fe+)	APHA-3500-Fe-B	mg/L	8.0	0.96
10	Lead (Pb^+)	APHA-3500-Pb B	mg/L	0.5	N.D.
11	Manganese	APHA-3500-Mn B	mg/L	1.5	0.14
12	Sulfate (SO_4)	APHA-4500-SO4C	mg/L	600	168
13	Zinc (Zn)	APHA-3500-Zn B	mg/L	5.0	0.81
14	Silver	APHA-3500Ag-B	mg/L	1.0	0.54
15	Boron	APHA-4500B-C	mg/L	6.0	0.19
16	Barium	APHA-3500Ba B	mg/L	1.5	0.13

PEQS: Punjab Environmental Quality Standards for municipal Effluents **N.D:** Not Detected

Note:

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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Monitoring Date:	03-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Khanpur, District Shikarpur		
GPS Coordinates:	28° 0' 5.916" N 68° 43' 27.962" E		

Sr. No.	Time	Parameters	Results (Average 24 Hrs)
	Hours	PM_{10} (µg/m^3)	PM_{10} (µg/m^3)
1.	10:00 A.M	87.6	
2.	11:00 A.M	89.3	
3.	12:00 P.M	102.5	
4.	01:00 P.M	119.3	
5.	02:00 P.M	122.6	
6.	03:00 P.M	141.9	
7.	04:00 PM	119.8	
8.	05:00 PM	121.7	
9.	06:00 PM	128.5	
10.	07:00 PM	98.29	
11.	08:00 PM	106.71	
12.	09:00 PM	103.62	102.802
13.	10:00 PM	102.57	
14.	11:00 PM	95.16	
15.	12:00 AM	97.18	
16.	01:00 AM	96.91	
17.	02:00 AM	94.45	
18.	03:00 AM	85.97	
19.	04:00 AM	85.11	
20.	05:00 AM	86.81	
21.	06:00 A.M	85.87	
22.	07:00 A.M	86.21	
23.	08:00 A.M	104.41	
24.	09:00 A.M	104.78	
SEQSAA			150 (µg/m^3)

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Shikarpur
Monitoring Date:	02-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Shikarpur		
GPS Coordinates:	27° 58' 3.920" N 68° 38' 19.672" E		

Sr. No.	Time	Parameters	Results (Average 24 Hrs)
	Hours	PM_{10} (µg/m^3)	PM_{10} (µg/m^3)
1.	09:00 A.M	102.21	100.729
2.	10:00 A.M	110.08	
3.	11:00 A.M	102.53	
4.	12:00 P.M	112.82	
5.	01:00 P.M	110.27	
6.	02:00 P.M	109.56	
7.	03:00 P.M	107.03	
8.	04:00 PM	105.81	
9.	05:00 PM	102.59	
10.	06:00 PM	101.07	
11.	07:00 PM	99.34	
12.	08:00 PM	100.82	
13.	09:00 PM	98.1	
14.	10:00 PM	97.37	
15.	11:00 PM	96.85	
16.	12:00 AM	94.12	
17.	01:00 AM	93.59	
18.	02:00 AM	94.88	
19.	03:00 AM	95.31	
20.	04:00 AM	93.62	
21.	05:00 AM	94.47	
22.	06:00 A.M	96.75	
23.	07:00 A.M	97.66	
24.	08:00 A.M	100.65	
SEQSAA			150 (µg/m^3)

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rajanpur, District Rajanpur
Monitoring Date:	08-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Rajanpur, District Rajanpur		
GPS Coordinates:	29° 2' 25.884" N 70° 19' 57.962" E		

Sr. No.	Time	Parameters	Results (Average 24 Hrs)
	Hours	PM_{10} (µg/m^3)	PM_{10} (µg/m^3)
1.	09:00 A.M	105.21	100.915
2.	10:00 A.M	111.08	
3.	11:00 A.M	109.53	
4.	12:00 P.M	110.82	
5.	01:00 P.M	110.27	
6.	02:00 P.M	109.56	
7.	03:00 P.M	107.03	
8.	04:00 PM	102.81	
9.	05:00 PM	101.59	
10.	06:00 PM	101.07	
11.	07:00 PM	99.34	
12.	08:00 PM	100.02	
13.	09:00 PM	98.1	
14.	10:00 PM	97.37	
15.	11:00 PM	96.85	
16.	12:00 AM	94.12	
17.	01:00 AM	93.59	
18.	02:00 AM	94.88	
19.	03:00 AM	95.31	
20.	04:00 AM	93.62	
21.	05:00 AM	95.41	
22.	06:00 A.M	96.71	
23.	07:00 A.M	97.62	
24.	08:00 A.M	100.05	
PEQSAA			150 (µg/m^3)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

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- Quality was assured through self calibration of the instrument.
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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan, District Rahim Yar Khan
Monitoring Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Rojhan, District Rahim Yar Khan		
GPS Coordinates:	28° 42' 54.555" N 69° 54' 2.354" E		

Sr. No.	Time	Parameters	Results (Average 24 Hrs)
	Hours	PM_{10} (µg/m^3)	PM_{10} (µg/m^3)
25.	11:30 A.M	101.31	104.161
26.	12:30 P.M	105.52	
27.	01:30 P.M	109.31	
28.	02:30 P.M	120.61	
29.	03:30 P.M	124.93	
30.	04:30 PM	119.18	
31.	05:33 PM	120.17	
32.	06:30 PM	122.25	
33.	07:30 PM	109.12	
34.	08:30 PM	102.70	
35.	09:30 PM	101.61	
36.	10:30 PM	102.05	
37.	11:30 PM	99.14	
38.	12:30 AM	98.19	
39.	01:30 AM	97.92	
40.	02:30 AM	93.43	
41.	03:30 AM	89.99	
42.	04:30 AM	88.11	
43.	05:30 AM	87.81	
44.	06:30 A.M	85.87	
45.	07:30 A.M	89.21	
46.	08:30 A.M	108.21	
47.	09:30 A.M	110.52	
48.	10:30 A.M	112.71	
PEQSAA			150 (µg/m^3)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were µg/m^3 otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst:

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www. iec-consultants.com

Environmental Protection Agency (EPA-KPK) Certified

Integrated Environment Laboratory

EPA Accredited

AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kashmore, District Kashmore
Monitoring Date:	05-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Kashmore, District Kashmore		
GPS Coordinates:	28° 26' 10.003" N 69° 34' 46.810" E		

Sr. No.	Time	Parameters	Results (Average 24 Hrs)
	Hours	PM_{10} (µg/m^3)	PM_{10} (µg/m^3)
1.	11:30 A.M	108.31	
2.	12:30 P.M	105.52	
3.	01:30 P.M	109.31	
4.	02:30 P.M	120.61	
5.	03:30 P.M	124.93	
6.	04:30 PM	119.18	
7.	05:33 PM	120.17	
8.	06:30 PM	122.25	
9.	07:30 PM	109.12	
10.	08:30 PM	102.70	
11.	09:30 PM	101.61	
12.	10:30 PM	100.52	
13.	11:30 PM	98.14	103.889
14.	12:30 AM	97.19	
15.	01:30 AM	96.92	
16.	02:30 AM	93.43	
17.	03:30 AM	89.99	
18.	04:30 AM	88.11	
19.	05:30 AM	86.81	
20.	06:30 A.M	84.87	
21.	07:30 A.M	85.21	
22.	08:30 A.M	109.21	
23.	09:30 A.M	109.52	
24.	10:30 A.M	109.71	
SEQSAA			150 (µg/m^3)

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were µg/m^3 otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst:

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

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Environmental Protection Agency (EPA-KPK) Certified

Annex IV: Predicted Noise Level for Sensitive Receptors Located at the Distance of 20 meters

Activity	Source	Typical Peak Sound Level in Work Cycle (Lm)	Typical MInimum Sound Level in Work Cycle (Lb)	Lm-Lb	Fraction of time spent at peak in work Cycle (Ta/T)	Equivalency Factor (E.f)	Noise level emissions Leq (h)=E.L =Lj+EF	Estimated Distance from Equipment to Observer (D) E	Usage Factor (UF)	Equipment Leq(h) at Receptor (dbA) Leq (h)	Leq(h) Site at Receptor db(A)
Clearing, earthwork, foundation, piling, super structure etc.	Wheel Loader	90	83	7	1	0	90	20	0.4	84	107
	Grader	90	82	8	1	0	90	20	0.4	84	
	Vibration roller	86	82	4	1	0	86	20	0.4	80	
	2-wheel vibration roller	81	85	-4	1	0	81	20	0.4	75	
	3-wheel roller	81	85	-4	1	0	81	20	0.4	75	
	Tire roller	76	85	-9	1	0	76	20	0.6	71	
	Bulldozer	86	85	1	1	0	86	20	0.5	81	
	Tire Pen-dredger	84	85	-1	1	0	84	20	0.3	76	
	Sprayer	87	80	7	1	0	87	20	0.4	81	
	Power Generator	98	85	13	1	0	98	20	0.2	89	
	Impact drill	87	85	2	1	0	87	20	0.2	78	
	Impact piling	112	80	32	1	0	112	20	0.5	107	
	Concrete Mixer	92	85	7	1	0	92	20	0.2	83	
	Truck	91	55	36	1	0	91	20	0.4	85	
	Concrete Pump	85	84	1	1	0	85	20	0.4	79	
	Mobile Lift	96	84	12	1	0	96	20	0.4	90	
	Pneumatic Hammer	98	84	14	1	0	98	20	0.4	92	
	Breaker	84	80	4	1	0	84	20	0.4	78	
	Pneumatic Spanner	95	85	10	1	0	95	20	0.3	87	
	Steel Cutting Machine	85	85	0	1	0	85	20	0.4	79	
	Steel Bending Machine	80	80	0	1	0	80	20	0.5	75	
	Water Bowzer	80	80	0	1	0	80	20	0.2	71	
	Fuel Pump	82	82	0	1	0	82	20	0.4	76	
	Dumpers	70	82	-12	1	0	70	20	0.4	64	
	Excavator	70	72	-2	1	0	70	20	0.4	64	
	Dewatering Pump (Diesel)	77	77	0	1	0	77	20	0.5	72	
	Drills	80	77	3	1	0	80	20	0.5	75	
	Trailer	84	84	0	1	0	84	20	0.6	79	

Predicted Noise Level for Sensitive Receptors Located at the Distance of 40 meters

Activity	Source	Typical Peak Sound Level in Work Cycle (Lm)	Typical MInimum Sound Level in Work Cycle (Lb)	Lm-Lb	Fraction of time spent at peak in work Cycle (Ta/T)	Equivalency Factor (E.f)	Noise level emissions Leq (h)=E.L =Lj+EF	Estimated Distance from Equipment to Observer (D) E	Usage Factor (UF)	Equipment Leq(h) at Receptor (dbA) Leq (h)	Leq(h) Site at Receptor db(A)
Clearing, earthwork, foundation, piling, super structure etc.	Wheel Loader	90	83	7	1	0	90	40	0.4	78	101
	Grader	90	82	8	1	0	90	40	0.4	78	
	Vibration roller	86	82	4	1	0	86	40	0.4	74	
	2-wheel vibration roller	81	85	-4	1	0	81	40	0.4	69	
	3-wheel roller	81	85	-4	1	0	81	40	0.4	69	
	Tire roller	76	85	-9	1	0	76	40	0.6	65	
	Bulldozer	86	85	1	1	0	86	40	0.5	75	
	Tire Pen-dredger	84	85	-1	1	0	84	40	0.3	70	
	Sprayer	87	80	7	1	0	87	40	0.4	75	
	Power Generator	98	85	13	1	0	98	40	0.2	83	
	Impact drill	87	85	2	1	0	87	40	0.2	72	
	Impact piling	112	80	32	1	0	112	40	0.5	101	
	Concrete Mixer	92	85	7	1	0	92	40	0.2	77	
	Truck	91	55	36	1	0	91	40	0.4	79	
	Concrete Pump	85	84	1	1	0	85	40	0.4	73	
	Mobile Lift	96	84	12	1	0	96	40	0.4	84	
	Pneumatic Hammer	98	84	14	1	0	98	40	0.4	86	
	Breaker	84	80	4	1	0	84	40	0.4	72	
	Pneumatic Spanner	95	85	10	1	0	95	40	0.3	81	
	Steel Cutting Machine	85	85	0	1	0	85	40	0.4	73	
	Steel Bending Machine	80	80	0	1	0	80	40	0.5	69	
	Water Bowzer	80	80	0	1	0	80	40	0.2	65	
	Fuel Pump	82	82	0	1	0	82	40	0.4	70	
	Dumpers	70	82	-12	1	0	70	40	0.4	58	
	Excavator	70	72	-2	1	0	70	40	0.4	58	
	Dewatering Pump (Diesel)	77	77	0	1	0	77	40	0.5	66	
	Drills	80	77	3	1	0	80	40	0.5	69	
	Trailer	84	84	0	1	0	84	40	0.6	73	

Predicted Noise Level for Sensitive Receptors Located at the Distance of 60 meters

Activity	Source	Typical Peak Sound Level in Work Cycle (Lm)	Typical MInimum Sound Level in Work Cycle (Lb)	Lm-Lb	Fraction of time spent at peak in work Cycle (Ta/T)	Equivalency Factor (E.f)	Noise level emissions Leq (h)=E.L =Lj+EF	Estimated Distance from Equipment to Observer (D) E	Usage Factor (UF)	Equipment Leq(h) at Receptor (dbA) Leq (h)	Leq(h) Site at Receptor db(A)
Clearing, earthwork, foundation, piling, super structure etc.	Wheel Loader	90	83	7	1	0	90	60	0.4	74	98
	Grader	90	82	8	1	0	90	60	0.4	74	
	Vibration roller	86	82	4	1	0	86	60	0.4	70	
	2-wheel vibration roller	81	85	-4	1	0	81	60	0.4	65	
	3-wheel roller	81	85	-4	1	0	81	60	0.4	65	
	Tire roller	76	85	-9	1	0	76	60	0.6	62	
	Bulldozer	86	85	1	1	0	86	60	0.5	71	
	Tire Pen-dredger	84	85	-1	1	0	84	60	0.3	67	
	Sprayer	87	80	7	1	0	87	60	0.4	71	
	Power Generator	98	85	13	1	0	98	60	0.2	79	
	Impact drill	87	85	2	1	0	87	60	0.2	68	
	Impact piling	112	80	32	1	0	112	60	0.5	97	
	Concrete Mixer	92	85	7	1	0	92	60	0.2	73	
	Truck	91	55	36	1	0	91	60	0.4	75	
	Concrete Pump	85	84	1	1	0	85	60	0.4	69	
	Mobile Lift	96	84	12	1	0	96	60	0.4	80	
	Pneumatic Hammer	98	84	14	1	0	98	60	0.4	82	
	Breaker	84	80	4	1	0	84	60	0.4	68	
	Pneumatic Spanner	95	85	10	1	0	95	60	0.3	78	
	Steel Cutting Machine	85	85	0	1	0	85	60	0.4	69	
	Steel Bending Machine	80	80	0	1	0	80	60	0.5	65	
	Water Bowzer	80	80	0	1	0	80	60	0.2	61	
	Fuel Pump	82	82	0	1	0	82	60	0.4	66	
	Dumpers	70	82	-12	1	0	70	60	0.4	54	
	Excavator	70	72	-2	1	0	70	60	0.4	54	
	Dewatering Pump (Diesel)	77	77	0	1	0	77	60	0.5	62	
	Drills	80	77	3	1	0	80	60	0.5	65	
	Trailer	84	84	0	1	0	84	60	0.6	70	

Predicted Noise Level for Sensitive Receptors Located at the Distance of 80 meters											
Activity	**Source**	**Typical Peak Sound Level in Work Cycle (Lm)**	**Typical MInimum Sound Level in Work Cycle (Lb)**	**Lm-Lb**	**Fraction of time spent at peak in work Cycle (Ta/T)**	**Equivalency Factor (E.f)**	**Noise level emissions Leq (h)=E.L =Lj+EF**	**Estimated Distance from Equipment to Observer (D) E**	**Usage Factor (UF)**	**Equipment Leq(h) at Receptor (dbA) Leq (h)**	**Leq(h) Site at Receptor db(A)**
Clearing, earthwork, foundation, piling, super structure etc.	Wheel Loader	90	83	7	1	0	90	80	0.4	72	95
	Grader	90	82	8	1	0	90	80	0.4	72	
	Vibration roller	86	82	4	1	0	86	80	0.4	68	
	2-wheel vibration roller	81	85	-4	1	0	81	80	0.4	63	
	3-wheel roller	81	85	-4	1	0	81	80	0.4	63	
	Tire roller	76	85	-9	1	0	76	80	0.6	59	
	Bulldozer	86	85	1	1	0	86	80	0.5	69	
	Tire Pen-dredger	84	85	-1	1	0	84	80	0.3	64	
	Sprayer	87	80	7	1	0	87	80	0.4	69	
	Power Generator	98	85	13	1	0	98	80	0.2	77	
	Impact drill	87	85	2	1	0	87	80	0.2	66	
	Impact piling	112	80	32	1	0	112	80	0.5	95	
	Concrete Mixer	92	85	7	1	0	92	80	0.2	71	
	Truck	91	55	36	1	0	91	80	0.4	73	
	Concrete Pump	85	84	1	1	0	85	80	0.4	67	
	Mobile Lift	96	84	12	1	0	96	80	0.4	78	
	Pneumatic Hammer	98	84	14	1	0	98	80	0.4	80	
	Breaker	84	80	4	1	0	84	80	0.4	66	
	Pneumatic Spanner	95	85	10	1	0	95	80	0.3	75	
	Steel Cutting Machine	85	85	0	1	0	85	80	0.4	67	
	Steel Bending Machine	80	80	0	1	0	80	80	0.5	63	
	Water Bowzer	80	80	0	1	0	80	80	0.2	59	
	Fuel Pump	82	82	0	1	0	82	80	0.4	64	
	Dumpers	70	82	-12	1	0	70	80	0.4	52	
	Excavator	70	72	-2	1	0	70	80	0.4	52	
	Dewatering Pump (Diesel)	77	77	0	1	0	77	80	0.5	60	
	Drills	80	77	3	1	0	80	80	0.5	63	
	Trailer	84	84	0	1	0	84	80	0.6	67	

Predicted Noise Level for Sensitive Receptors Located at the Distance of 300 meters

Activity	Source	Typical Peak Sound Level in Work Cycle (Lm)	Typical MInimum Sound Level in Work Cycle (Lb)	Lm-Lb	Fraction of time spent at peak in work Cycle (Ta/T)	Equivalency Factor (E.f)	Noise level emissions Leq (h)=E.L =Lj+EF	Estimated Distance from Equipment to Observer (D) E	Usage Factor (UF)	Equipment Leq(h) at Receptor (dbA) Leq (h)	Leq(h) Site at Receptor db(A)
Clearing, earthwork, foundation, piling, super structure etc.	Wheel Loader	90	83	7	1	0	90	300	0.4	60	84
	Grader	90	82	8	1	0	90	300	0.4	60	
	Vibration roller	86	82	4	1	0	86	300	0.4	56	
	2-wheel vibration roller	81	85	-4	1	0	81	300	0.4	51	
	3-wheel roller	81	85	-4	1	0	81	300	0.4	51	
	Tire roller	76	85	-9	1	0	76	300	0.6	48	
	Bulldozer	86	85	1	1	0	86	300	0.5	57	
	Tire Pen-dredger	84	85	-1	1	0	84	300	0.3	53	
	Sprayer	87	80	7	1	0	87	300	0.4	57	
	Power Generator	98	85	13	1	0	98	300	0.2	65	
	Impact drill	87	85	2	1	0	87	300	0.2	54	
	Impact piling	112	80	32	1	0	112	300	0.5	83	
	Concrete Mixer	92	85	7	1	0	92	300	0.2	59	
	Truck	91	55	36	1	0	91	300	0.4	61	
	Concrete Pump	85	84	1	1	0	85	300	0.4	55	
	Mobile Lift	96	84	12	1	0	96	300	0.4	66	
	Pneumatic Hammer	98	84	14	1	0	98	300	0.4	68	
	Breaker	84	80	4	1	0	84	300	0.4	54	
	Pneumatic Spanner	95	85	10	1	0	95	300	0.3	64	
	Steel Cutting Machine	85	85	0	1	0	85	300	0.4	55	
	Steel Bending Machine	80	80	0	1	0	80	300	0.5	51	
	Water Bowzer	80	80	0	1	0	80	300	0.2	47	
	Fuel Pump	82	82	0	1	0	82	300	0.4	52	
	Dumpers	70	82	-12	1	0	70	300	0.4	40	
	Excavator	70	72	-2	1	0	70	300	0.4	40	
	Dewatering Pump (Diesel)	77	77	0	1	0	77	300	0.5	48	
	Drills	80	77	3	1	0	80	300	0.5	51	
	Trailer	84	84	0	1	0	84	300	0.6	56	

Annex V: O&M Phase Noise Modelling

Station	Average Daily Traffic (ADT)	Vehicles Types	Traffic Values		Speed		Road Surface ID	Air Temp.	Gradient	Emission Level	
			Day	Night	Day	Night			Min / Max	Day	Night
	Veh/24h		Veh/h	Veh/h	km/h	km/h		[°C]	%	dB(A)	dB(A)
Proposed Shikarpur Rajanpur Road Traffic direction: Both directions											
Proposed Road (N55) 222km	20100	1 (LTV)	2107	847	100	100	16	34	-1	96.8 - 96.9	96.0 - 96.1
		2 (MTV)	248	770	100	100	16	34	-1	96.8 - 96.9	96.0 - 96.1
		3 (HTV)	4091	3467	100	100	16	34	-1	96.8 - 96.9	96.0 - 96.1
		4a (Two Wheeler)	4834	2080	60	80	16	34	-1	96.8 - 96.9	96.0 - 96.1
		4b (Tri Wheeler)	1116	539	100	100	16	34	-1	96.8 - 96.9	96.0 - 96.1

Note: Day = 6am to 10pm (16hr) and Night = 10pm to 6am (8hr)

Note: File containing data related to receivers is attached separately.

Annex VI: Chance Find Procedures

CHANCE FIND PROCEDURES

Project involves deep excavation, especially, for bridges construction; therefore, possibility of chance find is envisaged. However, in case of any chance find, the contractor will immediately report through Supervision Consultant to Directorate General (DG) of Archeological Department, Government of Pakistan to take further suitable action to preserve those antiques or sensitive remains. Representative of the DG will visit the site and observed the significance of the antique, artifact and Cultural (religious) properties and significance of the project. The report will be prepared by representative and will be given to the DG. The documentation will be completed and if required suitable action will be taken to preserved those antiques and sensitive remains.

In case of any artifact, antiques and sensitive remains are discovered, chance find procedures should be adopted by contractor workers as follows:

- Stop the construction activities in the areas of chance find;
- Delineate the discovered site or area;
- Consult with the local community and provincial Archeological Department
- The suggestion of the local communities and the concerned authorities will be suitable incorporated during taking the preventive measures to conserved the antique, artifact and Cultural (religious) properties
- Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remain, a night guard shall be arranged until the responsible local authorities take over;
- After stopping work, the contractor must immediately report the discovery to the Supervision Engineer.

The contact Address of Archeology Department is given below:
Archeology and Museum Department
1st Floor, Block-4, Sitara Market,
G-7 Markaz, Islamabad
Tel: 051-9206236
051-2201385

E-Mail: doam@cyber.net.pk

Annex VII: Covid-19 Management Plan

Covid-19 Management Plan

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

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

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

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

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

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

Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf. The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf.

All the stakeholders are on board to jointly prevent/ limit/ control the spread of COVID-19. All of the staff is required to take precautionary measures as well as maintain social distances. The use of thermal guns for checking every single person body temperature, placement of relevant flyers and disinfection spray inside of all the containers are few of the measures to combat COVID-19.

OBJECTIVE

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

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

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

WHAT IS CORONA VIRUS (COVID-19)

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)[24].

SYMPTOMS

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

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

MODE OF SPREAD

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

- Infected animals' dead or Alive;
- Air by coughing and sneezing;
- Close personal contact, such as touching or shaking hands;
- Touching an object or surface with a virus on it; and

[24] Source: World Health Organization

- Touching your mouth nose or eyes before washing your hands.

GENERAL STANDARDIZED PRECAUTIONARY MEASURES

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

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

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

PROJECT SITE SPECIFIC PRECAUTIONARY MEASURES

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

Employer's Side

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

Consultant's Side

Consultant's top management will issue the orders in the light of GoS guidelines containing the precautionary measures to control the spread of COVID-19 for the staff working at Site. Consultant staff at Site will fully complying with the orders including photographic evidence. Considering the severity of the prevailing virus Engineer devised the SOP containing precautionary action against the potential risk of novel corona virus.
Besides, above Consultant will ensure the following precautionary measures at Site.

- Adequate signage and information at all entrances and exits showing what is Corona Virus, how it spreads, what are the symptoms, standard precautions;

- The awareness session for the Contractor staff is equally important as of Consultant staff to combat the COVID-19 at Site. The Consultant will ensuring that Contractor is arranging such session at Site from time to time to reduce the potential risk of COVID-19. Further, all the newly inducted and existing staff have been given HSE training by the Consultant & Contractor.

Contractor's Side

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

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

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

- Contractor will prepare a pamphlet for the awareness of Site staff to combat the COVID-19. It will also place/posted at strategic points at Site.
- Launch awareness campaign to inform all the staff and labour about the coronavirus, to use facemask, hand hygiene, cough etiquette, and avoidance of close contact with animals and consumption of their raw products.
- Everyday awareness speech in English and Urdu in the temporary camp.
- All the employees are not allowed to go outside of the Project Area or on vacation to their homes and on daily basis visit to sites;
- Contractor will provide medical masks and antibacterial liquid hand wash to all personnel.
- Contractor will prepare the isolation facility at Site and provided three isolated rooms for such patients inside the temporary camp. Each room have three beds, oxygen cylinder, sanitizers, isolation kit, hand wash.
- Thermal scanning will be carried out continuously in the morning for everybody at the main gate of temporary camp.
- Record will be maintained for everyone that includes the temperature value of each person with their names, every morning and afternoon go to each department for scanning separately and noted down their name with temperature values.
- Contractor carry out disinfectant spray on daily basis morning and afternoon in each office and rooms and all the area of the camp.
- SSWMB and Consultant staff will also requested by Contractor to do not interact physically rather through electronically by emails or video conferencing.

RECOMMENDATIONS FOR THE CONTROL OF COVID-19 AT SITE

To Avoid Transmission

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

- Workers to remain at least two meters apart from each other at all times (social distancing) – i.e. spread out and reduce the number of people working together in one area of the site;
- Avoid eating lunch in the form of group in available mess/canteens at Site;
- Close site canteens/ food preparation and eating areas (avoid gatherings) – workers to bring their own prepared lunch to site and eat alone e.g. in their van, car, or in an open space;
- Avoid in-person meetings if possible. In the case that an in-person meeting is unavoidable, make sure to have it in a well-ventilated area with sufficient space for attendees to distance themselves from one another. For meetings such as toolbox talks, consider breaking them up into smaller group meetings versus one large meeting;
- Introduce enhanced cleaning procedures across the Site and touch points e.g. office equipment, plant and machinery controls, taps/toilet/washing facilities, handrails;
- Stagger start times on site to avoid congestion in entrance areas;
- Reduce the number of people on site inductions at any one time and hold them outdoors if possible;
- Stop workers moving across various sites (potential for cross contamination);
- No outsiders should be at the Project Site;
- Contractor, Consultant and Employer personnel are advised to avoid travelling and in case traveling is unavoidable, prior approval from the management should be essential. In case of travelling, the above mentioned measures need to be strictly followed by the traveller;
- Prompt identification and isolation of potentially infectious individuals is a critical first step in protecting workers and other Site staff. An isolated area should be available at Site to immediately isolate suspected person, as it is most important to stop its spread at Site.
- Rapid Response Team should be formed and be informed immediately in case of suspect and confirmed case of COVID-19.
- Medical team at Site should separate the suspected person displaying fever, cough or difficulty breathing from other personnel; and
- If a person has had close contact with an individual that has confirmed COVID-19, that person will not be allowed to return to the Site until he/she has been symptom free for 14 days.
- Clean and fumigate all the workplaces at Site on daily basis;
- Ask people to stay at home if they have fever, cough, difficulty in breathing, runny nose, sore throat as per organizational rules;
- An immediate replacement of solid soap with liquid anti-bacterial soap bottles may be appropriate.
- Provision of alcohol-based hand sanitizer need to available for all staff;
- Clean the religious places carpets and rugs. Have them washed in place over the weekend and then do regular cleaning;
- Have the cleaners/ maintenance crews regularly clean surfaces that are touched frequently by personnel with disinfectants such as in and out doors;
- Fresh medical tests of staff working should be carried out at Site;

- Dispose of all contaminated waste (gloves, paper, swab handles, etc.) into biohazard waste bags for disposal;
- Ensure that panic is not created. In fact the posters should start with statements such as do not panic and fear the virus but know and prevent; and
- Ensure proper ventilation system for all the personnel at Site.

Use of Personal Protective Equipment (PPEs)

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

Outside Visitors

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

Annex VIII: Sample Letter

Ref: _____ May 14, 2020

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Dualisation/Improvement of Shikarpur –Rajanpur Section of N 55 (Indus Highway)

Stakeholder Consultation

National Highway Authority (NHA) is carrying out the Dualisation/Improvement of Indus Highway- N55 Additional Carriageway Project (Shikarpur-Rajanpur Section).

NHA has hired the services of National Engineering Services Pakistan (NESPAK) to conduct Feasibility study, detailed design including the Environmental study of the project. Total length of the proposed section of N55 is approximately 222 kilometers and it passes through the districts of Shikarpur, Kashmore in Sindh and Rajanpur in Punjab province. Alignment map of the project is attached. As a part of Environmental Studies stakeholder consultation is a mandatory requirement to ensure that the concerns and apprehensions of the stakeholders can be identified, clarified and addressed.

As a standard practice, Environmental Team visits the stakeholder and conduct consultation meetings/interview/gathering. However, in the current situation of lock down due to Pandemic (Covid-19), following the Governments directives and SOPs it is not possible to visit the office and conduct consultation meetings. Therefore, following the SOPs all consultations shall be carried out keeping social distancing through phone calls, conference calls, Skype call utilizing the e-media. it is requested to please depute relevant persons representing your department/organization and share telephone number, skype Id, e-mail address so that we can arrange the consultation meeting through e-media.

Yours faithfully,

for National Engineering Services Pakistan (Pvt.) Limited

(_____)

NHA

Encl: Alignment map of the project


NORTH
N55
END POINT
RAJANPUR
DERA BUGTI
PUNJAB
BALOCHISTAN
INDUS RIVER
N65
ROJHAN
N5
PAKISTAN
DERA MURAD JAMALI
222 KM
BAKSHSHAPUR
KASHMORE
GHUSPUR
KANDHKOT
SHIKARPUR
START POINT
SHIKARPUR
SINDH
INDIA
LEGENDS
PROJECT ALIGNMENT
NATIONAL HIGHWAY
OTHER ROADS
RIVER
PROVINCIAL BORDER
INTERNATIONAL BORDER

Annex IX: Photolog

Pictorial Description of the Project Area

Site Survey Photos Rojhan to Rajanpur (Km 535-604)

RajanPur City Area (Starting Point)

Affected Structures within ROW at Kotla Nasir (Km 593)

Kotla Nasir City Area

Populated Area Along the Existing Road (**Kotla Nasir**)

Mosque located within 30m form Existing Alignment at **Kotla Nasir**

Mosque located within 30m of ROW at **Kotla Nasir**

Kot Bahadur City Area

Series of Electric Poles within ROW

Area Confined with Cotton Growing Area at **Kot Bahadur**

Arable cinfined along the ROW

Euclayptus dominated area at either side of ROW at **Kot Bahadur (Km 593)**

Euclayptus dominated area at either side of ROW at **Kot Bahadur (Km 590-592)**

Mosque Located at Km 581 at Kot Kot Bahadur

Live stock farm at Km 581, located at around 18km to Rjanpur

Orchard Growing Area (dominated by Mango Trees at Km 581-582) at Kot Bahadur

Linear Planation of Eucalyptus Trees at MozaGayamal at Km 577

Linear Plantation of Ecualyptus Trees at **MozaGayamal Area**

Water Pond Located Adjacent to ROW **at Basti Bajwa**

Petrol Pump at **Basti Bajwa** adjacent to ROW

Moza Gayamal Commercial area at Km 577-78

School Located adjacent to ROW (at **Miran Pur City Area**)

Wheat Stockyard at DirMusarrat Nazir Mazari at Km555 (**Bangla Hidayat Area**)

Miran Pur City Area at Km 548

Cotton Growing Area at **Bangla Hidayat**

Mosque located adjacent to ROW (**at Shamsabad**)

Dense Cotton growing area **at ShamsaAbabd**

Basti Lanjwani area confined with shops and eucalptus trees along the ROW

Sugar Cane crops growing area at **Umar Kot**

Shops across the adjecnet existing road at **Shamsabad City Area**

Boundary wall of Police Station adjacent located around 7-10m from the existing alignment

Shamsabad Area

Local inhabitants invloved in small scale business

Kashmore to Rojhan Section

Open Levelled land

Nomadic People living aroung the exsiting alignment

Railway line crossing at aroung 50-70m from exsisting alingment

Nomadic People living around the road within 250-30 m

Kandhkot to Kashmore

Dhakan Bangla Area (km 478)

Graveyard consisitng of 25-30 graves located adjacent to the existing raod at **Bakhsha Pur**

Railway track along the exsiting alignment around 10-15m from N-55

Grave yard along the N-55 **at Bakhsha Pur City**

Railway Phattak adjacent to proposed dualized section of N-55 at Bakhsha Pur City

Mosque located adjacent to N-55 road at **Baskhsha Pur City (Zargori Stop)**

Main Baskhsha Pur City Area

Water logged area (saline water bodies at different locations) at Bakhsha Pur City area

Police Checkpost at **Bangalwar Area**

Large Area confined with water logging at **Goth Nawab Khan**

Affected structures at Kadhkot Area

Ghoospur City Area

Water Logged area at Ghoospur city

Density of trees at the existing water bodies (saline water area) along the main N-55 Highway

Arable land utilized along the water logged areas at different patches at Ghoospur area

Mosques located along the N-55 highway at Ghoos Pur Area

Canal bridge at Ghoos pur Area
Kandhkot to Shikarpur

Mosques located adjacent to road alignment at Karam Pur Area

Eclectirc poles located along the road alignment

Canal bridge at Karam Pur Area

Police Checkpost along the N-55 highway at Karam Pur Area

Saline water body confined with scattered bushes along the existing alignemnet

Karam Pur city area

Commercial structures at around 10-15m from the N-55 highway

Rice Cultivated Area

Police Station at Napar Ghot (Karam Pur)

Water Logged areas at Karam Pur Areas

Densely populated saplings and bushes along the n-55 highway

Police station adjecent to existing alignment at **Napar Ghot** (Distt Shikarpur)

PARCO office **at Faizo Laro Distt Shikarpur**

Commercial structures along the N-55 at Faizo Laro (Ghot Dado Khan)

Mosque across the exsiting alignment at Rahim Abad Laro

Large sized pond areas confined with bushes at Rahim Abad Laro

Commercial Structures along the N-55 Highway at **Rahimabad Laro**

Local bricks making area at **Rahimabad Laro**

Mosque located adjacent to ROW at Khan Pur Area

Rice mill area across the N-55 highway at Khan Pur Area

Khan Pur City Area

Rice Cultivated area along the road alignment at Khan Pur city area

Mosques Located at Shikarpur Area, adjacent to ROW

Small large sized water logged patches at different locations Shikarpur areas

Shikar pur Area

Toll Plaza, Shikar Pur