Government of Pakistan
Ministry of Communication
National Highway Authority
27 Mauve Area, Sector G-9/1, Islamabad

Environmental Impact Assessment (EIA) Report

Consultancy Services Feasibility Study & Preliminary Design for Construction of Gilgit - Shandoor Road (216-Km)

Prepared & Submitted By

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ENVIRONEMNTAL IMPACT ASSESMENT (EIA) OF GILGIT-SHANDOOR ROAD (216 KM)

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
EIA	Environmental Impact Assessment
AOI	Area of Interest
AASTO	American Association Of State Highway And Transportation Officials
BOD	Bio-Chemical Oxygen Demand
CPEC	China-Pakistan Economic Corridor
CC	Contractor Consultant
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CP	Change Point
dB (A)	Decibel
DCR	District Census Report
DC	Design Consultant
DD	Deputy Director
DO	Dissolved Oxygen
EA	Environmental Assessment
EE	Environmental Engineer
EC	Environmental Committee
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environment Protection Agency
ESR	Environmental Sensitive Receiver
EGC	Engineering General Consultant's
GOP	Government Of Pakistan
GB	Gilgit Baltistan
GCM	Global Climate Model
GLOF	Glacier Lake Outburst Flow
JCC	Joint China Corridor
IEE	Initial Environmental Examination
Km	Kilometre
KKH	Karakoram Highway
µg/M3	Microgram Per Meter Cube
MBT	Main Boundary Thrust
NCS	National Conservation Strategy
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards
NHA	National Highways Authority
NOx	Nitrogen Oxides
NGO	Non-Governmental Organization
NOC	No-Objection Certificate
PEPA	Pakistan Environmental Protection Act
PNCS	Pakistan National Conservation Strategy
PEPC	Pakistan Environmental Protection Council
PM	Particulate Matter
PPC	Pakistan Penal Code
PPEs	Personal Protective Equipment t
PT	Panial Thrust
ROW	Right Of Way

SOx	Sulfur Oxides
SSEMP	Site Specific Environmental Management Plan
SC	Supervision Consultant
TSS	Total Suspended Solids
UC	Union Council
WHO	World Health Organization

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EXECUTIVE SUMMARY

NHA is planning to construct 2 lane carriage way from Gilgit to Shandoor Pass, total length of proposed project is 216 km Section of N-35 Project. The proposed alignment is passing through Gilgit division, encompasses the area of District Gilgit and District Ghizer. To comply with Pakistan Environmental Regulations as per Pakistan Environmental Protection Act (PEPA) 1997 and Gilgit Environmental Protection act 2014 (amended), National Highways Authority (NHA) entrusted Zeeruk International Pvt. Ltd with the assignment of carrying out an Environmental Impact Assessment (EIA) Study of the proposed section of N-35 Project from Gilgit to Shandoor pass.

The purpose of this route is not to overcome the traffic issues as the traffic is very low in the proposed location. The ultimate objective of this proposed link is to provide a connection with KPK and other provinces, so that China Pakistan Economic Corridor (CPEC) is taken into account. In the 6th Joint China Corridor (JCC) of China Pakistan Economic Corridor (CPEC) held in 2016, it was agreed to include Chitral Corridor Road from Gilgit, Shandoor and Chitral to Chakdara in CPEC portfolio. The road starts from Gilgit town located on Karakuram Highway and ends at Chitral town located on Nowshera-Chitral Highway. The Chief Ministers of KPK and Gilgit Baltistan provinces have requested to federalize the said road to implement the entire Project through National Highway Authority (NHA). Project forming part of the Gilgit-Shandoor-Chitral road would provide an alternative route to the CPEC. Detail design and feasibility study of the Shandoor-Chitral section has been completed. New road shall be an all-weather road so that it could facilitate the CPEC route during the winter season as well. This shall be the additional route to the people of Chitral valley apart in different direction.

The estimated cost of the 345-kilometre (Gilgit-Shandoor-Chitral) road shall be almost Rs. 45 billion. Foregoing in view, National Highway Authority has intended to appoint Zeeruk International Pvt. Ltd for feasibility study and preliminary design of Gilgit Shandoor Road (216 Km) Project.

The study has been conducted taking into account all current environmental policy as well as legal and administrative framework related to the construction of Gilgit Shandoor Road. All the relevant provisions of Environmental policies and Guidelines of Gilgit EPA and legal frameworks have been duly discussed. Gilgit Environmental Protection Act, 2014 aim to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, for whole Province of Gilgit.

The Gilgit Environmental Protection Agency shall administer and implement this Act and the rules and regulations made there under as per EPA in co-ordination with the relevant Government Agency and in consultation with the concerned sectors Advisory Committees, environmental policies for approval by the Council, take all necessary measures for the implementation of the national environmental policies approved by the Council and publish an Annual Environment Report on the state of the environment established standards for the quality of the ambient air, water and land, by notification in the official Gazette in consultation with the other relevant Government Departments/ Agencies.

The alignment passes through hilly terrain and many small and large streams. Most of the alignment traverses through several streams/nullahs such as Gilgit River and Ghizar River. The terrain is mountainous, rugged with little vegetation, very large screen cones and boulder moraine. The region is characterized by pattern of high and steep hills, which are high towards north. The general elevation of the land gradually increases after District Ghizer. Abundant glacial deposits overlie in different areas along the alignment

The geology of Gilgit Baltistan is dominated by the impact of the northward migrating Indo-Pakistan and Eurasian plates. The most important tectonic element features are salt range thrust, Potowar Plateau, Panial Thrust (PT) and main boundary thrust (MBT), Peshawar basin and Kashmir basin separated at Hazaras Syntaxis, Main Central Thrust (MCT), main mantle thrust intended to the north by Nanga Parbat Syntaxis, Kohistan Island Arc complex and main Karakorum Thrust.

The project area lies in two Districts. Mostly, proposed road alignment passes through various types of overburden material whereas, at some place, alignment passes through steep rock outcrops and landslides etc. Regionally, various types of rock outcrops are exposed along the surrounding area such as Granite, Diorite, Granodiorite, Volcanic, Metavolcanics and Phyllite etc.

The climatic pattern of District Gilgit and District Ghizer is almost same, because of its mountainous trains. The project site lies in northern area. The climate of the Northern Areas is greatly influenced by the presence of high mountain systems. The dominant weather of the project site is winter, which lasts eight to nine months a year. Both Districts are surrounded by glaciers. Major contribution of flow is due to the glacier melt. The eastern part of the area is found as moist temperate zone of the western Himalayas but moving north-westward, the Karakorum and the Hindukush ranges present a much drier environment. Future temperature projections by Global Climate Models (GCMs) suggest that the temperature in Gilgit may become 7°C higher than the present level by the end of the 21st century.

Gilgit is the nearest weather station of the project area. The climate of the district is characterized by cold winter and warm and dry summer. The summer season in low lying valleys is hot but at high altitudes it is very pleasant. Air and water study was based on National Environmental Quality Standards (NEQs) carried out by Green Crescent Environmental Engineering Consultants Pvt. Ltd. Monitoring of Ambient Air, Noise and Meteorological parameters was carried out at 6 different locations of the alignment for 24 hours each location. The parameters considered in monitoring for ambient air are No2, So2, Co2, PM 10 & PM 2.5. Similarly, the parameters for water testing were all the physical, chemical and biological parameters being monitored as per National Environmental Quality Standards (NEQs).

During the socio-economic survey, total number of household were selected as a sample size from District Gilgit and District Ghizer were 144 in numbers and taken from 12 villages coming along the alignment. Through village profile survey, estimated population of project area is taken. By using Standard Statistical Formula, the sample size was calculated using a confidence level of 95% and confidence interval10%. These households were selected by using systematic random sampling technique, which is a type of probability sampling. Based on the demographic and socio-economic indicators questionnaires were developed to collect the baseline data. Interviewing technique was used as a tool for data collection. People were informed about the goal of the project, the size of its infrastructure, during the socio-economic survey. In particular, local people's apprehensions about the proposed project have been discussed. Extensive sessions of questions and answers were held to clarify the works and activities related to the project in detail. Total population coming along the alignment is around 50,000 (fifty thousand) from both districts. As per methodology mentioned above it was indicated that household size consists of average 8 people.

Marriage within cousins or close relatives is more preferable in both district, and these people are very sincere and committed with their spouse. But some villages are very liberal, they allow their sons and daughters for marriage according to their likeness, but in some areas neither the groom nor the bride is allowed to choose his or her life partner. Mother has very little role in decision making for their sons and daughters while males are dominant in both areas. As per social survey, the majority of respondents (i.e. 79.33%) are married and only 2.23 % are separated from their wives while 18.44% are single/unmarried.

A series of roadside and focus group discussions were carried out with local communities to brief about the salient features of the project including its location, purpose, funding arrangements and implementation activities and to find out their opinion. Both male and female respondents were included in the consultation process on community level. People from different age groups, from both genders were interviewed.

During public consultations, people were made aware of the benefits of the project and were invited to express their viewpoints on the subject. Several issues were raised by the community during the consultation, which will be incorporated in Environmental Management Plan including with mitigation measures. Residents of the project area were very much supportive to the implementation of the proposed project. The project will have positive impacts on community and environment. Keeping in view the development for future perspective, it can be anticipated that after the implementation of the proposed project, the project area will be improved taking into account the parameters with respect to environment and society.

The potential environmental impacts of the proposed project include air and water contamination, noise generation and health and safety risks for the construction workforce, mostly to be countered during the construction phase through Environmental Management Plan. High risk activity includes excavation and transferring of materials producing high concentration of particulate matter as the area does not have proper roads. However, adequate safeguard measures for the human resource have been incorporated in the EMP.

This EIA has shown that potentially negative impacts associated with the proposed project are mostly moderate and reversible in nature, and can be easily addressed with the help of appropriately designed and effectively implemented mitigation measures proposed in this report. A comprehensive EMP has been prepared accompanied by an effective Environment Management Plan (EMP) and supported by an institutional arrangement. It is mandatory that EMP is made an integral part of the contract documents. For the implementation of EMP at work site the contractor will engage a full time environment specialist/Engineer. The Engineering Supervision Consultants (ESC) will also have a full time environmental expert placed at the construction site to provide professional guidance and supervision for the implementation of Environmental Management Plan.

After the construction of the proposed road, people living in the project area and the road user/ travellers will get the following benefits:

- Less time will be required for travelling and reaching the destination.
- To accelerate the economic activity by providing smooth access to national wide markets.
- During the construction phase, local labour will be accommodated in the construction activities.
- To provide sustainable delivery of a productive and efficient national road system contributing to decrease the transportation cost.
- To provide the livelihood and to educate the poor people of the project area.
- It is in favour of social stability and border defines of the homeland.
- It will act as a trade link between Pakistan and China.

Results of the EIA Study have shown that the impacts of the project activity on the physical environment will be negligible. However, there will be significant impacts on the biological and social environment. These impacts will be reduced by proper and judicious compensation to the affected and by implementing an appropriate tree plantation plan. This plantation along either sides of the road will enhance the aesthetics as well as the environmental conditions of the project area.

CHAPTER 1
INTRODUCTION

1.1 GENERAL

This report presents the findings of Environmental Impact Assessment (EIA) study of 2 lane carriage way from Gilgit to Shandoor Pass, total length of proposed project is 216 km Section of N-35 Project. The proposed alignment is passing through Gilgit division, encompasses the area of District Gilgit and District Ghizer. To comply with Pakistan Environmental Regulations as per Gilgit Environmental Protection act 2014, National Highways Authority (NHA) entrusted Zeeruk International Pvt. Ltd with the assignment of carrying out an Environmental Impact Assessment (EIA) Study of the proposed section of N-35 Project from Gilgit to Shandoor pass.

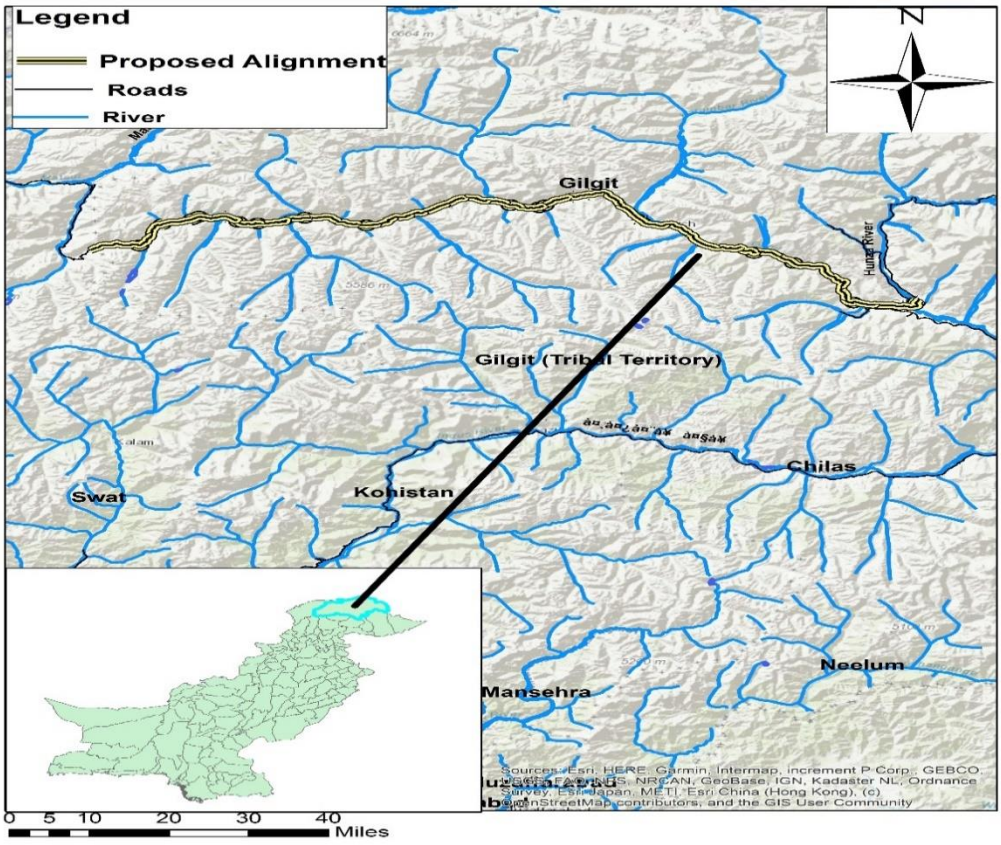


FIGURE 1.1: PROJECT ALIGNMENT VIEW WITH THE HELP OF GIS

1.2 BACKGROUND

To support sustained growth and increase competitiveness, Government of Pakistan (GOP) is taking a strategic and holistic approach to the transportation and has launched a major initiative to improve the trade and transport logistics chain along the north. The China-Pakistan Economic Corridor (CPEC) is a major and pilot project is a long-term and systematic project to promote economic cooperation through collaboration on Gawadar port, energy, transportation and industrial assistance. Infrastructure projects under the support of CPEC will span the length and breadth of Pakistan, and will eventually link the city of Gawadar in the south-western region of Pakistan to China's north-western autonomous region of Xinjiang via a vast network of highways and railways.

In the 6th Joint China Corridor (JCC) of China Pakistan Economic Corridor (CPEC) held in 2016, it was agreed to include Chitral Corridor Road from Gilgit, Shandoor and Chitral to Chakdara in CPEC portfolio. The road starts from Gilgit town located on Kara kuram Highway and ends at Chitral town located on Nowshera-Chitral Highway. The Chief Ministers of KPK and Gilgit Baltistan provinces have requested to federalize the said road to implement the entire Project through National Highway Authority (NHA). Project forming part of the Gilgit-Shandoor-Chitral road would provide an alternative route to the CPEC. Detail design and feasibility study of the Shandoor-Chitral section has been completed. New road shall be an all-weather road so that it could facilitate the CPEC route during the winter season as well. This shall be the additional route to the people of Chitral valley apart in different direction. The estimated cost of the 345-kilometre (Gilgit-Shandoor-Chitral) road shall be almost Rs. 45 billion.

Previously, it was constructed in 2002 by the provincial government, but due to substandard geometry of the alignment both of horizontal or vertical the vehicles such as semi-truck has difficulty to negotiate up and/down when the grade is too steep. In order to reduce these inclines or sharp horizontal curves NHA has been planned to properly design the existing road as per AASHTO standards. It wills connect adjoining areas and valleys and make a crucial contribution to economic development and growth and bring important social benefits. Providing access to employment, social, health and education services make a road network crucial in fighting against poverty. Improvements in road transport facilities stimulated tourism.

NHA handed over the responsibility to Zeeruk International Pvt. Ltd in association with Kasib Associates and Engineering General Consultants (EGC) to carry out Feasibility Study and Preliminary Design of Gilgit-Shandoor 216 km, the total cost of the project construction is 32.15 billion . The main objective of NHA for planning this 2 lane carriageway is to provide a safe, congestion free and high speed facility to commuters of the project area as well as to tourists. This carriageway will improve the communication network between the Province Punjab, KPK and Northern Areas of Gilgit-Baltistan Province and also boost the trade with China. Overall, the Project will have a positive impact on the economic development of the country due to trade activities and tourism.

All Projects under Jurisdictions of Gilgit-Baltistan are required to comply with the environmental legislation of Government of Gilgit-Baltistan. Therefore, it's their Policy to promote environmentally sound, socially acceptable and commercially viable urban infrastructure projects. Thus all projects are required to conform to the terms of Environmental Protection Agency (EPA) as mandated by the Gilgit-Baltistan Environmental Protection Act 2014.Part VI Section 16 of the Gilgit-Baltistan Environmental Protection Act '15 states that:

"No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof."

1.3 AIM AND OBJECTIVES OF EIA

The aims and objectives of the EIA of Development of Gilgit-Shandoor 2 lane carriageway are:

- Identification of all significant impacts that may require detailed assessment.
- Consultation with the concerned departments and stakeholders which are directly related to the Project.
- Identification and assessment of all major and minor impacts during Pre- Construction, Construction and Operation phases.
- Propose mitigation measures to minimize, eliminate or to compensate the potential adverse impacts of the Project that are identified during assessment.

- Preparation of Environmental Management Plan (EMP) and, Preparation of an Environmental Assessment report for submission to the Environmental Protection Agency, Gilgit-Baltistan.

1.4 SCOPE OF THE STUDY

The scope of this study includes the "Preparation of the Environmental Impact Assessment Report for "Development of Gilgit- Shandoor 2 lane carriageway "for the issuance of NOC from the Pakistan Environmental Protection Agency Gilgit- Baltistan.

1.5 CONSULTANCY SERVICES

This report will be submitted to "Gilgit- Baltistan (GB) Environmental Protection Agency (GB EPA) for approval. After the approval of this Report, the Project Proponent and the Contractor will be bound to follow the conditions of approval of the EIA report during the execution of engineering activities on the site. The Consultancy Agreement in terms of Environmental Impact Assessment includes the following.

- Collection of relevant data to establish baseline environmental conditions and an objective assessment of the impacts resulting from project activities covering all environmentally sensitive functions and activities.
- Conduct studies on all relevant environmental aspects (social, economic, cultural, physical and ecological) of the project.
- Determine potential impacts and identify mitigating measures to minimize the risk.
- Determine the requirements of an environmental management plan specifying mitigation measures for dealing with significant effects.
- Study will be conducted in accordance with the EIA Guidelines for Transportation issued by the EPA-GB, the guidelines of the major ISO Standards; and within the guidelines of the Land Acquisition Act, the Environmental Regulation of IEE/EIA 2000 and the National and Provincial Conservation Strategy of Pakistan."

1.6 THE PROPONENT AND CONSULTANT

The proponent of the Project is NHA while the Consultant is Zeeruk International Pvt. Ltd the addresses are given as under:

Proponent Contact Address	Consultant Contact Address
General Manager (EALS) National Highway Authority (NHA) 27 Mauve Area, G-9/1, Islamabad Ph: 051-8351506	Zeeruk International Pvt. Ltd Time Square Plaza, third Floor I-8 Markaz Islamabad Email: zeerukpk@yahoo.com Ph:051-4938215

TABLE 1.1: CONTACT DETAILS OF PROPONENT AND CONSULTANTS

1.7 STUDY TEAM

A multi-disciplinary team was formulated to conduct the study. The team comprises the following persons:

Sr. No.	Name	Designation
1	Ambreen Tariq	Principle Environmentalist Expert
2	Abdul Shakoor	Sr. Environmentalist
3	Umair Rashad	Jr. Environmentalist
4	Gull zaib Joiya	Geologist
5	Haider	Hydrologist
6	Ali Wazir Khan	Social Expert
7	Owais Khan	Horticulturalist / Botanist

TABLE 1.2: LIST OF CONSULTATNT TEAM IN PREPARING EIA REPORT

1.8 EIA APPROACH & METHODOLOGY

The approach for conducting Environmental Impact Assessment of Gilgit-Shandoor 2 lane carriageway Project is to follow the requirement of GB Environmental Protection Agency.

1.8.1 Study Approach

The study has been conducted in accordance with "Gilgit- Baltistan Environmental Protection Agency (EPA)", "Government of GB, IEE / EIA Regulations, 2000" and National Highway Authority framework. The study is based on both primary and secondary data and information. The primary data includes data collected from field observations and secondary data includes review of the "District Census Reports (DCRs)" and relevant information from Government Departments. Discussions were held with stakeholders including government officials, community representatives and a wide range of road users and roadside dwellers. The main purpose of this approach was to obtain a fair impression on the people's perceptions of the project and its environmental impacts.

1.8.2 Methodology

The following methodology was adopted for carrying out the EIA study of the proposed Project:

1.8.3 Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity was aimed at achieving a common ground of understanding of various issues of the study.

1.8.4 Data Collection Planning

Subsequent to the concept clarification and understanding obtained in the preceding step, a detailed data acquisition plan was developed for the internal use of the EIA Consulting Team. The plan included identification of specific data requirements and their sources determined time schedules and responsibilities for their collection and indicated the logistics and other supporting needs for the execution of the data acquisition plan.

1.8.5 Data Collection

In this step, primary and secondary data were collected through field observations, environmental monitoring in the field, concerned departments and published materials to establish baseline profile for physical, biological and socioeconomic environmental conditions. Following activities were performed for data collection:

- Site Reconnaissance
- Analysis of Maps and Plans
- Literature Review
- Desk Research
- Public Consultations
- Field Observations & Studies
- Laboratory Analysis

1.9 STRUCTURE OF THE REPORT

This EIA Report has been prepared following the GB Environmental Protection Agency (EPA) Guidelines for Environmental Assessment. The format of the Report consists of the following sections:

Section 1: Introduction

This section represents an introduction of the EIA Report. It contains the scope of study and overview of the project. The section also includes the project categorization as per GB-EPA.

Section 2: Policy, Legal and Administrative Framework

This section comprises policy, guidelines, statutory obligations and roles of institutions concerning EIA study of the proposed project.

Section 3: Description of the Project

In this section, salient features of the project are presented. It provides information about the Project location and its benefits to the public. The focus information is as under:

- Overview of the Proposed Project
- Location of the Project
- Project Components including Geometric Design Standards;
- Project Right of Way (Row)
- Alternatives of the Project

Section 4: Description of the Environment

It provides an overview of the present environmental baseline of the project area. It discusses the following:

- Physical Environment
- Ecological Environment
- Cultural Environment

Section 5: Socio-Economic Environment& Public Involvement and Disclosure

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

- Identification of the Main Stakeholders
- Details of Scoping Sessions
- Stakeholders' Concerns
- Proposed Measures for incorporating the Stakeholders' Concerns
- Village Meetings

Section 6: Anticipated Environmental Impacts and Mitigation Measures

This section provides the information on the anticipated environmental impacts and proposed mitigation measures. It discusses the following:

- Project areas
- Pre-Construction/Design Phase Impacts and Mitigation Measures;
- Construction Phase Impacts and Mitigation Measures
- Operation Phase Impacts and Mitigation Measures.

Section 7: Environmental Management Plan

This section describes the measures suggested for executing the Environmental -Management Plan (EMP) at the project site. It elaborates the following in details:

- Objectives of EMP
- Key Environmental and Social Components
- Role of Functionaries
- Specific Implementation Responsibilities
- Environmental Monitoring Plan
- Environmental Management Plan (In Matrix)
- Environmental Mitigation Cost
- Environmental Technical Assistance and Training Plan
- Environmental Monitoring, Mitigation and Training Costs.

Section 8: Conclusions

This section presents the outcomes of the whole study. It explains the following in details:

- Identification of the Main Issues and Concerns
- Proposed Mitigation Measures
- Benefits of the Project
- Surveillance and Monitoring of the Expressway after Construction

CHAPTER 2
POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL

This section deals with the relevant policy, legal and administrative framework instituted by the Government of Gilgit Baltistan for the protection of environment. All the relevant provisions of these policy and legal frameworks have been duly considered in this EIA study. In addition to this, the roles and responsibilities of the proponent as well as the Gilgit- Baltistan Environmental Protection Agency (GB-EPA) have been mentioned in this section.

2.2 POLICY FRAMEWORK

The Federal Ministry of Environment has been devolved under 18th amendment in the constitution of Islamic Republic of Pakistan and similarly provinces were enabled to legislate on the subject of environment, therefore Gilgit Baltistan assembly under schedule 4 of "Gilgit- Baltistan (Empowerment and Self-Governance) Order 2009" can make laws on the list of subjects provided in it. In that context, Gilgit Baltistan has its own Environmental Protection Act and hence the Gilgit Baltistan Environmental Protection Agency (GB-EPA) is the responsible authority for policy making on environmental protection in Gilgit Baltistan. The proposed project will be financed by Govt. of GB which requires compliance to the Environmental Policy and Guidelines, so it is obligatory on the part of the Proponent to follow these for environmental assessment.

2.3 NATIONAL ENVIRONMENT POLICY, 2005

The National Environmental Policy (2005) provides an overarching framework for addressing the environmental issues (particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification etc.) confronting Pakistan. It recognizes the goals and objectives of the Pakistan National Conservation Strategy (PNCS, 1992), National Environmental Action Plans, and other existing environment related national policies, strategies, and action plans. It also provides broad guidelines to the federal government, provincial governments, federally administered territories and local governments to address their environmental concerns and to ensure effective management of their environmental resources.

2.4 LEGAL FRAMEWORK

The Government of Gilgit Baltistan has promulgated laws/acts, regulations and standards for the protection, conservation, rehabilitation and improvement of the environment. In addition to this, they have also developed environmental assessment procedures governing developmental projects. Following are the excerpts of these laws and procedures relevant to the proposed project.

2.5 GILGITBALTISTAN ENVIRONMENTAL PROTECTION ACT, 2014 (GBEPA-14)

The Act was enacted in 2014 by repealing the Pakistan Environmental Protection Act (1997). It provides the framework for establishment of the Gilgit Baltistan Environmental Protection Council, establishment of Gilgit-Baltistan Environmental Protection Agency, Establishment of the Gilgit-Baltistan Sustainable Development Fund, protection and conservation of species, conservation of renewable resources, establishment of Environmental Courts and Green Courts, Initial Environmental Examination (IEE), and Environmental Impact Assessment (EIA).

Section 16 of the Act stresses the need to carry out environmental assessment study prior to construction or operation of a project.

2.6 EPA (REVIEW OF IEE AND EIA) REGULATIONS, 2000

These regulations provide lists of the projects requiring IEE and EIA. They also briefly describe the preparation and review of environmental reports.

2.7 PAKISTAN ENVIRONMENTAL ASSESSMENT PROCEDURES, 1997

Pakistan Environmental Assessment Procedures (1997) is, in fact, a package which contains the following sets of information relevant to the proposed Project:

a) Policy and Procedures for Filing, Review and Approval of Environmental Assessment Reports

It describes environmental policy and administrative procedures to be followed for filing of environmental assessment reports by the proponents and its review and approval by the concerned environmental protection agency/department.

b) Guidelines for the Preparation and Review of Environmental Reports

These guidelines are developed to facilitate both the proponents and decision makers to prepare reports (inclusive of all the information contained therein) and carry out their review so as to take informed decisions.

c) National Environmental Quality Standards, 2000

The Pakistan Environmental Protection Council first approved these standards in 1993. They were later revised in 1995 and 2000. They furnish information on the permissible limits for discharges of municipal and industrial effluent parameters and industrial gaseous emissions in order to control environmental pollution.

2.8 LAND ACQUISITION ACT (1894)

Projects may require government procurement of privately owned land and the displacement of land users. Land may be acquired through:

- Expropriation (Compulsory Acquisition)
- Voluntary negotiation with the owners for sale of land
- Donation from the land owners

The Land Acquisition Act (1894) deals with the government acquisition of private properties for public purposes including large development projects. There are 55 sections in this Act mainly dealing with area notifications, surveys, acquisition, compensation, apportionment awards, disputes resolution, penalties and exemptions.

2.9 PROJECT IMPLEMENTATION AND RESETTLEMENT OF AFFECTED PERSONS ORDINANCE 2000

This ordinance will be used to safeguard the interests of persons and groups involuntarily displaced from the existing places to new resettlement areas.

2.10 CANAL AND DRAINAGE ACT, 1873

This Act entails provisions for the prevention of pollution of natural or man-made water bodies.

2.11 CUTTING OF TREES (PROHIBITION ACT), 1975

The act prohibits cutting and chopping of trees without permission of the Forest Department. Section 3 of the act states “No person shall, without prior approval of the local formation commander or an officer authorized by him in this behalf, cut fell or damage or cause to cut, fell or damage tree”.

2.12 PAKISTAN PENAL CODE, 1860

This Act defines the penalties for violations concerning pollution of air, water bodies and land.

2.13 THE NORTH-WEST FRONTIER PROVINCE WILD-LIFE (PROTECTION, PRESERVATION, CONSERVATION AND MANAGEMENT) ACT, 1975

This Act defines rules and regulations for the protection, preservation, conservation and management of wildlife.

2.14 ANTIQUITIES ACT 1975

The Antiquities Act of 1975 ensures the protection of the cultural resources of Pakistan. All the archaeological features (e.g. archaeological sites, arte facts, historical carvings, historical monuments, temples, shrines and old graveyards come under the cultural property. The Act is designed to protect "antiquities" from destruction, theft, negligence, unlawful excavation, trade and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area which is of archaeological significance. Under this Act, it is understood that all project proponents are obliged to:

- Ensure that no activity is undertaken in the proximity of a protected areas without permission of the competent authority; and
- In case any antiquities have been found or reported in any Project Area it will be the responsibility of the proponent to report to the department of Archaeology, Government of Pakistan.

2.15 MOTOR VEHICLE RULES, 1969

Motor Vehicle Rules 1969 (MVR 1969) define powers and responsibilities of Motor Vehicle Examiners (MVEs). The establishment of MVE inspection system is one of the regulatory measures that can be taken to tackle the ambient air quality problems associated with the vehicular emissions.

2.16 INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORK

Government of GB has financed the proposed project. The proposed project falls under the following Institutional and Administrative Framework.

2.16.1 Environmental Protection Agency, Gilgit Baltistan (GB-EPA)

The Pakistan Environmental Protection Agency (PAK-EPA) is meant for the enforcement of environmental laws in Pakistan. They have delegated powers to provincial environmental protection departments/agencies for review, approval and monitoring of environmental assessment projects. The proposed project is in Gilgit-Baltistan therefore the GB-EPA will be responsible for reviewing the report, issuing Environmental Approval and overall/broad based monitoring of the proposed project activities to ensure compliance with the Environmental Management Plan.

2.16.2 The Telegraph Act, 1910

This Act was promulgated for installation of telegraph poles and stringing. This Act makes a provision of installing poles/towers without acquiring any land. However, provision is there for temporary acquisition of land during the construction period. As such, compensation is made for the loss of crop for a specific period.

2.16.3 Electricity Act, 1910

This act provides a legal basis for distribution of Power. It enables a licensee to conduct operations for supply of electricity and binds the license to payment of compensation in respect of any damages caused during the construction, operation and maintenance of power distribution facilities.

2.16.4 Pakistan Penal Code, 1860

The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of the environment, the Penal Code empowers local authorities to control noise, toxic emissions and disposal of effluents (NEQS enforced by EPAs supersede the application of this legislation to industries and municipalities).

2.16.5 Factories Act, 1934

The clauses relevant to the project are those which concern health, safety and welfare of workers, disposal of solid wastes and effluents, and damage to private and public property. The Factories Act also provides regulations for handling and disposal of toxic and hazardous materials. As construction activity is classified as „industry", these regulations will be applicable to the project construction contractor.

2.16.6 The Forest Act, 1927

The Forest Act empowers provincial governments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce; quarrying and felling, lopping and toping of trees, branches in reserved or protected areas. There are a few orchards and other trees, but no forests in the primary or secondary impact zone found periphery of Gilgit-Shandoor Road Project Area.

2.16.7 Gilgit Baltistan (Northern Areas) Wildlife Preservation Act, 1975

This Act provides for the establishment of national parks, wildlife reserves and wildlife sanctuaries and the issuing of hunting licenses and certificates of lawful possession. It regulates hunting, prohibits the use of in humane methods and imposes certain other limitations, such as time of day, season and area in which hunting is permitted. The First Schedule to the Act contains a list of animals divided according to the categories of “small game” and “big game”. All activities at the project site will have to be carried out keeping in view the provisions of this act.

2.16.8 Gilgit Baltistan (Northern Areas) Fisheries Act, 1975

This act is related to the fisheries in the Gilgit Baltistan. The act mainly describes the prohibition of destruction of fish by explosive and destruction of fish by poisoning water. The act also describes the fish size not to be killed and capture specified in the second column of the First Schedule. Moreover, the action also describes the separate penalties for the violation of section4, 5 or 9 and section 6, 7, 8 or 10.

2.16.9 The Exclusive Fishery Zone (Regulation of Fishing) Act, 1975

This act may be called the Exclusive Fishery Zone (Regulation of Fishing) Act, 1975. It extends to the whole of Pakistan and to waters within the zone. It applies to all fishing crafts within the Zone and to all persons on board such fishing crafts. This exclusive fishery zone grants power to “Fishery Officer” to issue permit to catch fish. The regulation of fishing act protects the fish against:

- Dynamiting and poisoning prohibited
- Closed season and prohibited area. There are other articles which provide protection to fish.

2.16.10 Explosives Act, 1884

Under the Explosives Act, the project contractors are bound by the regulations on handling, transportation and using explosives during the quarrying, blasting, and other purposes.

2.16.11 Gilgit Baltistan (Northern Areas) Forest Rules, 1983

The Gilgit Baltistan (Northern Areas) Forest Rules protected forests which are either the property of the government or have property rights to the whole or part of the forest produce. However local people may have some concessions and user rights. They may be able to use these forests for grazing and collection of fuel wood and other non-timber products.

2.16.12 National Disaster Management Act (NDMA), 2010

National Disaster Management Act, 2010, is the core legislation which defines the roles and responsibilities of the concerned authorities related to the natural disaster management plan etc. Section 9, 16, 20, 22 and 25 of the Act, 2010 explicitly mentioned that who will prepare and implement the disaster management plans at National, Provincial and District Level in case of disaster.

Under the section 9 of above referred act, NDMA has laid down the guidelines for preparation of disaster management plans by different Ministries or Departments and the Provincial Authorities. NDMA give directions to the concerned Ministries or Provincial Governments and the Provincial

Authorities regarding measures to be taken by the, in response to any threatening disaster situation or disaster. These plans are updated on seasonal basis according to the forecast. For the proposed Project, Gilgit Baltistan Disaster Management Authority (GBDMA) is responsible for the preparation and updating of Disaster Management Plan. The detailed Disaster Risk Management Plan will be prepared by the EPC contractor based on these guidelines.

2.16.13 Guidelines for Public Consultations

These guidelines deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their legitimate concerns in any impact assessment study. These guidelines cover

- Consultation, involvement and participation of Stakeholders;
- Techniques for public consultation (principles, levels of involvements, tools, building trust);
- Effective public consultation (planning, stages of EIA where consultation is appropriate);
- Consensus building and dispute resolution; and
- Facilitation involvement (including the poor, women, building community and NGO capacity.

2.16.14 Guidelines for Sensitive and Critical Areas

The Guidelines for Sensitive and Critical Areas, 1997, identify officially notified protected areas in Pakistan, including critical ecosystems; archaeological sites etc., and provide checklists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include, among others, archaeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves.

CHAPTER 3
PROJECT DESCRIPTION

3.1 GENERAL

The proposed project is a 2-Lane single carriageway road with a width of 7.3 meters. Due to raid increase in urbanization traffic load is also increasing on the existing road (N-35) and its strategic importance, it's up gradation and other alternatives are considered to overcome the traffic congestions and provide smooth traffic flow. The main objective of this carriage way is to provide a safe and high speed facility to commuters of the project area as well as to tourists. The construction of this carriageway will provide strategic link, and will also boost the economic activities and trade with China.

3.2 PROJECT AREA

Gilgit-Baltistan is making the northern part of Pakistan, expands over a rugged mountainous topography of 72,496 square kilometres area. This area shares its borders with four countries and that with a province in its surroundings, include, China in the North, Tajikistan across the Wakhan corridor in the North-West, Afghanistan in the West, Indian held Kashmir in the East and Khyber Pakhtunkhwa province is located in the South. The region houses the three great mountain chains of the world such as Himalaya, Hindukush and Karakoram.

This mountain area is administered under the three major Divisions, further distributed into ten Districts. First, the Gilgit Division (Buruśal) encompasses the areas of Gilgit, Ghizer, Hunza and Nagir District, second, the Baltistan Division consists of Skardu, Shigar, Kharmang and Ganche Districts and third, the Diamir Division (Dardistan) covers the areas of Astor and Diamir Districts of Gilgit-Baltistan (G-B). Our proposed project falls under the jurisdiction of Ghizer District, and Gilgit District in Gilgit Division.

3.2.1 District Gilgit

District Gilgit is one of the districts of Gilgit Baltistan in northern Pakistan. District Gilgit is divided into four Tehsils, namely, Bagrot Valley, Juglot, Danyore, Naltar Peak and The Nomal Valley

3.2.2 District Ghizer

District Ghizer is divided into four Tehsils, Punyāl, Ishkōman, Gupis, and Yasin. However Gahkuch is the headquarter of Ghizer. From Gahkuch there are two openings:

- The valley lies on the right leads to Ishkōman Tehsils with Head Quarter at Chaṭor-khand
- On left leads to Tehsils Gupis with Head Quarter at the town with the same name.
- Near Gupis town, valley once again splits into two:
- The valley to the right bank leads to Yasin Tehsil with Head Quarter at the main town named Yasin.
- On left bank leads to the border lands of Gupis at Shandoor Pass. Anyhow, Yasin was also known as Woorshigoom, means the land Woorshik, or Virchik of Wakhis.

3.3 EXISTING ROAD CONDITION

There is no alternate route towards Shandoor from Gilgit and as much as possible the existing road shall be followed with improvement of existing geometry at places and kept within formation width. However, realignment at certain reaches (Built-up areas) is formulated. Detail of existing route mentioned below.

Gilgit - Phandar	
Length	136km
Surface type	TST
Carriage way	3.65m
Shoulder II	2m+2m

Phandar - Shandoor Pass	
Length	80km
Surface type	Earthen /Shingle
Carriage way	7.0 m

3.4 PROJECT ADMINISTRATIVE JURISDICTION

The project falls under the administrative jurisdiction of GB. The starting point of the project alignment start from the small town of Gilgit city (Sultanabad links with KKH) and whole portion of alignment passes through number of small town of District Gilgit and District Ghizer e.g Singul, Sherqilla, Gahkuch, Gupis, and Phandar, Teru etc.

3.5 OBJECTIVES OF THE PROPOSED PROJECT

The proposed Project will greatly benefit the road users by reduction in the vehicle operating cost due to less traffic congestion, better pavement surface and improved geometry. Time delays and accidents will also be reduced. Besides vehicle operating cost, there are numerous unquantifiable benefits such as improved Environment, better communication, enhanced economic activities and less driving Stress etc. The implementation of the Project is envisaged to have the following

Objectives

- Connection to adjoining areas.
- Comfort for local people for travelling.
- Tourism will be increased /improved to great extent.
- It will create job opportunity for the local people living nearby villages.
- The said project will provide basic need better communication system to the people of area.
- To provide a safe, congestion free and high speed facility to the commuters of the project area and tourists.
- To provide a trade link between Pakistan and China.
- It will also contribute towards the promotion of industry and other infrastructure.
- To improve linkages of Gilgit Baltistan to the Provincial and National Highways.

3.6 FINAL ALIGNMENT

FIGURE3.1: PICTORIAL REPRESENTATION OF PROJECT ALIGNMENT IN GOOGLE EARTH

3.7 DETAILS OF STRUCTURES ON DIFFERNTS RDS OF FINAL ALINGMENT

3.7.1Bridges

There are 16 bridges on the Gilgit-Shandoor corridor with a combined length of 1.3km. Bridge spans range from 30m single span bridges to 160m Multiplan bridges. All bridges have pile foundation with 1.2m diameter piles. The super structures have both I-girder and box girder members. I girders provide superior economy for straight sections, while box girder can accommodate larger curves in the road alignment. Three open tunnel will be constructed at different RDs as shown in table 3.8.2 to avoide land slide areas . Furthermore, snow shelters are provided in areas of excessive land sliding. Details of Structures attached in **Annex –XIII.**

Sr. No.	RDs From	RDs To	Structures
1	0+720	1+090	Bridge
2	16+320	16+480	Bridge
3	39+750	39+780	Bridge
4	49+510	49+750	Bridge
5	62+260	62+360	Bridge
6	67+000	67+050	Bridge
7	79+090	79+170	Bridge
8	86+060	86+130	Bridge
9	107+040	107+100	Bridge
10	113+640	113+670	Bridge
11	135+740	135+800	Bridge
12	150+860	150+910	Bridge
13	161+600	161+660	Bridge
14	177+780	177+860	Bridge
15	188+750	188+810	Bridge
16	195+010	195+170	Bridge

3.7.2 Tunnel

Sr. No.	RDs From	RDs To	Structures
1	90+600	90+900	Open Tunnel
2	153+300	153+900	Open Tunnel
3	156+660	157+400	Open Tunnel

3.7.3 Snow Gallery

Sr. No.	RDs From	RDs To	Structures
1	23+900	26+800	Snow Gallery
2	31+200	31+450	Snow Gallery
3	46+400	46+800	Snow Gallery
4	96+320	96+500	Snow Gallery
5	124+150	124+310	Snow Gallery
6	138+400	138+800	Snow Gallery
7	148+800	149+200	Snow Gallery
8	153+900	154+000	Snow Gallery
9	154+000	155+700	Snow Gallery
10	173+800	174+400	Snow Gallery

11	174+500	174+900	Snow Gallery
12	175+600	176+050	Snow Gallery

3.8 ROAD ALIGNMENT

The project road is traversing totally in a mountainous terrain and the design speed in TOR is 60 km/h. However, design speed of 120 km/h is also given in TOR for the same project whereas, there is no plain area observed in the entire stretch.

The geometric standards followed in hilly areas are different from those in flat terrain. The alignment chosen will enable the ruling gradient to be attained in minimum of the length, minimizing steep gradient, hairpin bends and needless rise and fall.

3.8.1 Codes and Standards

The following standards shall be used for updating the available design or new design work if any:

Description	Standards
For Geometric Design	AASHTO
For Pavement Design	AASHTO, TRL Road Note 31 1993 AASHTO Mechanistic-Empirical pavement design (TOR)
For Materials & Testing	ASTM, AASHTO
For Structural Design	AASHTO
For Live Loads	West Pakistan Code of Practice for Highway Bridges 1967
For Seismic Design	AASHTO with latest Seismic Zoning Map for Pakistan published by the US Geological Survey. The map shall be procured from the relevant authorities and provided to NHA, both in hard and soft format

TABLE 3.1: CODE AND STANDARDS

3.9 PRELIMINARY GEOMETRIC DESIGN

3.9.1Design Standards

Roads are designed in conjunction with design guidelines and standards. AASHTO is a standard which are used in the design of National Highways of Pakistan. Therefore, following technical standards of AASHTO 2011 shall be applied to all alternatives. The Horizontal and vertical alignment shall be designed to meet the requirements of 120km/h (Plain Terrain) and 60km/h (Hilly Terrain) design speed.
Two design speeds have been labelled in “TOR” i.e. 70kph and 60kp, on page 50 & 53, please clarify which one to be selected for the purpose of undertaking design process. Following are the allied parameters for 120kph and 60kph.

3.9.2Highway Geometrics 120 km/h Design speed

- Horizontal – minimum radius 756m.
- Minimum stopping sight distance (SSD) 250m.
- Vertical curves – minimum crest “k” 95 and sag “k” 63, minimum length 60m.
- Super elevation will meet the 120km/h Design Speed.

- Minimum Passing Sight Distance (SSD) 295m.

3.9.3Highway Geometrics 60 km/h Design speed

- Horizontal – minimum radius 123m.
- Minimum Stopping Sight Distance (SSD) 85m.
- Vertical curves – minimum crest “k” 11 and sag “k” 18, minimum length 60m.
- Super elevation will meet the 60km/h Design Speed.
- Minimum Passing Sight Distance (SSD) 180m.

3.10 DESIGN CRITERIA AASHTO 2011

The project road is proposed to be designed on the criteria given as hereunder for different types of terrain:

Sr. No.	DESIGN ELEMENTS	UNIT	DESIGN PARAMETERS	
1.	Design speed of main highway & Interchange loops	KPH	**Plain Terrain**	**Hilly Terrain**
			120kph	**60kph**
2.	Min. radius	m	756	123
3.	Radius absolute minimum	m	540	92
4.	Max. rate of Super elevation	%	6	6
5.	Min. Stopping Sight Distance	m	250	85
6.	K’ value for crest vertical curves	K/%A	95	11
7.	‘K’ value for sag vertical curves	K/%A	63	18
8.	Passing Sight Distance	m	295	180
9.	K’ value for crest vertical curves	K/%A	181	38
10.	Runoff length(one lane rotation	m	57	36
11.	Run out length(one lane rotation	m	19	12
Roadway Cross Section & Carriageway Cross Slopes				
12.	Lane width	m	3.65	3.65
13.	Number of lanes	No.	2	2
14.	Pave shoulder outer	m	2	2.0 hill side & 1.5 river side
15.	Pavement slope	%	2	2
16.	Shoulder slope	%	4	4
** Passing Sight Distance in AASHTO 2004 is 775 for 120kph and 410 for 60kph. *‘K’ value for crest curves of Passing Sight Distance in AASHTO 2004 is 695 for 120kph and 195 for 60kph.				

TABLE 3.2: DESIGN ELEMENTS AND DESIGN PARAMETERS

3.11 HIGHWAY ALIGNMENT

Horizontal alignment of a road is the combination of curves and straight and presented on plan view. Horizontal alignment design involves the understanding on the design aspect such as design speed and the effect of horizontal curve on the vehicles. The horizontal curve design elements include design of super elevation, extra widening at horizontal curves, design transition curves, and sit back distance and horizontal alignment shall be design as per for flat, mountainous and rolling terrain.

Vertical alignment is a combination of parabolic vertical curve and straight section joining them. Straight section is referred to as grades and the value of their slope is the gradient, usually expressed in percentage form e.g. a 5% grade usually expressed in percentage form e.g. a 5% grade climbs through 5 meters over a horizontal distance of 100 meters. The same concept from standard will be used while design.

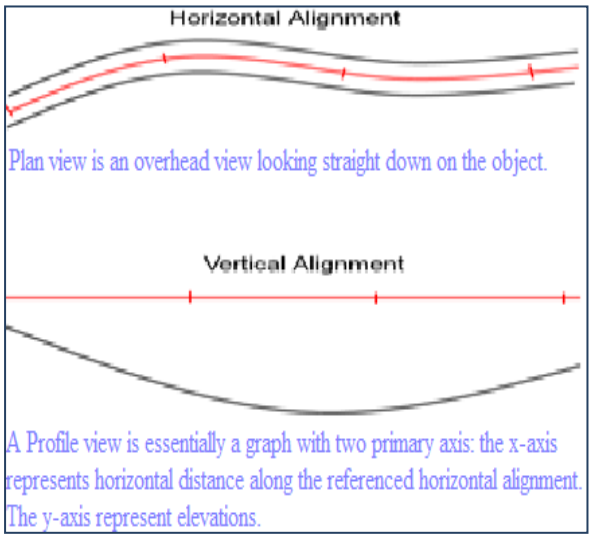


FIGURE 3.2: COMPARISON OF HORIZONENTAL ALIGNMENT AND VERTICAL ALIGNMENT

Faulty geometric standards, after construction, are frequently difficult to rectify at a later date and they are always costly. As such, both horizontal and vertical geometry shall be accorded due importance at the initial design stage itself and selected standards will not be compromised without the most careful deliberation.

The design shall be consistent within any area and the standards proposed for the different elements shall be compatible with one another. It is sometimes necessary to reduce the selected design speed for economic reasons but any abrupt changes in the design speed shall be avoided.
The design for geometric elements will cover:

- Horizontal alignment.
- Longitudinal profile.
- Cross-sectional elements.
- Junctions, intersections and interchanges.

The minimum radii of horizontal curve applicable to the project highway are:

Natural terrain	Design Speed	Desirable Minimum	Absolute Minimum
Plain	120	756	540
Mountainous	60	252	194

3.12 DESIGN SPEED

Design speed is a selected speed for the purposes of the design and correlation of those features of a road such as horizontal curvature, vertical curvature, super elevation, and sight distance, upon which the safe operation of vehicles depend. Other features such as pavement and shoulder width, side clearances, etc., are indirectly related to design speed.

The design speed also depends on the type of terrain. A plain terrain can afford to have any geometry, but for the same standard in a hilly terrain requires substantial cutting and filling implying exorbitant costs as well as safety concern due to unsuitable slopes. Therefore, the design speed is normally reduced for terrains with steep slopes.

Two design speeds have been labelled in "TOR" i.e. 70kph and 60kp, on page 50 & 53, please clarify which one to be selected for the purpose of undertaking design process.

On some specific locations design speed may be compromised due to site constraint.

Sr. No.	Road type	Design speed
1	Limited Access Roads	
2	Freeways in urban areas	90 - 120
3	Freeways and Expressways in rural areas	110 - 120
4	Expressways in urban areas	80 - 110
5	Flat terrain	90 - 120
6	Rolling terrain	80 - 100
7	Mountainous terrain	60 - 80
8	Urban	
9	Arterial street	60 - 100

TABLE 3.3: DESIGN SPEED CRITERIA FOR PROPOSED ALIGNMENT

3.13 CIRCULAR CURVE

The most common type of curve used in a horizontal alignment is a simple circular curve. A circular curve is an arc with a single constant radius connecting two tangents. The design speed of carriageway in hilly section shall be 60kph with minimum radius of 123m and 6% super elevation as per AASHTO design criteria. The minimum radius of circular curve without super elevation will be used 1440m.

Design speed of 120km/hr as given in TOR is not understandable because geographically the terrain is totally hilly and contains no plan area.

A minimum turning radius of 15m shall be adopted for right turns to permit a turning speed of 20km /hr. Maximum radius for left turns shall be 30m which will permit a turning speed of 30km/hr. For village and other lower category Roads including any permitted access connections to adjacent properties, a turning radius of 15m shall be adopted. The radii of horizontal curve will not be less than desirable value except where site conditions are restrictive and adequate curve length is not available. In such restrictive condition, the radius of curvature will not less than the absolute minimum value.

3.13.1Super elevation

The super elevation applied to the curves will however be limited to a maximum of 6%, the super elevation to be applied shall not in any case be less than the standard cross fall of 2.00%. Cross falls would be 2.00% for the bituminous concrete carriageways and 4% for shoulders, except where super elevation has been applied.

3.13.2Critical Length of Grade

The term “critical length of grade” is used to indicate the maximum length of a specified ascending gradient upon which a loaded truck can operate without an unreasonable reduction in speed (15 km/h).

Entrance Speed Km/hr	Critical Grade Lengths (m)						
	Grade %						
	2	3	4	5	6	7	8
30	245	138	95	75	60	51	42
40	327	183	127	99	80	67	57
50	409	228	159	123	100	84	71
60	491	273	191	147	120	101	85
70	573	318	223	171	140	117	99
80	654	363	254	197	160	134	113
90	736	409	286	221	180	151	127
100	818	455	318	245	200	168	140
110	900	500	350	270	220	185	155
120	982	545	382	295	240	202	169
110	900	500	350	270	220	185	155
VALUES TAKEN FROM AASHTO CHART							
Weight/power ratio is about 120 kg/kW [200 lb/hp] is representative of the size and type of vehicle normally used as a design control for main highways.							
A 15-km/h speed reduction is used as the general design guide for determining the critical lengths of grade.							

TABLE 3.4: CRITICAL ANALYSIS OF GRADE LENGTH

3.14 VIEW OF EXISTING ALIGNMENT WITH RESPECT TO NEW DESIGN LINES

Existing road shall be followed according to design speed as specified in TOR but where site condition or economic consideration does not permit, the design speed will be reduced in consultation with client. Such change shall be introduced gradually by means of successive sections increasing/decreasing design speed so that road user becomes progressively trained to changes. The need for warning signs shall be considered wherever reduction of design speed is unavoidable. At several locations the alignment may be designed straight to avoid zigzag pattern or if need to provide Gap Bridge over deep gorge instead of passing through long loops, this development may be deviated from existing track to keep in mind the improvement and upgrading the geometry as per NHA standard and for avoidance of inconvenience to traffic use this road. This improvement will also Impact on some built areas, where land will require to be acquired and some houses may be

relocated. The new alignment shall be kept away from river for avoid damaging of road from direct hitting of flood water or overflow.

Following Google images of existing track and our New Design Lines will clearly have demonstrated the site situation.

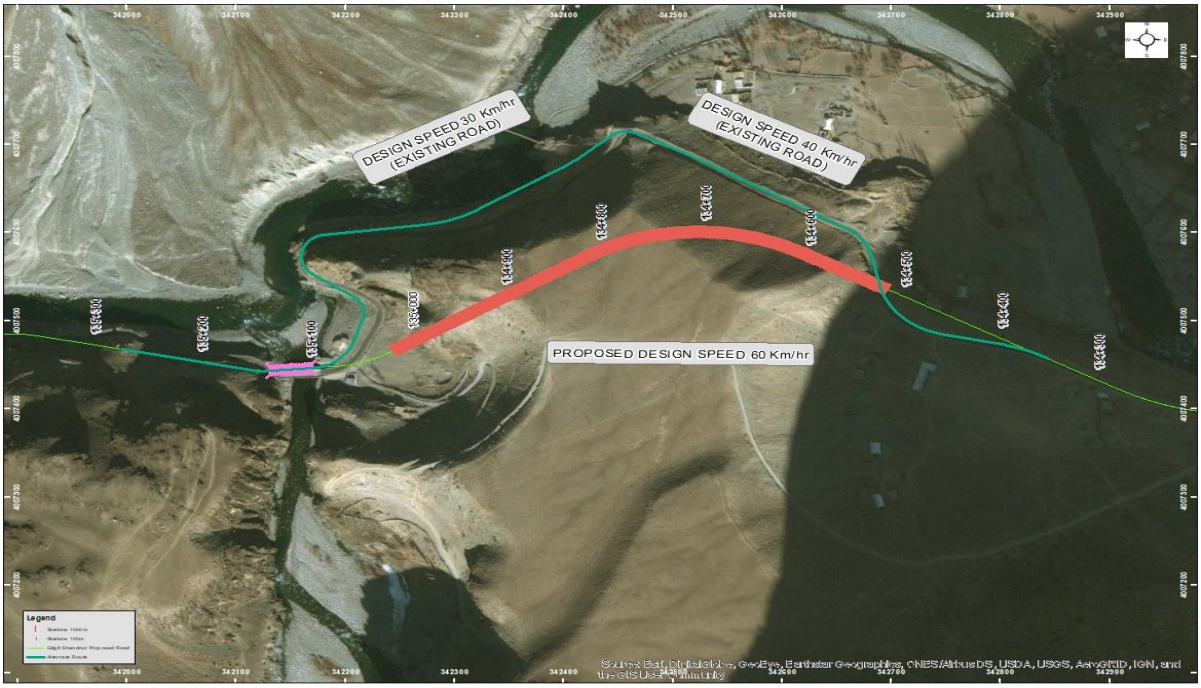


FIGURE: 3.3: GOOGLE IMAGES OF EXISTING TRACK AND OUR NEW DESIGN LINES (DEEP GORGE)

FIGURE 3.4: GOOGLE IMAGES OF EXISTING TRACK AND OUR NEW DESIGN LINESROAD PASSING ALONGSIDE OF RIVER

FIGURE 3.5: GOOGLE IMAGES OF EXISTING TRACK AND OUR NEW DESIGN LINES(AVOIDANCE OF LOOPS)

FIGURE 3.6: GOOGLE IMAGES OF EXISTING TRACK AND OUR NEW DESIGN LINESALIGNMENT PASSING THROUGH (BUILT UP AREA)

3.15 VERTICAL ALIGNMENT

There are two major elements in vertical geometry of an alignment i.e. longitudinal gradient and vertical curve. The following gradients for Plain / Rolling terrain conditions as of the Project Highway are given below. Survey change points (CP) shall be established at every 300 to 400m interval or as per site condition.

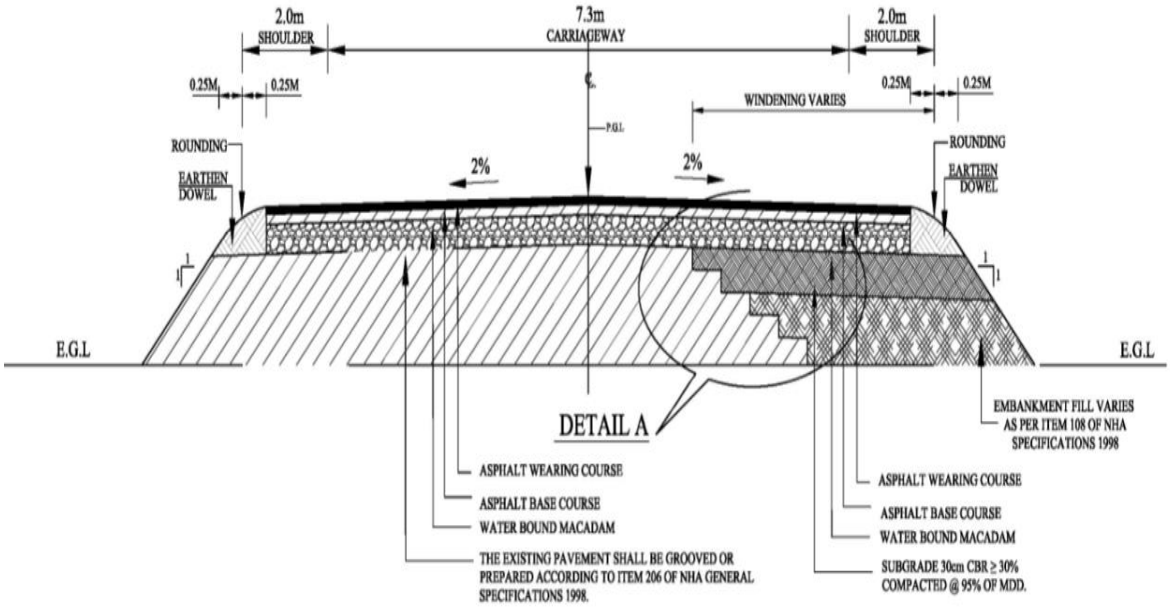
Natural terrain	Ruling Gradient	Limiting Gradient
Plain / Rolling	3.3%	5.0%
Mountainous	5.0%	6.0%
Steep	6.0%	7.0%

TABLE 3.5: DETAIL OF VERTICLA GEOMETRY OF ALIGNMENT

3.16 TYPICAL CROSS SECTIONS OF THE PROPOSED ROAD

Cross Sections define the configuration of a proposed roadway at right angles to the centre line. It shows width, thickness and description of the surfacing courses as well as the geometrics of the graded roadbed, side ditches and side slope.

Proposed section for Gilgit- Shandoor road with 2- Lane each 3.65m with along with 2m shoulder is given below;



TYPICAL CROSS SECTION (FOR FILL)
FOR CBR ≥ 30%

FIGURE 3.7: DESIGN OF TECHNICAL CROSS SECTION (FOR FILL)

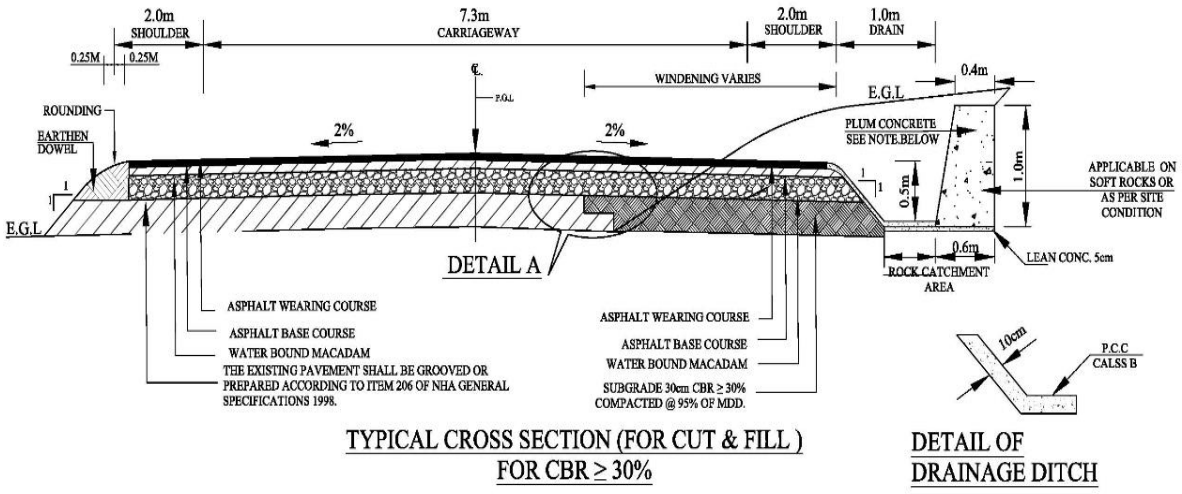
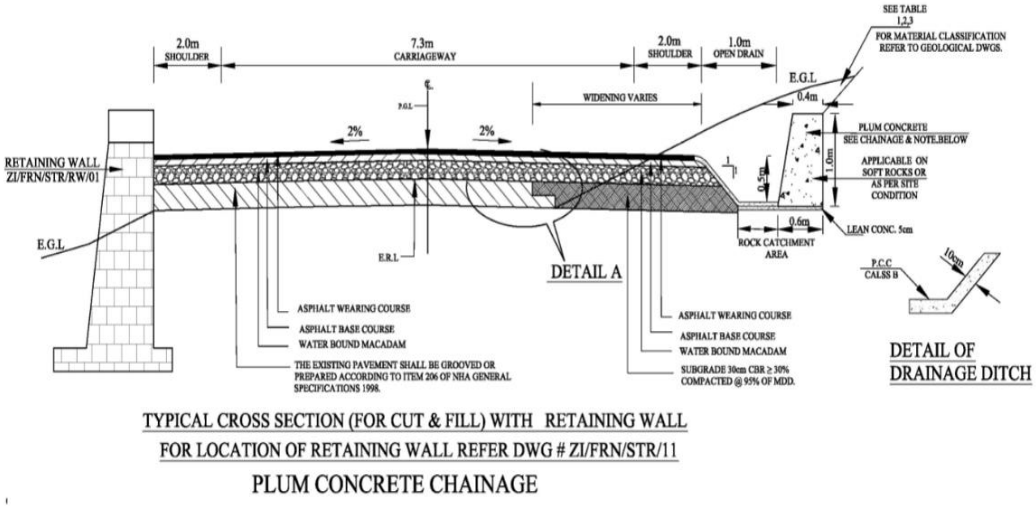


FIGURE 3.8: DESIGN OF TECHNICAL CROSS SECTION (FOR CUT AND FILL)



3.17 DESIGN CONTROLS

3.17.1Terrain classification

- The geometric design of a highway is significantly influenced by the terrain conditions. Economy dictates a sensible choice of different standards for different types of terrain. Where it deems necessary to change design standards, it has been done discreetly and special attention will be paid to consistency and road safety.
- The project road lies in mountainous terrain. The geometric standards relevant to mountainous terrain as contained in AASHTO would therefore be adopted. Alignment through hilly areas is slightly different from alignment through a flat terrain. Some of the special considerations for highway alignment through hilly terrain is crucial i.e. stability of slope, hill side drainage and ineffective rise and fall, stability against geological disturbance, Prevention of soil erosion.
- The locations where road alignment gets damaged due to hitting of flood water or overflow shall be investigated for remedial measures.
- Cut slope shall be rendered stable in the construction stage itself, by cutting at the correct angle and benching etc including slope stabilizing structures like drain, breast walls, pitching etc.

- For drainage of water from roadside, an affective system of drainage shall be constructed to lead the run-off to natural water courses.
- The HFL has been checked of project road adjacent to Phandar Hydropower on Ghizer River and Hanzel Hydropower to use source of Hydro Power Resources of Pakistan and Dermadar Ghizer Hydropower of 2 MW from Hydro Development in Gilgit-Baltistan therefore, the proposed road at those locations has no issue from HFL of main reservoir of hydropower to a sufficient level to cause sufficient inundation of project area.

3.18 TRAFFIC COUNT

3.18.1 Existing Road Network

Main purpose of doing traffic count is to estimate the existing traffic demand in the study area. Figure below shows the study area and existing road network within the study area. The main road providing connection between Gilgit and Shandoor is called Gilgit-Shandoor Road. The existing road passes through number of small town that are Singul, Sherqilla, Gahkuch, Gupis, and Phandar. In Gilgit, it connects with N-35 Highway also known as Karakoram Highway.

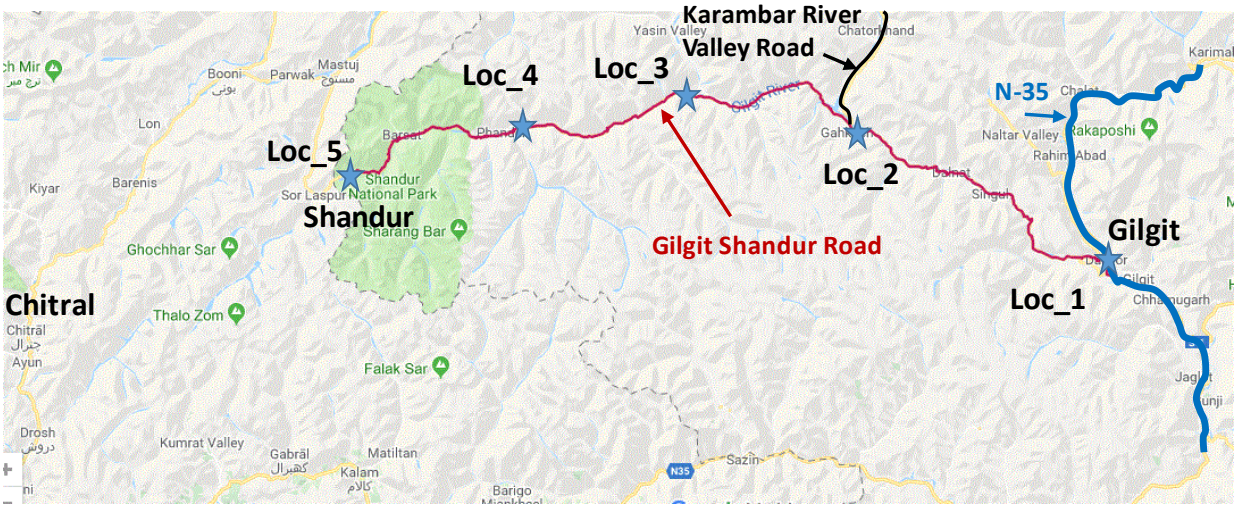


FIGURE 3.9:EXISTING ROAD NETWORK OF GILGITSHANDOOR

3.18.2 Traffic Count and Locations

Consultant conducted traffic counts on Four Locations. Table below shows the summary of traffic counts location, duration, detail reports of counts per hour, per day are attached in **Annex -III**

TABLE 3.6: AVERAGE TRAFFIC COUNT & LOCATIONS

Year	Cars	Light Truck/ Mazdas/Mini Bus	Large Buses	Truck 2 Axle	Truck 3 Axle	Truck 4 Axle	Truck 5 Axle	Truck 6 Axle	Tractor Trolley	Total Vehicles Per Day
2019 (Base)	**1,248**	842	85	274	84	29	8	7	28	**2,605**

Location ID	Description	Duration of Counts	Types of Counts
Loc_1	Entrance of Gilgit Cityon N-35	3 –Days	Directional Classified Counts
Loc_2	Near Sultan Abad on N-35		
Loc_3	Near Singul on Gilgit Shadoor Road		
Loc_4	Near Gahkuch City on Gilgit Shadoor Road		

3.18.3 Vehicle Classification

Vehicles shall be classified according to the FHWA vehicle classification scheme. The names and categories will slightly be modified according to local Pakistani traffic. Figure below shows classification scheme used for this project with some variation according to local (Pakistan) vehicle classification and axle configuration.

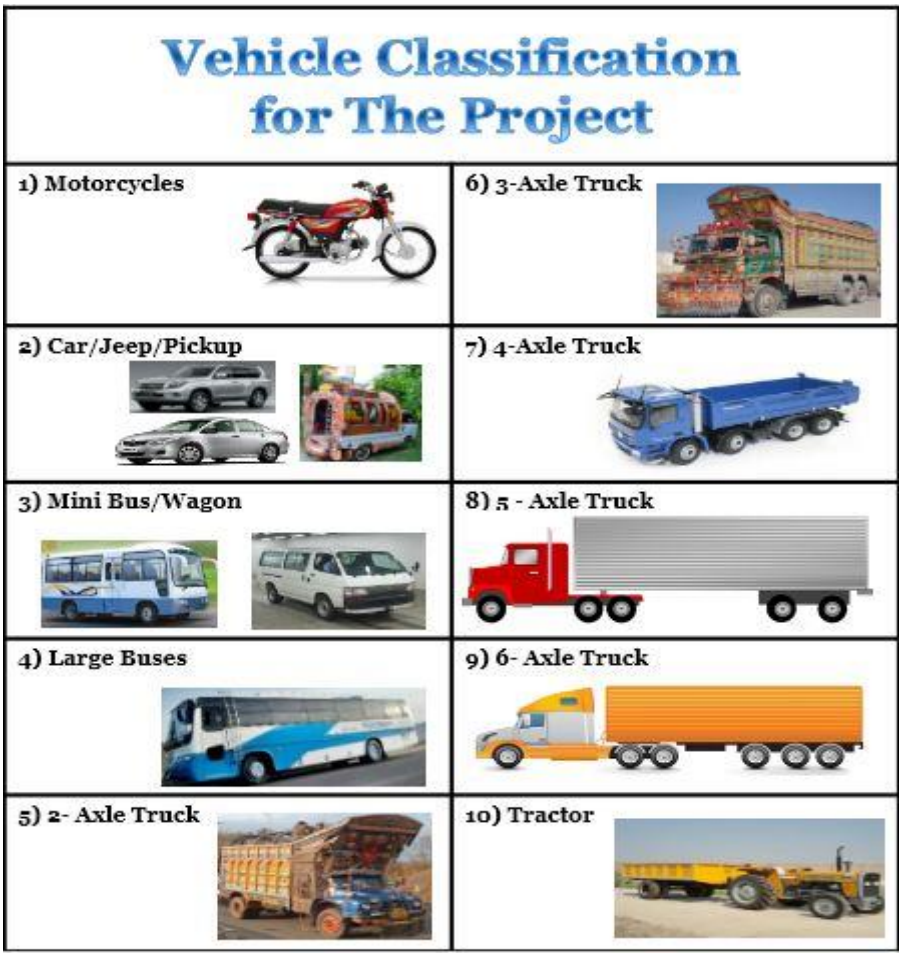


FIGURE 3.10: VEHICLE CLASSIFICATION

Journey Time (Travel Time Study)

Travel time study shall be done for the exiting Gilgit-Shandoor Road using Floating Car Method. The data shall be collected using GPS device. The output of this study will include travel time, distance, average speed and fuel consumption.

Origin & Destination Survey

It is expected that proportion of existing commuters travelling on N-35, will divert to the new route. Therefore, the Origin Destination Survey shall be conducted on N-35 near Gilgit. The roadside interviews shall be performed for O-D Surveys.

Axle Load Study

The accurate estimate of traffic loading is one of the important input parameter for pavement design. An axle load study shall be carried out to determine the existing loading pattern of trucks operating on the roads. It is not appropriate to base design on legal axle load limits because of the widespread problem of overloading. Data shall be obtained from NHA weighing stations that are near to our Alignment on N-35. Table below shows the current legal axle load enforced by NHA.

Vehicle Type ID	Axles	Axle Configuration	Permissible Gross Vehicle Wight in Tons
1	2-Axle	2-xl-SS	17.5
2		2-xl-SS	
3		2-xl-SS	
4		2-xl-SS	
5	3-Axle	3-xl-SD	27.5
6		3-xl-SSS	
7	4-Axle	4-xl-ST	39.5
8		4-xl-SSD 4-xl-SDS	
9		4-xl-SSSS	41.5
10	5-Axle	5-xl-SST	48.5
11		5-xl-SDD	49.5
12		5-xl-SSSD 5-xl-SDSS	51.5
13	6-Axle	6-xl-SDT	58.5

Symbol	Legend
S	Steer or single axle
D	Tandem Axle
T	Tridem Axle

TABLE 3.7: AXEL LOAD STUDY

3.19 CONSTRUCTION MATERIALS

The proposed alignment passes through various rock units i.e. granitic rock (diorite, granodiorite), volcanic and Meta-Sediments (schist, phyllites, Meta carbonate etc). These rocks are exposed along the proposed road corridor. However, mostly these rock units are covered with overburden/alluvium material along the road. Besides, along proposed road alignment; high relief areas exist through the various rock types i.e. granite, diorite, granodiorite and Meta volcanic (basalt and schist etc). The structural excavation will result in the production of a large quantity of debris for embankment filling. The materials used in construction of this 2 lane carriage way would include coarse aggregates (crush), fine aggregates (sand), soil, water, asphalt, reinforcement, cement etc. Almost all these raw materials are locally available in the area, most of present near river basins. The construction material for proposed alignment will be procured from approved quarries and no new quarry will be required by the contractor.

3.19.1 Borrow Soil for Embankment

Materials for embankment should consist of suitable material from borrow road way excavation or structure excavations. Borrow material can be used only when material obtained from road way or structural excavation is not suitable or is different for embankment formation. Topography of the project area is mostly consisting of mountain terrain which requires cutting and filling. In this area, cutting material can be used for filling purposes where needed. However, in soft areas of valleys, borrow soil for road embankment is available.

3.19.2 Borrow Material for Sub Base

Suitable Materials for sub base are locally available and hence are Economical. Available material may consist of pit run or bed run gravels, sand gravels mix or soil aggregates. The project is mostly in a rolling terrain and hilly areas. Gravels/Boulders mixed with sandy soil are available from the river bed. This material can be used as sub base after removing the material coarser than 2” size.

3.19.3 Source of Crushed Aggregate

Proposed road alignment passes side by side along river Gilgit and different small towns of Gilgit Baltistan. River bed has large boulders/Gravels which can be locally crushed to yield aggregate for road pavement and structures. The crushers are functioning near this river. Crushed stones were tested by the Design Consultant and suggested that this material is suitable for use in road construction, after crushing to the specified size and gradation. Aggregate available from the crusher was also used for different minor town’s projects. Several medium size crushers are exploiting these quarries. The quantities available are quite large and mining leases have already been obtained by various parties. For coarse aggregates, main sources are identified along or nearby the proposed road corridor. Summary for these sources is given in the following Table 3.8.

Sr. No.	Co-ordinates	Source	Lithology
1	E: 442063 N: 3975828	Crush Plant at RD: 3+170	River Bed (Gravel & cobbles of igneous and metamorphic origin)
2	E: 427819 N: 3981486	Gilgit River near RD: 22+300	River Bed (Gravel & cobbles of igneous and metamorphic origin)
3	E: 425711 N: 3986336	Gilgit River near RD: 29+530	River Bed (Gravel & cobbles of igneous and metamorphic origin)
4	E: 416652	Gilgit River near RD:	River Bed (Gravel & cobbles of

	N: 3991754	41+800	igneous and metamorphic origin)
5	E: 383918 N: 4009484	Gilgit River near RD: 84+920	River Bed (Gravel & cobbles of igneous and metamorphic origin)
6	E: 367391 N: 4009811	Gilgit River near RD: 106+230	River Bed (Gravel & cobbles of igneous and metamorphic origin)
7	E: 364362 N: 4009287	Gilgit River near RD: 109+820	River Bed (Gravel & cobbles of igneous and metamorphic origin)
8	E: 351264 N: 4012517	Gilgit River near RD: 124+510	River Bed (Gravel & cobbles of igneous and metamorphic origin)
9	E: 341391 N: 4007094	Gilgit River near RD: 136+690	River Bed (Gravel & cobbles of igneous and metamorphic origin)
10	E: 442926 N: 3978232	Hunza River near RD: 0+800	River Bed (Gravel & cobbles of igneous and metamorphic origin)
11	E: 392525 N: 4003559	Crush plant near RD: 73+200	River bed material and screen material

TABLE 3.8: LOCATION OF IDENTIFIED SOURCES FOR COARSE AGGREGATES ALONG PROPOSED ALIGNMENT

Note: - All the above given sources are approachable through the existing Gilgit to Shandoor road.

3.19.4 Source of Fine Aggregate:

Fine aggregate generally consists of natural sand or crushed stone with most particles smaller than 4.75 mm. It is generally considered to have a lower size limit of 0.07 mm or less. The material between 0.06 mm and 0.002 mm is classified as silt and particle smaller silt or termed clay. For this purpose, field work was conducted along the proposed corridor and in the vicinity of the proposed corridor. Fine aggregate sources are identified along the Gilgit River. The samples were collected from the local sand deposits and river beds. Their detail is given below in Table 3.9.

Sr. No.	Co-ordinate	Location
1	E: 442063 N: 3975828	Near RD: 3+170 km along Gilgit River
2	E: 427819 N: 3981486	Near RD: 22+150 km along Gilgit River
3	E: 425711 N: 3986336	Near RD: 29+300 km along Gilgit River
5	E: 422038 N: 3989549	Near RD: 34+420 km along Gilgit River
6	E: 416652 N: 3991754	Near RD: 41+500 km along Gilgit River
7	E: 383918 N: 4009484	Near RD: 84+920 km along Gilgit River
8	E: 379555 N: 4014419	Near RD: 92+200 km along Gilgit River
9	E: 367391 N: 4009811	Near RD: 106+000 km along Gilgit River
10	E: 364362 N: 4009287	Near RD: 109+820 km along Gilgit River
11	E: 351358 N: 4012521	Near RD: 124+400 km along Gilgit River
12	E: 442926 N: 3978232	Hunza River near RD: 0+800 km

TABLE 3.9: LIST OF SAMPLES WERE COLLECTED FROM THE LOCAL SAND DEPOSITS AND RIVER BEDS

3.19.5 Water Demand

Surface water, several natural streams are flowing within the periphery. The laboratory results show that water is suitable for all construction requirements. The river and stream water is the study area is alkaline in nature and can be used for concrete manufacturing due to negligible chloride and sulphate content. Water chemical results revealed that available water source are within the permissible limit of pH value, Sulphate and Chloride contents, therefore, can be used for the construction purpose

3.19.6 Asphalt, reinforcement and cement

For road construction process Asphalt, reinforcement and cement will be transported from easily assessable areas

3.20 CONSTRUCTION CAMPS

The area requirement for construction camps will depend upon the deployed Manpower and the type and quantity of machinery mobilized. It is not possible to establish camp sites on ROW. The site for suitable campsite would me 500 m away from the proposed project site, area for camp site will selected keeping in view the availability of adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to local markets, and would be far away from sensitive and populated areas. Final locations will be selected by the contractor after approval from NHA.

3.21 MANPOWER REQUIREMENTS

The demand for manpower in the construction and operational phase of the projects depends on the workload of the project and, given the time schedule, the contractor will mobilize about 100 people on the proposed Gilgit-Shandoor project. The manpower would be needed during the construction and operation of the proposed road is listed in the table below.

Sr. No.	Designation	No. of post	Man month
1	Project Director (Engineer)	1	36
2	Director (Land Acquisition & Social)	1	18
3	Director (Environment & Afforestation)	1	36
4	Project Coordinator (Engineer)	1	36
5	Deputy Director (Engineer)	2	36
6	Assistant Director (Engineer)	2	36
7	LAC	1	36
8	Inspector/ Supervisor Surveyor	4	36
9	Accountant	2	36
10	Superintendent (Admin)	1	36
11	Account Assistant / Superintendent	1	36
12	Steno typist	4	36

TABLE 3.10: LIST OF MAN POWER REQUIREMENT

S. No.	Designation	No. of post	Man month
1	Computer Operator	8	36
2	Quanoongo	1	36
3	Patwari	1	36
4	UDC	6	36
5	LDC	10	36
6	Driver	10	36
7	Naib Qasid	10	36
8	Helper	12	36
9	Chowkidar	10	36
10	Sweeper	6	36

TABLE 3.11: LIST OF MANPOWER REQUIRMENT AT CAMPSITE OFFICE

NHA staff for operational of project

Sr. No	Designation	No. of post	Man Month
1	Dy. Director (Engr.)	1	36
2	Asst. Director (Engr)	2	36
3	UDC	3	36
4	Drivers	3	36
5	Naib Qasids	3	36
6	Chowkidars	3	36
7	Total	15	

TABLE 3.12: LIST OF NHA STAFF FOR MAINTENANCE

MACHINERY REQUIREMENT

Type of machinery and equipment requirement for proposed project activities

Sr. No.	Types of machinery /Equipment
1	Dump Truck
2	Front End Loader
3	Dozer
4	Grader
5	Vibratory Roller
6	Asphalt Distributor
7	Batching Plant
8	Concrete Transit Truck
9	Concrete Pump
10	Agg. Spreader
11	Three Wheel Rollers
12	Tandem Roller
13	Asphalt Plant
14	Excavator
15	Water Pumps
16	Cranes
17	Vibrators
18	Generators

19	Self-Propelled Pneumatic Roller

TABLE3.13: LIST OF MACHINERY AND EQUIPMENT AT PROJECT SITE

3.22 EXCAVATED MATERIAL DUMPING

Dumping site of excavated material must be 1.5 km away from residential activity, proposed project dumping site will be selected after the screaming of the area, before the beginning of the construction activity.

3.23 PROJECT ALTERNATIVES

3.23.1 General

One of the goals of the EIA is to explore alternatives to the plan. In relation to the proposed activity "alternatives" means different ways of meeting the general goals and conditions of the proposed activity. The following section includes an overview of alternate routes, alignments, transport modes and technologies, as well as an alternative' no intervention'

3.23.2 No Project Alternatives

In this case no action alternate is defined as no action should be undertaken for the construction of the proposed project. This would result in the continues deterioration of the existing road, bridges and drainage system along the right of way (ROW) and also cause hider in economic development. all positive benefit would be foregone, on a short run, minor impact would be cause during maintained activity but the steadily declining state of the roadway would severely hamper economic development in the area. In the light of these considerations, the no action alternative idea is not for the best interest of Gilgit Shandoor.

3.23.3 Alternative Road Corridors

By keeping in view the present topography of the proposed project area, it was noticed that there is no other feasible route that would be able to compete the existing alignment in term of travel time.

3.23.4 Alternative Transport Mode

The alternative transport mode includes railway, and other mean of transportations whereas, air access is only to District Gilgit not towards Shandoor from Rawalpindi, but it travels cost is too much not everyone can bear it. Thus, there is no alternative transportation to reach else than existing alignment. With the improvement of the existing alignment, the traffic may be reduced up to some extent; however, this would not be the solution to cater the traffic problems in the future.

3.23.5 Comparative Analysis of Alternatives

Option-1	Option-2	Option-3
Length of proposed Options		
216+425 km	217+487 km	217+014
Geology along proposed road alignments		

Option-1	Option-2	Option-3
• Alignment passes through strong to very strong rock units. • Alignment passes through overburden material with gentle slope. • Overburden material may cause the prone area at some areas during widening of existing road. • Proposed alignment is quite safe as compare to option-03	• Alignment passes through strong to very strong rock units. • Alignment passes through overburden material with steep slope and gentle slope at some places. • Steep slope along overburden material will cause the prone area during construction.	• Alignment passes through strong to very strong rock units with steep slope. Huge quantity of blasting will require during construction. • Alignment passes through unconsolidated overburden material with steep slope. • Steep slope along overburden material will cause the land slide prone area during construction.
Proposed tunnels		
-	Four (4) Tunnels with 1800 m total length. Length = 500 m	-
Length of Landslide/vulnerable areas		
26+775 km	45+250 km	74+750 km
Protection Works		
• Minimal protection works (open tunnels, benching, retaining wall etc) will be required during widening of existing road as compare to Option-2 & 3 along steep slopes of overburden material. • Minimal quantities of cutting with blasting will be required during widening of existing road as compare to Option-2 & 3 along the steep slopes of exposed rock units.	• Huge protection works (open tunnels, benching, retaining wall etc) will be required as compare to Option-1 along steep slopes of overburden material. • Huge quantities of cutting with blasting will be required as compare to Option-1 along the steep slopes of exposed rock units.	• Huge protection works (open tunnels, benching, retaining wall etc) will be required along steep slopes of overburden material. • Huge quantities of cutting with blasting will be required along the steep slopes of exposed rock units.
Total quantity of main proposed bridges		
16no's	25 no's	31 no's
Total quantity of main proposed culverts		
836 no's	1085 no's	1530 no's
Per KM Cost(approximate)		
1400Million(PAK Rs)	1800 Million(PAK Rs)	2100 Million(PAK Rs)

TABLE 3.14: COMPARATIVE ANALYSIS OF ALL THREE ALIGNMENT

Note: After the detailed site survey of all three proposed alignments by the consultants, the key information regarding all the proposed options is mentioned in above table, clearly shows the comparison between all three alignments. After reviewing the pros and cons of all three alignmentsby NHA Team, NHA Team visited to the project site and finalized the alignment option -1 by including some minor changes at starting point and in Gahkuch.

CHAPTER 4
DESCRIPTION OF THE ENVIRONMENT

4.1 GENERAL

The purpose of environmental baseline study is to gathered data regarding the project area, to establish database against which potential impacts can be predicted and managed later. The EIA of the proposed project Gilgit –Shandoor two lane carriage way covers a detailed description of the project area, including resources present within the area, which are expected to be affected by the project, as well as, those which are not expected to be directly affected by the construction and operation of the project. In terms of physical, biological and socio-economic aspects, the existing environmental conditions around the proposed project were considered. A site visit was conducted to survey the field area and to collect environmental data on physical, biological and socioeconomic parameters.

4.2 METHODOLGY OF DATA COLLECTION

To study the physical and ecological environment within the project vicinity , data was collected through physical observations, from Government surveys, Local government statistics, site visits and District Census Report.

4.3 PHYSICAL ENVIRONMENT

The areas covered under physical resources are; climate, water resources, topography, seismology, geology and soil conditions. The objective of the study was to establish.

- The topography, geology and climatic condition of the project area
- Baseline conditions of surface and groundwater resources
- Assess the surface and groundwater quality
- To assess the air quality of the area
- To provide the proponent of the project and stakeholders with sufficient knowledge about socio-economic set-up, agriculture, ecological features, built-up buildings and infrastructure of the project area

The detailed description of physical resources is discussed as under:

4.3.1 Topography

The alignment passes through hilly terrain and many small and large streams. Most of the alignment traverses through several streams/nullahs such as Gilgit River and Ghizar River. The terrain is mountainous, rugged with little vegetation, very large screen cones and boulder moraine. The region is characterized by pattern of high and steep hills, which are high towards north. The general elevation of the land gradually increases after District Ghizer. Abundant glacial deposits overlie in different area along the alignment.

4.3.2 Regional Geology

The geology of Gilgit Baltistan is dominated by the impact of the northward migrating Indo-Pakistan and Eurasian plates. The most important tectonic element features are salt range thrust, potwar plateau, Panial thrust (PT) and main boundary thrust (MBT), Peshawar basin and Kashmir basin

separated at Hazaras Syntaxis, main central thrust (MCT), main mantle thrust intended to the north by Nanga Parbat Syntaxis, Kohistan island Arc complex and main Karakorum thrust.

4.3.3 Site Geology and Soil

The project area lies in two Districts. Mostly, proposed road alignment passes through the various types of overburden material whereas, at some place, alignment passes through steep rock outcrops and landslides etc. Regionally, various types of rock outcrops are exposed along the proposed area and surrounding the area such as Granite, Diorite, Granodiorite, Volcanic, Metavolcanics, Phyllite etc.

Granite: Granite is a plutonic igneous rock. It is gray to greenish gray, very coarse-grained, slightly to moderately weathered and very strong. Granite is composed of quartz, K-feldspar, albite, muscovite, epidote, biotite and chlorite as accessory minerals.

Diorite: Diorite is a plutonic igneous rock. It is speckled black and white, coarse-grained, very strong and slightly weathered on the surface. Mineral contents include plagioclase, amphibole and pyroxene.

Granodiorite: Granodiorite is a phaneritic-textured intrusive igneous rock similar to granite, but containing more plagioclase feldspar than orthoclase feldspar. It is gray to dark gray, coarse-grained, very strong and slightly weathered.

Volcanic/Basalt: Volcanism is exposed along the proposed road alignment. Basalt is a dark-colored, igneous rock composed mainly of plagioclase and pyroxene minerals. It most commonly forms as an extrusive rock. It is dark gray to greenish gray, fine-grained, hard and slightly and moderately weathered.

Metavolcanics/Meta andesite: Meta andesite is a Meta volcanic rock. It is composed of partially reconstituted microcrystalline matter, Plagioclase, Actinolite, K-Feldspar, Quartz, Amphibole and other accessory minerals. Meta andesite is dark gray to greenish gray, fine-grained, massive and moderately weathered.

Phyllite: Phyllite is low-grade metamorphic rock, of pelitic composition with a well-developed schistosity that often has a silky sheen due to the parallel orientation of phyllosilicate minerals. It is very fine-grained, black to gray or light greenish gray in colour and slightly weathered on the surface. The foliation is commonly crinkled or wavy in appearance.

Overburden: These deposits consist of unconsolidated soil; silty clay with rounded to sub-angular & rounded to sub-rounded gravel, cobbles and boulders. Overburden material has further been categorized into:

Glacial Deposits: Glacial deposition is the settling of sediments left behind by a moving glacier. As glaciers move over the land, they pick up sediments and rocks. The mixture of unsorted sediment deposits carried by the glacier is called glacial till. It comprises of sandy silty clay with angular to sub-angular gravel, cobbles and boulders.

Fluvial Deposits: Fluvial deposits are sediments that are transported and deposited by rivers in a continental environment. It comprises of sandy silt and silty sand with rounded to sub rounded gravel, cobbles and boulders.

Alluvium: Alluvium is deposited by rivers and streams. Alluvial deposits are usually most extensive in the lower part of a river's course, where the river slows down. It consists of silt, sand, clay and gravel.

Colluviums: It is a general name for loose, unconsolidated sediments that have been deposited at the base of hill slopes by either rain wash, slow continuous down slope creep, or a variable combination of these processes. Colluvium is typically composed of a heterogeneous range of rock types and sediments ranging from silt to rock fragments of various sizes. This term is also used to specifically refer to sediment deposited at the base of a hill slope by un-concentrated surface runoff or sheet erosion. It consists of angular to sub-angular gravel, cobble and boulders with a mix of sandy silty clay.

Scree: These are unconsolidated rock fragments and small loose rock pieces that form or cover a slope on a mountain

RDs To	RDs From	Rock/Overburden
0+000	12+000	Alluvium,+ Fluvial Deposit Colluvial + Glacial Deposit Granite +Colluvium
12+000	31+050	Granite + Colluvium+ Scree +Fluvial Deposit+ Colluvium + Alluvium
31+050	46+800	Colluvium + Alluvium +Granite +Hard Granite (along river side)Pain Area- Alluvium + Metavolcanics Hard
46+800	60+000	Meta volcanic +Colluvium+Pain Area –Alluvium+Granite + Volcanic +Meta Sediments
60+000	75+620	Granodiorite+Granite+Colluvium
75+620	88+085	Alluvium+Granite+Colluvium+Meta sediments+ Granodiorite
88+085	96+515	Granodiorite+Colluvium+Meta Sediment+Alluvium
96+515	128+080	Colluvium+Volcanic+Granodiorite+Alluvium river side
128+080	147+970	Fluvial deposit+Granite+Glacial +Colluvium+Alluvium +Volcanics
148+100	174+270	Phyllite+Glacial +Colluvium+Alluvium+Granite+ Volcanics
174+270	216+000	Diorite+Scree+Granodiorite+volcanics+Colluvium+Alluvium

TABLE 4.1: CLASSIFICATION OF ROCKS WITHIN TWO DISTRICTS ALONG THE ALIGNMENT

4.4 SEISMICITY

As mentioned earlier in above chapters of the report that Project Area is located in District Gilgit and in District Ghizer both lies in seismic province and mostly shows E-W trending folds and faults. The deformation within this zone is primarily the result of thrusting and of deep crustal devolvement processes associated within the collision of the plates. Tele seismic data for northern Pakistan shows a concentration of seismic activities in three main zones around the Project Area. The project area lies in the north of Pakistan with major fault lines passing through the area. The seismic activity is the result of movement along various active faults in the region. Thus it may be seen that the collision mountain ranges, where active faults are common, is characterized by extensive zones of high seismicity and contains several seism tectonic features generated by an integrated network of active faults.

4.4.1 Hindu Kush West Karakorum Seismic Zone

This zone comprises the Tirich Mir region and the adjacent Afghan territory. It is seismically hyperactive with frequent earthquakes of magnitude 5-7 and focal depths of 100-200 km (Kazmi

1979b). Focal mechanism solutions and spatial distribution of earthquakes and their hypo-centres indicate the presence of a fault plane down to about 200 km depth and a 25 km thick contorted Beni off zone within the upper mantle. According to Billington et a1. (1977), these features are typical of regions of active lithospheric subduction. This zone coincides with the Akbaytal Fault of Boulin (1990), which is the eastward extension of Herat Fault or the Waser-Rushan Pshart Suture of Sengor et a1. (1988). Focal-mechanism solutions by Vermaet at (1980) indicate that thrust and strike-slip movements are equally prevalent in the Hindukush and in addition to NE lineament (Akbaytal Fault) characterized by strike-slip movement, they mention a NW lineament also which is dominated by thrust faulting.

4.4.2 Yasin Seismic Zone

The region around the town of Yasin is seismically active and there is a cluster of several earthquake epi-centres of magnitude 3-5 and focal depth of fewer than 50 km. The Main Karakoram Thrust passes through this zone and it may be the source for this seismic activity.

4.4.3 Hamran Seismic Zone

The Hamran seismic zone is located along the deep, linear, northwest-trending Hamran Valley, south of Gupis. South of Gupis, along the Hamran Valley which is in the centre of the Ghizer Range, there is a particularly active seismic zone with frequent earthquakes of 3 to 5 magnitude and with hypocentres ranging from < 50 to 100 km depth. In recent years these earthquakes have caused much damage in Gupis and adjacent areas. Though no distinct active fault has yet been mapped in this region, focal mechanisms for some elements from this zone (Chandra 1978) show thrusting on northwest trending nodal planes. Seismic data collected by the International Karakoram Project shows that in this region seismic deformation is confined to the upper 20 km of the crust both during important earthquakes and during background activity (Yielding et al. 1984).

The seismic design parameters for the project (50 years' lifetime) are recommended as a Maximum Design Earthquake (MDE) of 0.25 g with 10% probability of exceedance with a corresponding return period of 475 years, and an Operation Basis Earthquake (OBE) of 0.15 g with 50% probability of exceedance and 75 years return period. The Project Area per Code of Pakistan (2007) (Seismic Provisions) falls entirely in the Zone 3 as shown in Table

Zone	PGA (g)
1	0.05 to 0.08
2A	0.08 to 0.16
2B	0.16 to 0.24
3	0.24 to 0.32
4	> 0.32 g

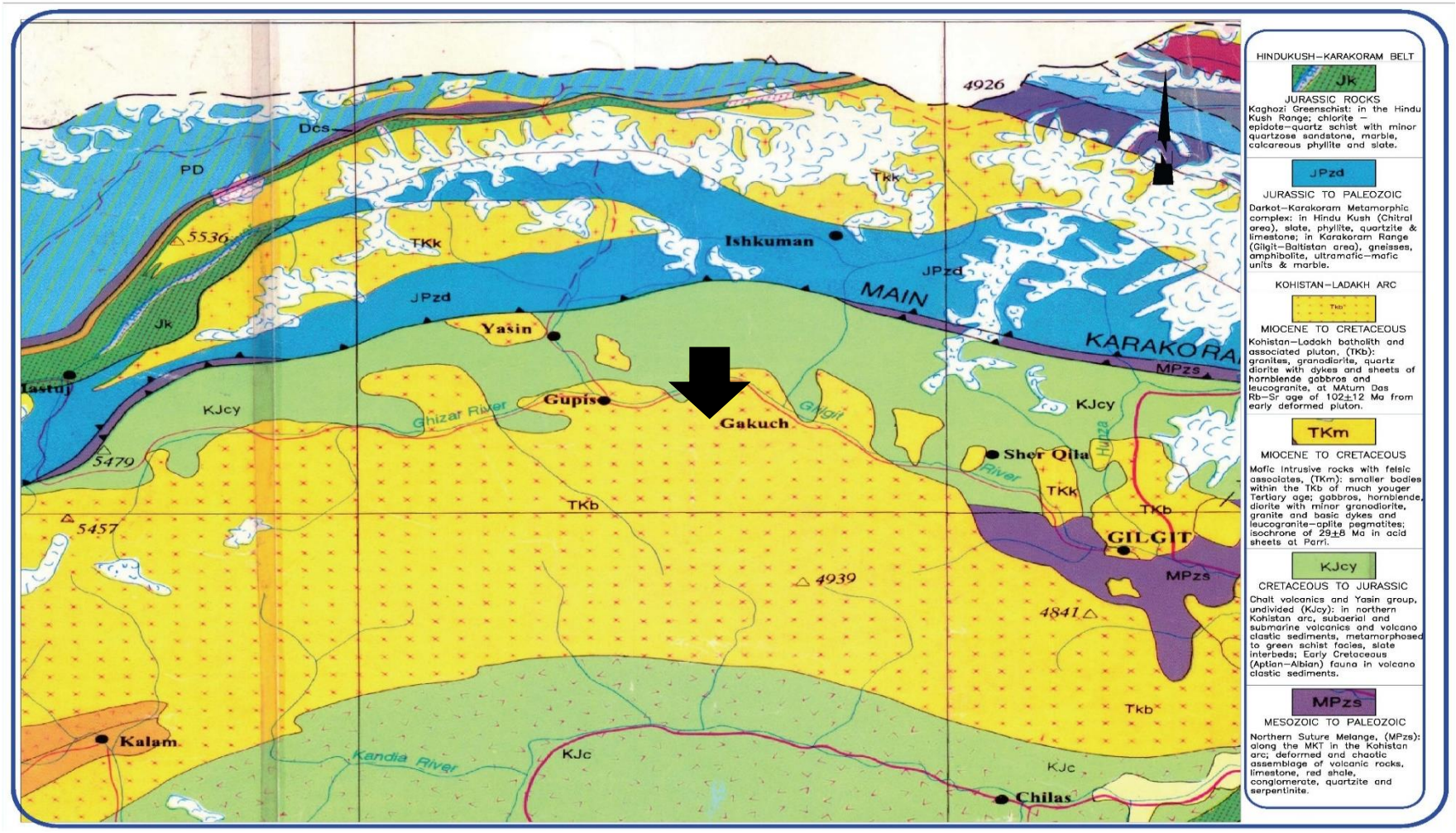


FIGURE 4.1: REGIONAL GEOLOGICAL MAP SHOWING THE REGIONAL GEOLOGY AND MAJOR FAULTS ALONG THE PROPOSED CORRIDOR FROM GILGIT TO SHANDOOR

4.5 NATURAL DISASTERS

The project area and its surrounding valleys are highly susceptible to natural disasters such as landslides, flash floods and avalanches, which affect civic life of areas within project vicinity. According to the Pakistan Meteorological Department (PMD), The Project area is located in a seismically active zone with a shake potential equivalent to an earthquake of magnitude 6 to 7 on the Richter scale. A recent example of the types of natural hazards facing Gilgit is the Ata Abad Lake, which formed due to a massive landslide in 2010 and dammed the Hunza River. The unstable lake poses a threat to the downstream populations of Gilgit and Oshkan Das14.

4.6 CLIMATE

The climatic pattern of District Gilgit and District Ghizer is almost same, because of its mountainous trains. The project site lies in northern area. The climate of the Northern Areas is greatly influenced by the presence of high mountain systems. The dominant weather of the project site is winter, which lasts eight to nine months a year. Both Districts are surrounded by glaciers. Major contribution of flow is due to the glacier melt. The eastern part of the area is found a moist temperate zone of the western Himalayas but moving north-westward, the Karakorum and the Hindukush ranges present a much drier environment. Future temperature projections by Global Climate Models (GCMs) suggest that the temperature in Gilgit may become 7°C higher than the present level by the end of the 21st century. Gilgit is the nearest weather station and the climatic data has been obtained from EPA, GB. The climate of the district is characterized by cold winter and warm and dry summer. The summer season in low lying valleys is hot but at high altitudes it is very pleasant.

4.6.1 Hazards Due to Climate Change

The intensity and frequency of climate hazards and extreme climate events appear to have increased in GB during the past few decades. This includes floods, landslides, GLOFs and avalanches around the HKH. Pakistan is seventh most vulnerable country to the impacts of climate change. A brief description of climate change disasters that occurred in recent years and their impacts is presented in Table 4.2.

Hazard Type	Events/loss	Vulnerable/Groups
Landslides	**Frequent landslides in deep valleys**: Frequent landslides occur due to heavy rain in deep valleys of the region. **2016 landslides on KKH**: KKH and different roads in Gilgit-Baltistan were closed at 175 points due to land sliding **January 2010,Attabad landslide disaster:** A cracked mountain at Attabad slid down into Hunza river creating 25km long lake taking 20 lives and thousands displaced.	**Remote villages across the region:** Frequent landslides cause damage to the lands and property of communities living in remote villages of all districts across the region **Protracted blockade of KKH:** Causes severe social problems including shortage of food and essential medicines in GB **Upper Hunza**: Attabad village was completely devastated with debris whereas six of small villages and 25km of KKH was totally submerged into newly formed lake.
Avalanches	**April 2012, Gyari sector:** Near Siachen Glacier; 70 feet of snow engulfed a military base taking the lives of 129 soldiers and 11 civilians.	All areas situated near the seasonal snow cover areas are vulnerable to avalanche phenomena.

Flash Floods	**August 2010, Pluvial and Flash Floods:** Due to heavy rain in different areas of GB; 122 people dead; 60 injured; 1,230 houses damaged; 12,300 displaced in the region. **Ghizer:** Dozens of villages devastated in the Tehsils of Yasin, Punial and Ishkoman; Heavy casualties in **Diamir;** and **Skardu** and Ghanche districts of Baltistan **July 2015, Khaplu. Ghanche, Baltistan:** The area was hit by devastating floods caused by the heavy melting of glaciers in the summer season. Score of people died and loss of property and land. Damage to 42 power stations across the region	All groups and population adjacent to natural streams and along the rivers banks are vulnerable to floods. Roads and infrastructure, power generating stations; and irrigation channels and drinking water supply systems have frequently being hit by flash floods.
GLOF	**2014 & 2015 Bagrote Valley, Gilgit:** The area was hit by multiple GLOF events in 2014 and 2015 that caused huge damage to livelihood and infrastructure. **Khanday, Baltistan:** GLOF events devastated the Khanday village in Baltistan causing huge damage to the area **Gojal, Hunza:** Three glacial lake outburst floods (GLOFs) have hit three villages - **Passu, Ghulkin and Hussaini-- in Gojal Tehsil, upper Hunza** damaging properties, livestock, orchards and disrupting trade and traffic on Karakoram Highway almost every year	**Bagrote Valley, Gilgit**: Bagrote valley has witnessed various GLOF events in the current decade and many glacial lakes are reported in the area thus making the valley vulnerable to the GLOF phenomena. **Khanday, Baltistan**: Most of the area along Khanday Nallah is vulnerable to GLOF. **Gojal, Upper Hunza:** The area has highest density of glacial lakes, some of which are at the verge of burst. The vulnerability is high due to the fact that KKH is passing through the glacial area and villages are very close to the glaciers.

TABLE 4.2: BRIEF DESCRIPTION OF CLIMATE CHANGE DISASTERS

4.7 TEMPERATURE DISTRICT GILGIT

In District Gilgit, the summers are hot and clear, the winters are very cold and partly cloudy, and it is dry year round. Over the course of the year, the temperature typically varies from 23°F to 92°F and is rarely below 12°F or above 98°F.The best time of year to visit District Gilgit for hot-weather activities is from early July to late August.

The hot season lasts for 3.1 months, from June 10 to September 14, with an average daily high temperature above 82°F. The hottest day of the year is July 28, with an average high of 92°F and low of 67°F. The cold season lasts for 3.4 months, from November 30 to March 11, with an average daily high temperature below 51°F. The coldest day of the year is January 18, with an average low of 23°F and high of 41°F.

During air quality monitoring, the meteorological parameters were also monitored in both District , the result of meteorological parameters are given below:

District Gilgit

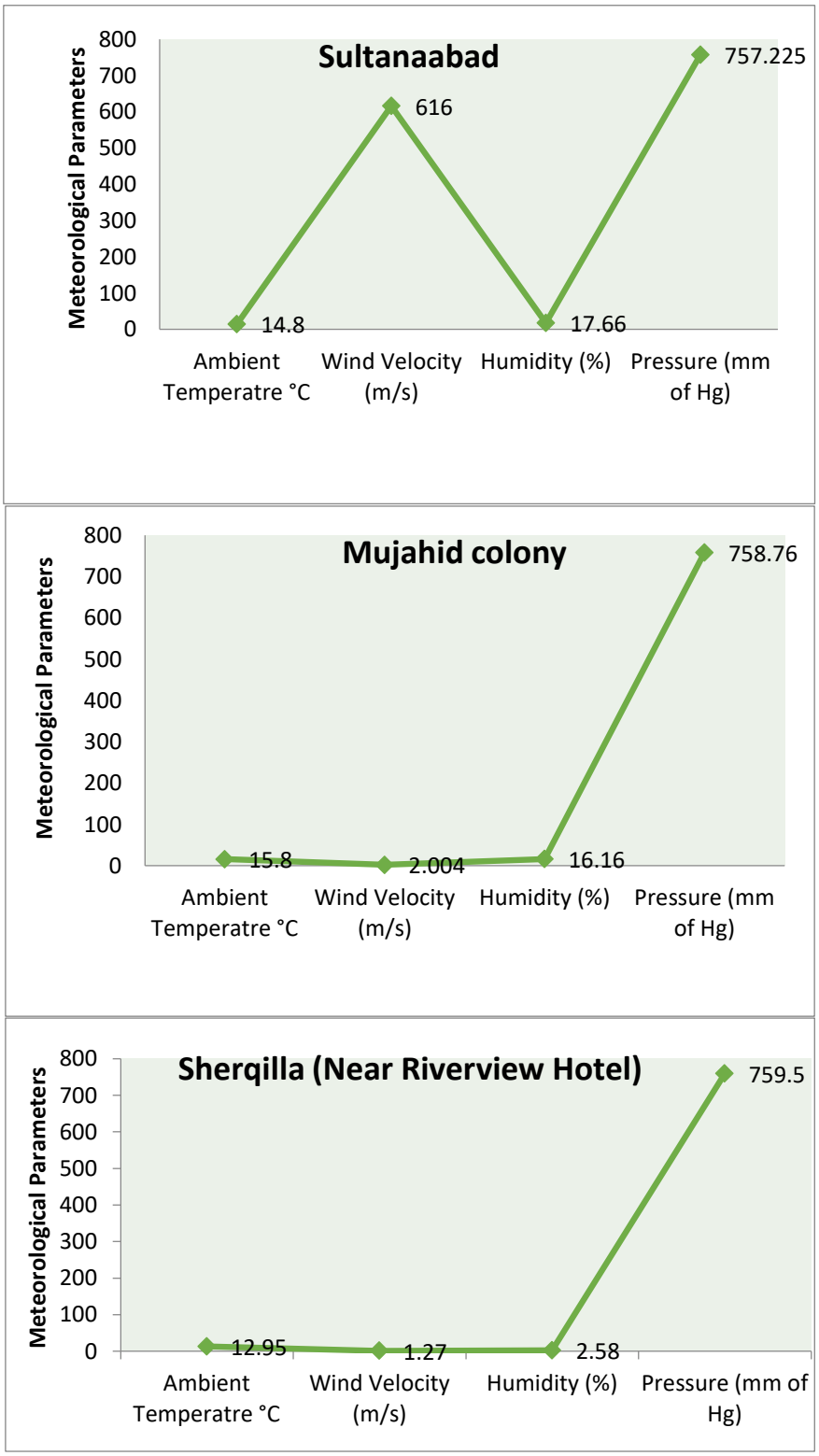


FIGURE 4.2: AVERAGE HIGH AND LOW TEMPERATURE IN DISTIRCT GILGIT

District Ghizer

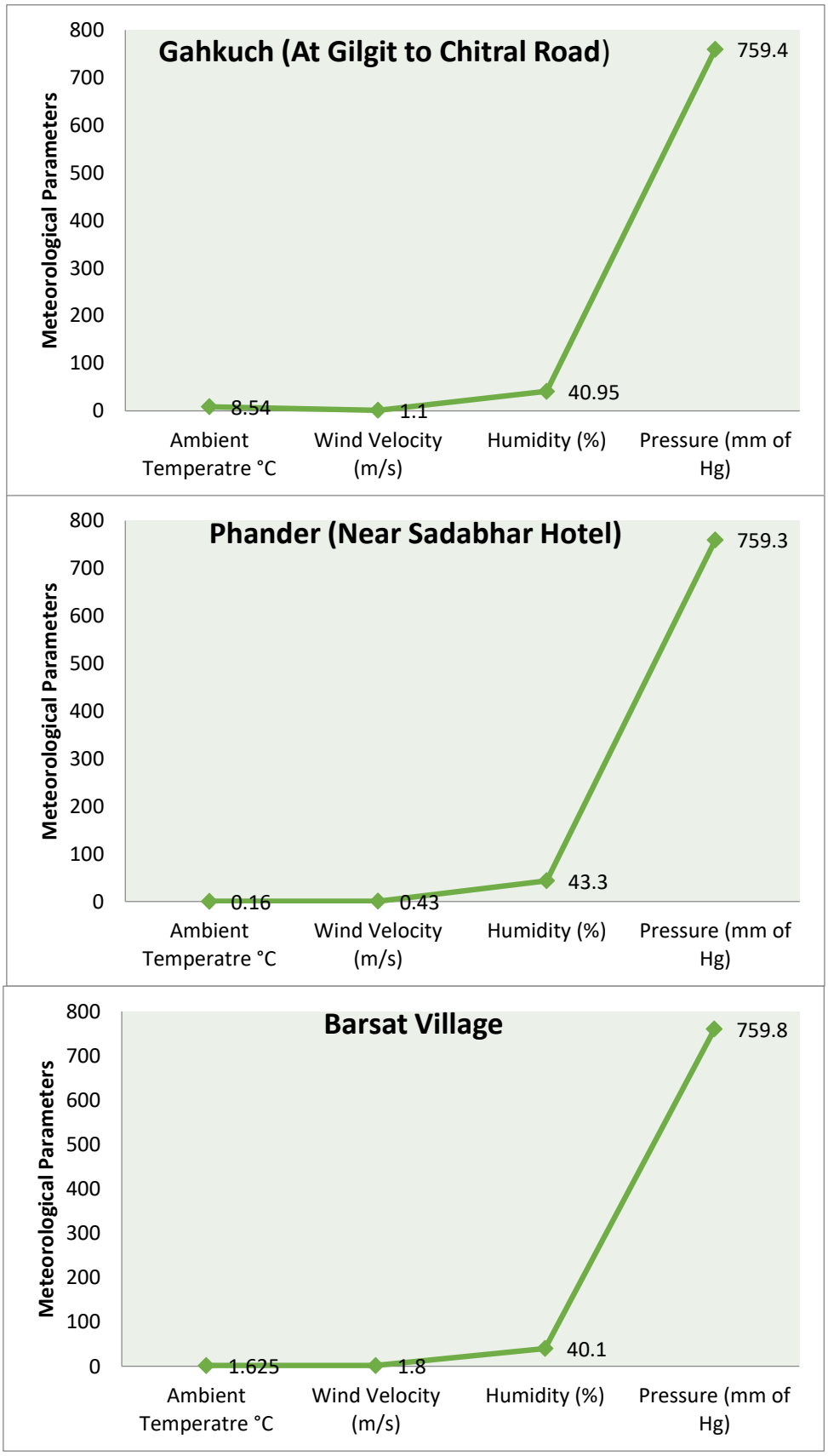


FIGURE 4.3: AVERAGE HIGH AND LOW TEMPERATURE IN DISTRICT GHIZER

4.8 SURFACE WATER HYDROLOGY

There is only one water body, Gilgit River also referred to Ghizer River, in the project area. Gilgit River originates from as elevation 4300 m from large glaciers of Khakush Gol and Shuni Gol in Shandoor area and flow eastward joining number of tributaries including Yasin, Iskhuman and Hunza River and ultimately joins the Indus River. The catchment area of Ghizar River near Phandar Lake is estimated about 1442 km2.

4.8.1 Surface water

Randomly sampling procedure was adopted to find out the concentration of surface water parameters in the project vicinity, as mentioned above only one water body is flowing on the right side along the project site, so at different sites sample were collected from different coordinates as shown in table 4.3 , 4.4 and 4.5.

Gilgit River Water (MC) 35.55'32.0"N 74.18'39.0"E			
Sr. No.	**Parameters**	**Unit**	**Results**
1	**pH**	__	8.23
2	**TDS**	mg/l	51
3	**oil and Grease**	mg/l	<0.2
4	**BOD**	mg/l	<1.0
5	**COD**	mg/l	<1.0
6	**TSS**	mg/l	8
7	**Lead**	mg/l	<0.013
8	**Nickle**	mg/l	<0.008

TABLE 4.3: RESULTS OF SURFACE WATER SAMPLE POINT 1 (MUJAHID COLONY)

Gilgit River Water (SQ) 36.05'20.0"N 74.02'51.0"E			
Sr. No.	**Parameters**	**Unit**	**Results**
1	**pH**	__	8.12
2	**TDS**	mg/l	125
3	**oil and Grease**	mg/l	<0.2
4	**BOD**	mg/l	<1.0
5	**COD**	mg/l	<1.0
6	**TSS**	mg/l	9
7	**Lead**	mg/l	<0.013
8	**Nickle**	mg/l	<0.008

TABLE 4.4: RESULTS OF SURFACE WATER SAMPLE POINT 2 (SHERQILLA)

Gilgit River Water (Barsat) 36.09'37.0"N 72.41'46.0"E			
Sr. No.	**Parameters**	**Unit**	**Results**
1	**pH**	__	8.45
2	**TDS**	mg/l	61
3	**oil and Grease**	mg/l	<0.2
4	**BOD**	mg/l	<1.0
5	**COD**	mg/l	<1.0
6	**TSS**	mg/l	<1.0
7	**Lead**	mg/l	<0.013
8	**Nickle**	mg/l	<0.008

TABLE 4.5: RESULTS OF SURFACE WATER SAMPLE POINT 3 (BARSAT)

4.8.2 Ground water

As we know the project site is on high elevation, only natural streams, nullahs, and flowing river is detected within the periphery. Mostly locals are dependent of river water or on natural streams to fulfil their drinking demand, but at some villages, water supply is provided, so tap water sample were collected, results shown below in table 4.6, 4.7 and 4.8.

Sultan Abad (Borehole) 35.56'53.0"N 74.22'24.0"E				
Sr. No.	**Parameters**	**Unit**	**Results**	**NEQs**
1	**pH**	__	8.24	6.5-8.5
2	**Turbidity**	NTU	ND	<5NTU
3	**Total Hardness**	mg/l	204	<500mg/l
4	**TDS**	mg/l	230	<1000
5	**Nitrite**	mg/l	<0.01	≤3p
6	**Nitrate**	mg/l	0.3	≤50
7	**Copper**	mg/l	<0.0045	2
8	**Mercury**	mg/l	<0.0008	≤0.001
9	**Total Coliforms**	CFU/100ml	Absent	0/100ml
10	**E coli**	CFU/100ml	Absent	0/100ml

TABLE 4.6: GROUND WATER SAMPLE COLLECTION FROM SULTANABAD (BOREHOLE)

Gahkuch 36.10'38.0"N 73.46'11.0"E				
Sr. No.	**Parameters**	**Unit**	**Results**	**NEQs**
1	**pH**	__	7.49	6.5-8.5
2	**Turbidity**	NTU	ND	<5NTU
3	**Total Hardness**	mg/l	200	<500mg/l
4	**TDS**	mg/l	250	<1000
5	**Nitrite**	mg/l	<0.01	≤3p
6	**Nitrate**	mg/l	3.5	≤50
7	**Copper**	mg/l	<0.0045	2
8	**Mercury**	mg/l	<0.0008	≤0.001
9	**Total Coliforms**	CFU/100ml	Absent	0/100ml
10	**Ecoli**	CFU/100ml	Absent	0/100ml

TABLE 4.7: GROUND WATER SAMPLE COLLECTION FROM GAHKUCH

Phandar (tap) 36.09'44.0"N 72.53'25.0"E				
Sr. No	**Parameters**	**Unit**	**Results**	**NEQs**
1	**pH**	__	8.34	6.5-8.5
2	**Turbidity**	NTU	ND	<5NTU
3	**Total Hardness**	mg/l	44	<500mg/l
4	**TDS**	mg/l	51	<1000
5	**Nitrite**	mg/l	<0.01	≤3p
6	**Nitrate**	mg/l	0.3	≤50
7	**Copper**	mg/l	<0.0045	2
8	**Mercury**	mg/l	<0.0008	≤0.001
9	**Total Coliforms**	CFU/100ml	Absent	0/100ml
10	**E coli**	CFU/100ml	Absent	0/100ml

TABLE 4.8: GROUND WATER SAMPLE COLLECTION FROM PHANDAR

The concentration of parameter in surface and ground water with project fringe is below than National environmental quality standards. Water quality reports are attached in Annex -1

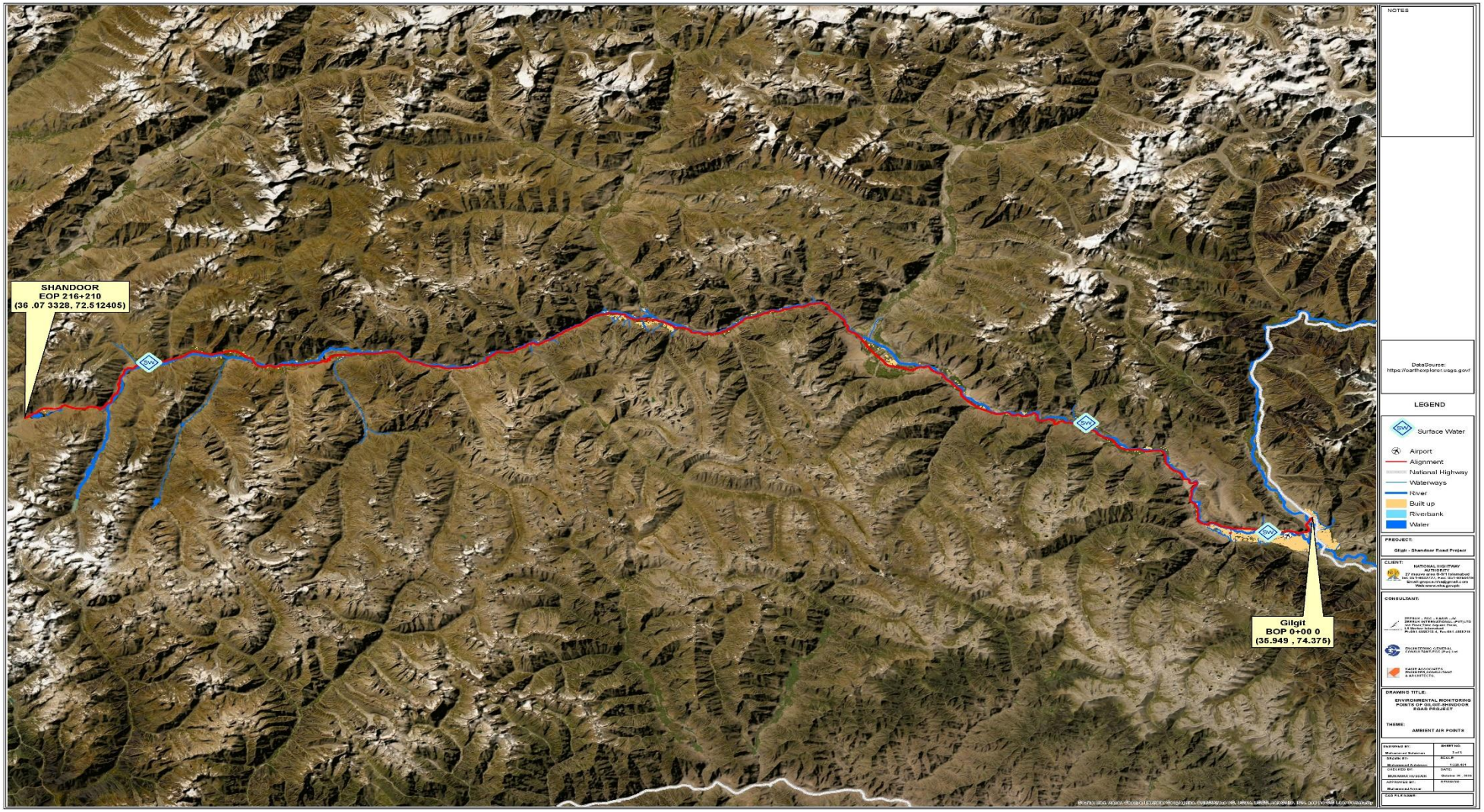


FIGURE 4.4: SURFACE WATER MONITORING POINTS

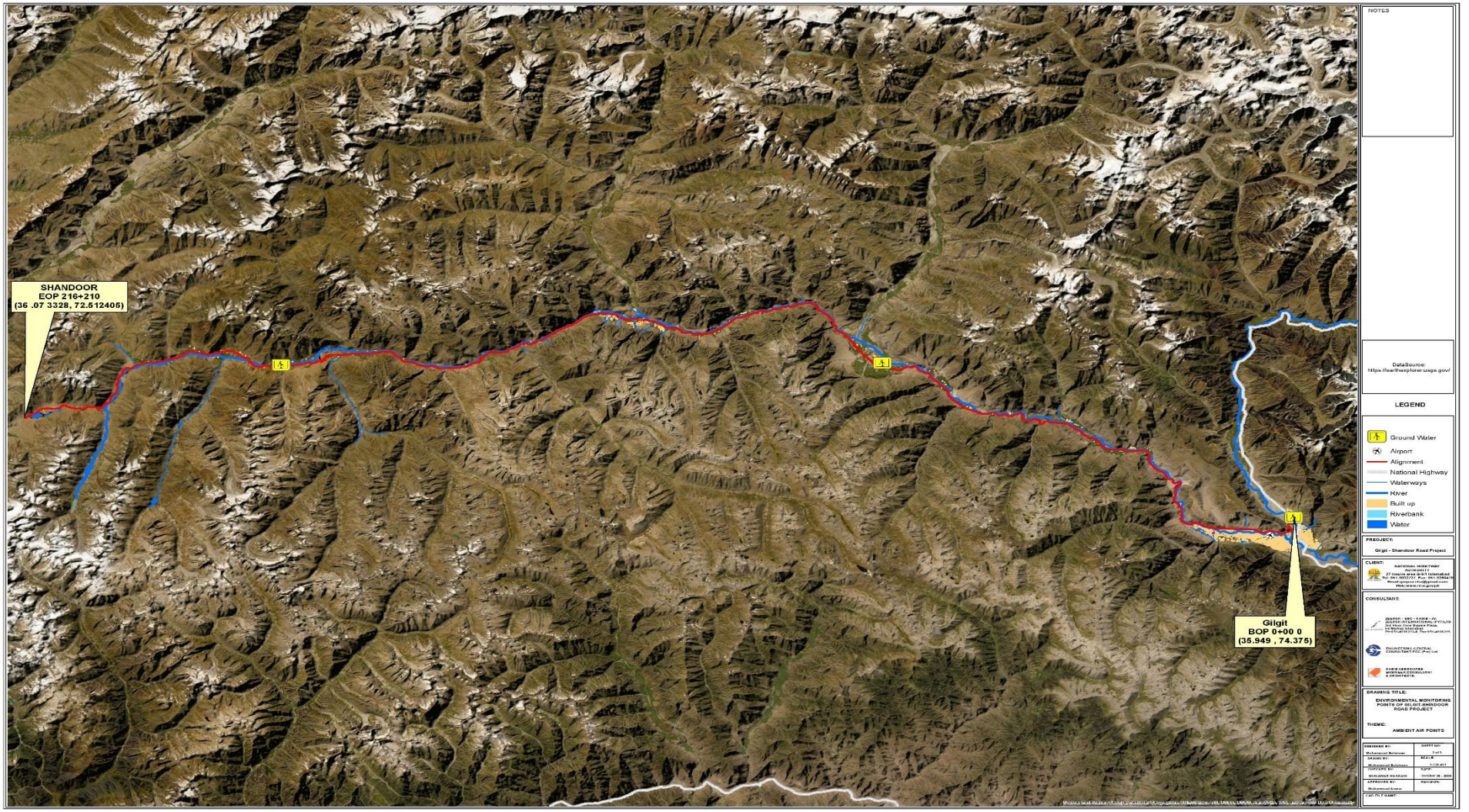


FIGURE 4.5: GROUND WATER MONITORING POINTS

4.9 AMBIENT AIR QUALITY

After every 40 km of distance air monitoring station were installed at project site, to Determined concentration of particulates matter, heavy metal in the environment of District Gilgit and District Ghizer ,total 6 location were chosen after baseline survey as shown below in graphical representation. Three from District Gilgit and three from District Ghizer, side by side with monitoring station noise detector were also installed for 24 hours at all sites.

Sr. No.	Sampling Matrix	Locations (Coordinates)
District Gilgit		
1	Ambient Air (Point 01)	35°56'52.0" N 74°22'27.0" E
2	Ambient Air (Point 02)	35°55'34.0" N 74°18'40.0" E
3	Ambient Air (Point 03)	36°05'26.0" N 74°02'47.0" E
District Ghizer		
4	Ambient Air (Point 04)	36°10'38.0" N 73°46'12.0" E
5	Ambient Air (Point 05)	36°09'42.0" N 72°53'25.0" E
6	Ambient Air (Point 06)	36°09'43.0" N 72°41'41.0" E

TABLE 4.9: AMBIENT AIR QUALITY MONITORING LOCATIONS

Results of air quality monitoring for various parameters are given in Table 4.9 All values are below the applicable NEQs limits except for particulate parameters which are high throughout.

Sr. No.	Parameter	Average Test Results at Sampling Locations							Unit	Duration (hours)	NEQS
		01	02	03		04	05	06			
1	NO2	14.1	14.09	14.54		14.49	11.99	13.22	µg/m3	24	80
2	No	7.76	7.71	8.33		8.67	7.89	7.68	µg/m3	24	40
3	NOx	21.76	21.08	22.87		23.16	19.88	20.90	µg/m3	24	120
4	So2	15.19	15.38	14.75		15.13	16.00	14.96	µg/m3	24	120
5	CO	0.28	0.28	0.25		0.32	0.24	0.27	µg/m3	24	5
6	PM10	94.04	117.29	117.17		119.92	115.17	108.08	µg/m3	24	150
7	PM2.5	18.17	22.42	19.67		25.08	17.67	19.88	µg/m3	24	35

TABLE 4.10: AMBIENT AIR QUALITY MONITORING

The results of Nitrogen Dioxide in all locations along the alignment is measured based on 24 hours' study. The results of all the locations were found similar with average minimum 11.99 µg/m3 at location 5 and average maximum 14.54 µg/m3 at location 3. Nitrogen Oxides has been recorded 8.67µg/m3 at location 4, which is highest among all other locations while it is estimated the lowest at location 2. The concentration of Nox was found 23.16 µg/m3 at location 4 while the lowest recorded concentration of Nox was found 19.88 µg/m3 at location 5 of ambient air monitoring. The results of Sulphur Dioxide at all the locations range from location to location. However, it is recorded 14.75 µg/m3 at location 3 and 16 µg/m3 at location 5.

Particulate Matter is an air pollution substance that is directly emitted into the atmosphere through anthropogenic activities including combustion from car-engines, households, industrial activities.

The results also show that the concentration of PM10 is found nearer to the NEQs. The concentration of Carbon Monoxide within the periphery of project area is found below NEQs and WHO Standards. Maximum average concentration was found at location 4 and lowest concentration was observed at location 1. The air quality result shows that the concentration of PM2.5 is less than permissible limit.

The reason of these low values is less vehicular emission in the area, and low number of anthropogenic activity.

Noise Level

The major sources of noise commonly include traffic movement. Noise is generated from motor engines, vehicle transmission and exhaust systems, car horns. The noise level depends on traffic flow, speed and mode of transport, and road conditions, including the gradient and surface characteristics. The Project Area is mostly rural; the noise level may be high in some sections due to close proximity of receptors.

The Noise Level along the different locations of Study Area was measured in District Gilgit and in District Ghizer and the results are presented in Figure 4.4 to Figure 4.7 The average value of noise along the alignment in Study Area is within the NEQS guidelines however, the levels are expected to go beyond limits during the construction and operation phases. Roadside noise levels were measured from the edge of the road. Average noise level along the alignment is between 55.3 and 44.2 dB(A) for day and night respectively, whereas peak noise level was recorded between 59.7 and 51.5 dB(A) for day and night respectively.

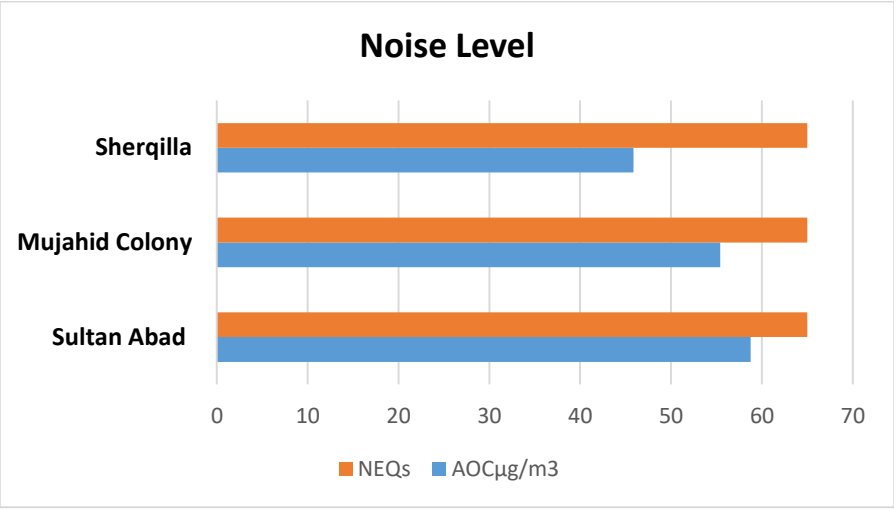


FIGURE 4.6: GRAPHICAL REPRESENTATION OF NOISE (DAY) CONCENTRATION IN DISTRICT GILGIT

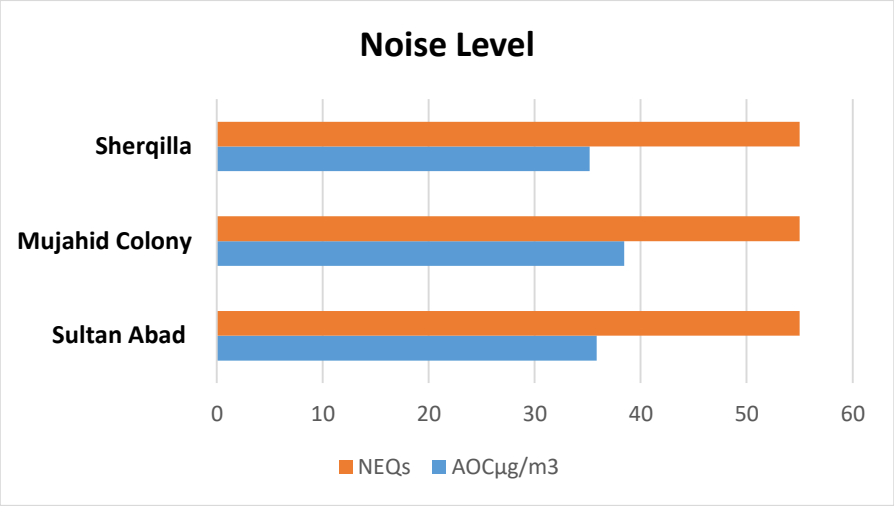


FIGURE 4.7: GRAPHICAL REPRESENTATION OF NOISE (NIGHT) CONCENTRATION IN DISTRICT GILGIT

The above two figure shows the comparison of noise in day and night time in the project area It clearly shows that noise level in both time is less that standards.

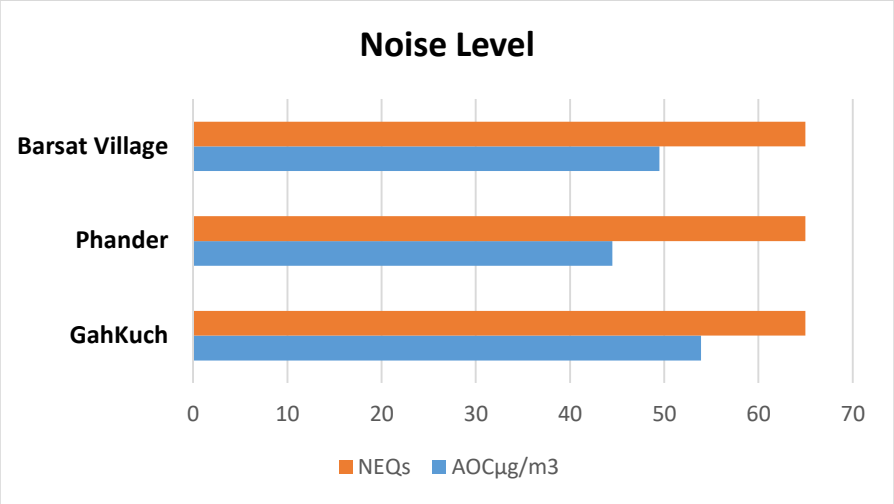


FIGURE 4.8: GRAPHICAL REPRESENTATION OF NOISE (DAY) CONCENTRATION IN DISTRICT GHIZER

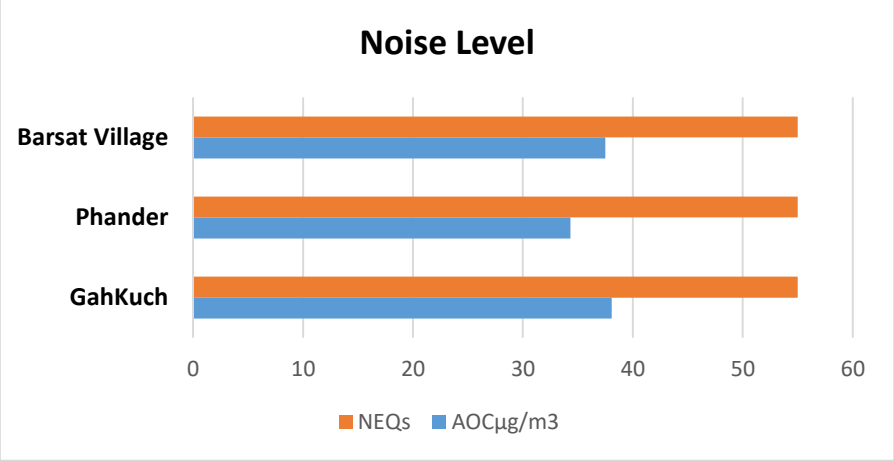


FIGURE 4.9: GRAPHICAL REPRESENTATION OF NOISE (NIGHT) CONCENTRATION IN DISTRICT GHIZER

The above two figure shows the comparison of noise in day and night time in the project area It clearly shows that noise level in both time is less than standards. The overall air quality of District Gilgit and District Ghizer result shows, that air quality of project area is clean, concentration of all parameters are below from National Environmental Quality Standards of Pakistan. Air quality monitoring report is attached in Annex-1 of the report.

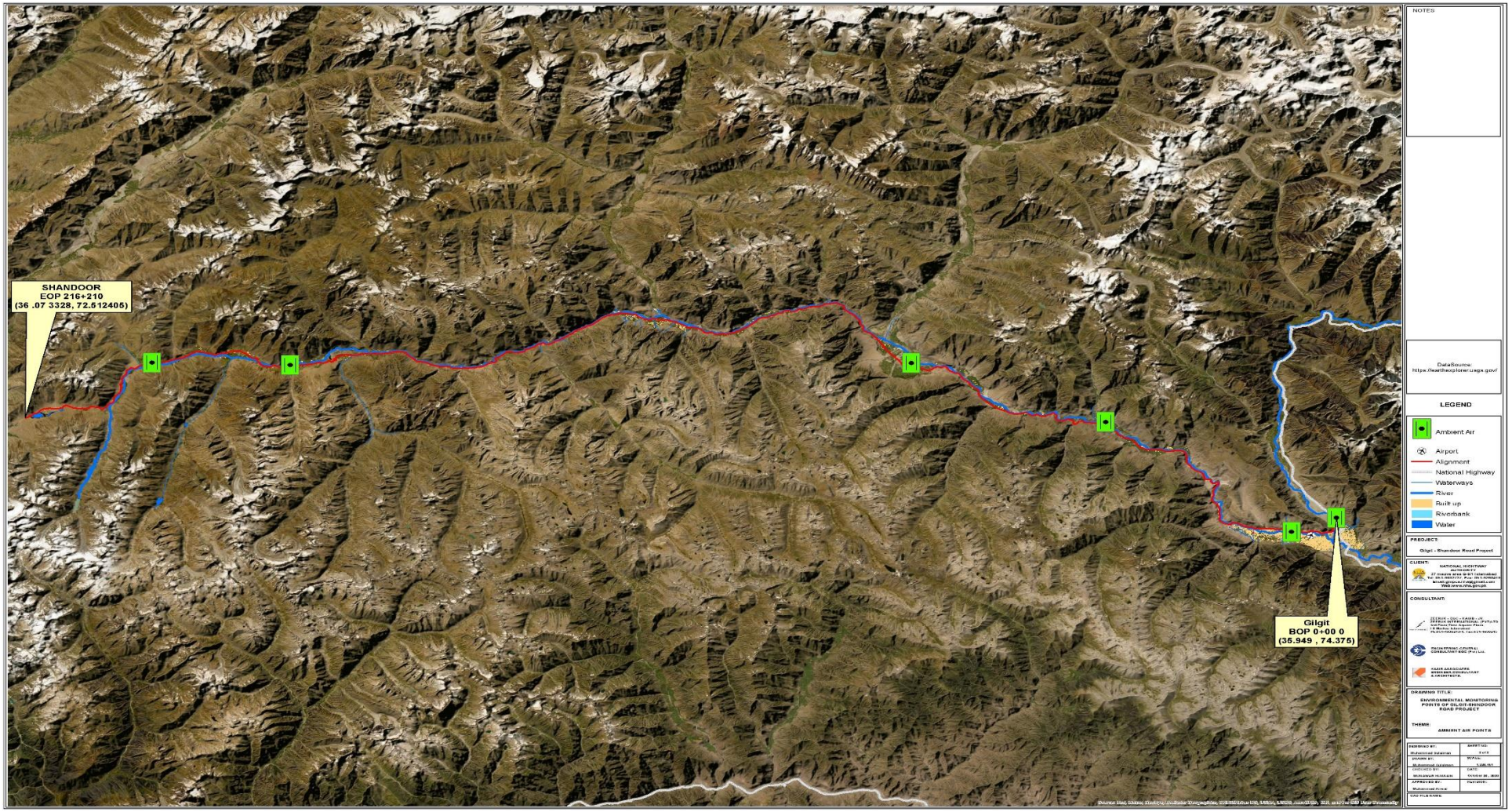


FIGURE 4.10: AIR AND NOISE MONITORING POINTS

4.10 ECOLOGCAL ENVIRONMENT

Ecological study of the project area has been conducted during the field visits, standard ecological assessment technique based on primary and secondary information, discussion with Government departments and meeting with groups of communities/public living in and around the Project area coupled with expert visual observations was used for the assessment. The Gilgit - Baltistan is rich in flora and fauna because of different climatic conditions and ecosystems. In spite of unscientific management and ruthless hunting in the past, wildlife in the Gilgit - Baltistan still supports rare and endangered species of mammals and birds like Marco Polo sheep, blue sheep, Markhor, black bear, brown bear, Chakor, snow leopard and ram Chakor. Due to the destruction of habitat wildlife population of Gilgit - Baltistan is decreasing rapidly and other valuable species are also decreasing. Until 1947, almost all the important valleys, most of them now included in protected areas, supported a high density of wild animals and hunting was allowed to only a few British and high ranking local officials, rulers and persons with high social status.

4.10.1 Terrestrial Fauna

Terrestrial fauna of the area comprised of domestic animals including dogs, sheep, goats, cows, donkeys and yaks. The wildlife in Project area and its surrounding is famous for its faunal diversity (mammals, residents and migratory). List of wild animals found in the area is given in Table 4.11

Sr. No.	Scientific name	Common name	Local name
1	Capra ibex ibirica	Himalayan Ibex	Kill Mayaroo
2	Vulpes vulpes montana	Red fox	Loee
3	Lepus capensis	Cape hare	Ushayoo
4	Uncia uncia	Snow leapord	Dee
5	Felis lynx	Himalayan lynx	Bug bayaro
6	Canis lupus	Wolf	Shahaal
7	Ursus arctos	Brown bear	Ich

TABLE 4.11: LIST OF FAUNA IN THE PROJECT AREA

4.10.2 Birds-Avifauna

Many bird species have been observed in the Study Area. These include passage migrants, vagrant, resident, breeding and irregular visitors. The migratory birds descend from higher altitudes during the winter months. Typical bird species found here include Snow Partridge Lerwa,chakor Alectoris chukar, Common Quail Coturnix, Common Hoopoe Upupa epops, Common Swift Apus, Rock Pigeon Columba livia and Common Kestrel Falco tinnunculus. The others common birds observed in the Study Area are given in Table 4.12 below:

Sr. No.	Common Name	Scientific Name
1	Peregrine Falcon	Falco Peregrinus
2	Alpine Chough	Pyrrhocorax Graculus
3	Jungle Crow	Corvus Macrorhynchos
4	House Sparrow	Passer Domesticus
5	Chukar Partridge	Alectoris Chukar

6	Golden Eagle	Aquila Chrysaetos
7	Hoopoe	Upupa Epops
8	Himalayan Snow Cock	Tetraogallus Himalayensis
9	Northern Eagle	Owl Bubo Bubo
10	Brown Dipper	Cinclus Pallasii
11	Hill Pigeon	Columba Rupestris
12	Kestrel	Falco Tinnunculus
13	Laughing Thrush	Garrulax Lineatus
14	Wood Pecker	Dendrocopos Mahrattensis
15	Black Billed Magpie	Pica Pica
16	Whistling Thrush	Myiophoneus Careuleus

TABLE 4.12: LIST OF SPECIES OF BIRDS FOUND IN THE PROJECT AREA

4.10.3 Endangered, Threatened and Vulnerable Species of Fauna

The IUCN red list of Endangered, Threatened and Vulnerable Species in Northern areas is shown in Table 4.13.

Category	Species	
	Scientific Name	Common Name
Endangered species	Capra flconeri	Markhor
	Eupegaurus cinereus	Wolly flying squirrel
	Ovis vigneri	Ladakh urial
	Unica unical	Snow leopard
Vulnerable Species	Ursus thibetanus	Asiatic black bear
Threatened species	Naemorhedus goral	Grey goral
	Moschus chrusogaster	Musk deer
	Matmota caudate	Long-tailed marmot
	Pseudois nayaur	Blue sheep

TABLE 4.13: ENDANGERED, THREATENED AND VULNERABLE SPECIES OF FAUNA

None of these threatened, vulnerable and endangered species have been reported in the project area.

4.10.4 Fist and Fisheries

The Gilgit - Baltistan has many rivers, streams and alpine lakes fed by snowmelt and glacier waters. The freshwater resources contain several fish species which are an important component of the region's biodiversity. The fish diversity in Gilgit - Baltistan is not yet described with greater detail despite its biological and evolutionary significance. However, some recent studies report that there are about 17 species of native fish and 3 of exotic fish. Out of 17 native species, four are endemic to Gilgit - Baltistan, while several others have ranges confined to one or two localities.

The Gilgit River also known as Ghizer River including 45 streams and 5 lakes from Shandoor to Gahkuch provides as ideal habitat for fish species. The fish species found in that area including Phandar Lake are Brown tout (salmo trutta fario), schizothorax, plagiostomus, S. labiatus and S.esocinus. Breeding season of trout fish starts from late October to February in which fishing is prohibited. The species of fish observed in the project area are listed below in table 4.14.

Sr. No.	Scientific Name	Common Name
1	Oncorhynchus Mykiss	Rainbow Trout

2	2Salmo Trutta	Brown Trout Critically
3	Racoma Labiata	Kunar Snow Trout
4	Carassius Auratus	Goldfish
5	Cyprinus Carpio	Common Carp

TABLE 4.14: LIST OF FISH SPECIES FOUND IN PROJECT AREA

4.10.5 Flora

The vegetation of the Study Area falls in the Dry Sub-Tropical Shrub Zone and Dry Temperate Coniferous Forest Zone. The former is located at lower elevations and southern slopes of mountains especially along the Gilgit and Ghizer Rivers. The latter consists of forests found in the inner or northern slopes of the Himalayas and are less susceptible to monsoons. The dry temperate coniferous forests occur between elevations of 1,500 to 3,400 meters. These forests are characterized by fewer deciduous tree species, although coniferous species predominate. Forests occur in the valleys, including the Naltar and Bagrot Valleys and also in the vicinity of the Jutial Nullah. Typical tree species in these forests include Picea smithiana, Cedrus deodara and Pinus willichiana. Smaller shrubs include Acacia nilotica Quercus ilex and Juglans regia and scattered shrubs of ArtimEIA maritima, Indigofera gerardiana, Sambucus ebulus, Salix tetrasperma Sorbaria tomentosa, Morrusalba and Plectranthus rugosus. These forests not only provide habitat for faunal species but also provide timber the locals use for domestic and commercial purposes. The indigenous species are xerophytic in nature including mainly willow Ilenthus and poplar, whereas eucalyptus, frash ber, etc. are found in Study Area. The detail of vegetative species found in the Study Area is given in Table 4.15 below.

Sr. No.	Common Name	Scientific Name
1	Bhaid (Willow)	Salix Tetrasperma
2	Thoth(Mulberry)	Morrus Alba
3	Ilenthus	Ilenthus Spp
4	Khail	Pinus Roxburghii
5	Poplar	Populus Alba
6	Kikar	Acacia Nilotica
7	Palosa/Phulahi	Acacia Modesta
8	Safida	Eucalyptus
9	Frash	Tamarix Aphylla
10	Eucalyptus	Eucalyptus Camaldulensis
11	Ber	Zizyphus Moritiana
Fruits Tress		
12	Walnut	Juglan
13	Pricot	Armenian plum
14	Mulberry	Morus
15	Almond	Prunus dulcis
16	Apple	Malus domestica
17	Pears	Pyrus
18	Grapes	Vitis
19	Pomegranate	Punica granatum
20	Cherry	Prunus avium

21	Fig	Ficus carica
22	Peach	Prunus persica

TABLE 4.15: LIST OF TREES OBSERVED IN DISTRICT GILGIT AND DISTRICT GHIZER

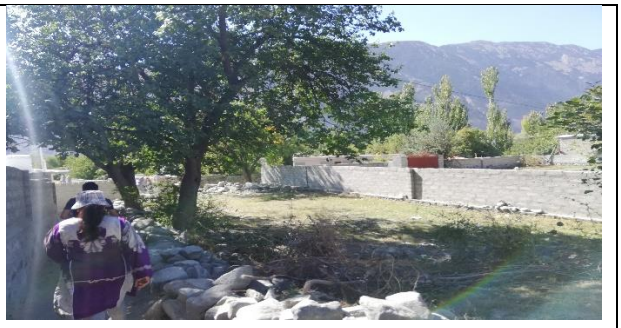


FIGURE 4.11: PICTORIAL VIEW OF TREE SPECIES

4.11 LAND DETAILS

The proposed project passes through environmentally sensitive areas from both Districts , to Collect relevant baseline data and for mitigation measures the proposed project is divided into following ecological zone ;

- Ecologically Normal Zone: Gilgit to Ghakuch
- Ecologically Sensitive Zone: Ghakuch to Khalti-Ghupis
- Ecologically Highly Sensitive Zone: Ghupis to Phander –Handrap
- Ecologically Critical Zone: Phandar-Handrap to Shandur Pass

In the project area, the land is primarily used for agriculture purposes. The land can be classified as irrigated and un-irrigated. Irrigated land has the certain sources of water like natural stream, through piping system. The un-irrigated land is normally rained. Some scattered houses as well as densely populated houses have also been observed to be situated along the entire alignment of the project area. Figure 4.12 and 4.13 shows land use pattern of starting and ending point of project area, remaining portion regarding sensitive receptors coming along the alignment clear exhibits attached in **Annex -II** of the report.

Ecologically Normal Zone: Gilgit to Ghakuch

Gilgit to Gahkhuch is Ecologically Normal zone , from start point the proposed project alignment is shifted on right side of the river bank from Sultanabad to Hanzal, from Hanzal onwards the alignment shifted on left side of the river bank, minor settlement coming along the alignment. No fragile ecosystem is present within that area and no wild life Sanctuaries.

Ecologically Sensitive Zone: Ghakuch to Khalti-Ghupis

By keeping in view environmental sensitivity From RD 80+000 Gahkuch to RD 114+200 Ghupis ecologically in sensitive zone, because proposed project area is surrounded by lush green pastures and wet land eco system. A total of 8 species of mammals were recorded in the area. Canis lupus (Wolf), Capra ibex (Himalayan Ibex) and Moschuschrysogaster (Himalayan Musk Deer) were reported by the Wildlife staff and local peoples. Only one species of lagomorphs, Lepus capensis (Cape Hare)

was seen. The fecal material of the Vulpesvulpes (Common Red Fox) was observed on different places of the area. The area is rich in large mammal species which adequate that the area is ecological rich in biodiversity. Three species of rodents, Apodemousrusiges (Himalayan Wood Mouse,), Mus musculus (House Mouse) and Rattusturkestanicus (Turkistan Rat) and one insectivore, Crocidurapullata (Asiatic Whitetoothed Shrew) were recorded in the study sites.

Ecologically Highly Sensitive Zone: Ghupis to Phander –Handrap & Ecologically Critical Zone: Phandar-Handrap to Shandur Pass

The road alignment is surrounded by fish feeding areas, area is full of trout fishes, green patches on Row comprises of different specie's of trees.

The Ghizar River including 45 streams and 5 lakes from Shandure to Gahkuch provides as ideal habitat for fish species. The fish species found in that area including Phandar Lake are Brown tout (salmo trutta fario), schizothorax, plagiostomus, S.labiatus and S.esocinus. Breeding season of trout fish starts from late October to February in which fishing is prohibited. Being a carnivorous in nature, the trout take food from natural environment, which includes protozoan, coelenterates, rotifers, insects, crustaceans, mollusks and larvae of many insects. It has also been observed that trout fish eat local fishes, while the eggs of trout are being eaten up by local fishes. There is no commercial fishing in the area. Fish caught by the locals are consumed at household level.

4.12 MINNING IN THE PROJECT AREA

The GB has been endowed with rich natural and cultural heritage and a hospitable and peace loving people, the Gilgit-Baltistan (GB) offer unique potential for tourism, gemstones and minerals development particularly, it has great potential in precious, semi-precious gemstones and adventure, culture, natural and community-based tourism. The area has opportunities for trans-boundary trade in tourism and minerals through promoting border trade, commerce, scientific, cultural and conservation exchanges due to its unique geo-strategic position.

The proposed project has taken this area to a new flashpoint, this project will be a great game changer for the business groups working in tourism, gemstones and minerals.

The proposed project road from Gilgit to Shandoor will open new doors of opportunities. Gilgit to Shandur Pass is stretched some 216 kilometers, the area is potential for mine and minerals, presently, there are various sites which have been leased out for exploration of mines and minerals all the way from Gilgit to Shandure.Some parts of Gilgit and Ghizer are much potential for mines and minerals, presently, the exploration of marble and other minerals are being undertaken at Henzal district Gilgit, some parts of Yasin and gupis district Ghizer by the authorized lease holders.

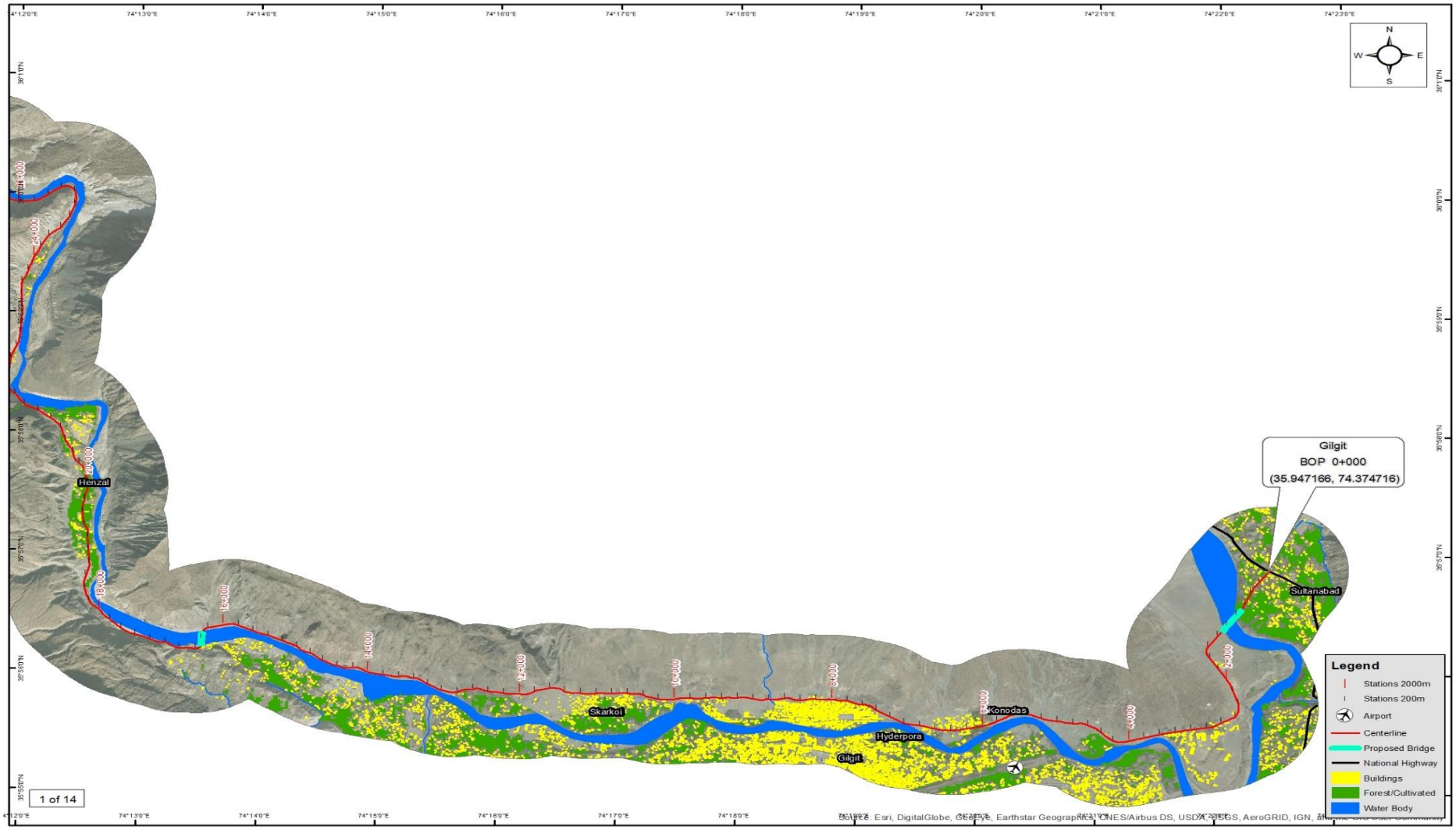


FIGURE 4.12: LAND USE PATTERN OF STARTING POINT OF THE ALIGNMENT

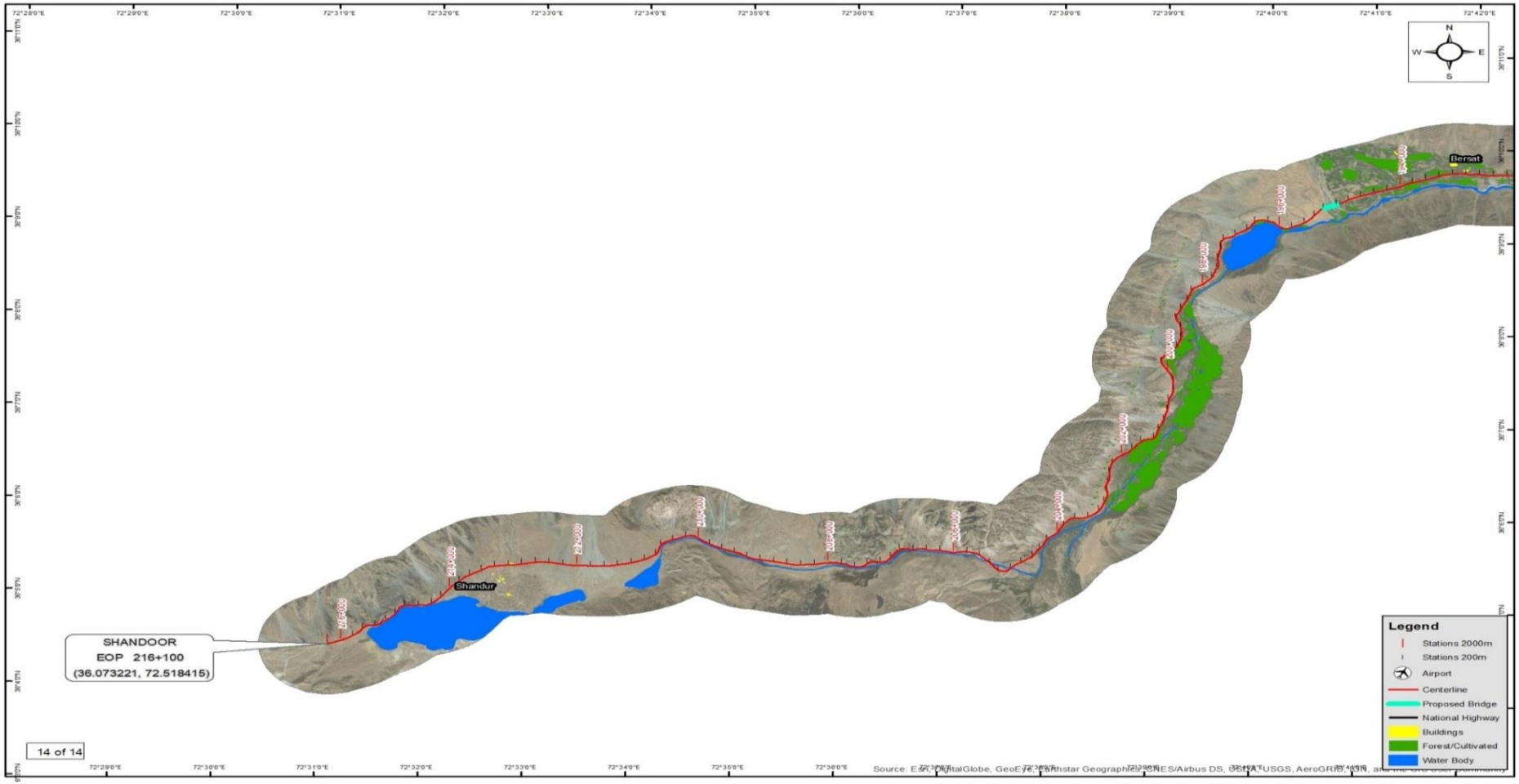


FIGURE 4.13: LAND USE PATTERN OF ENDING POINT OF THE ALIGNMENT

CHAPTER 5
SOCIO-ECONOMIC ENVIRONMENT& STAKEHOLDER DISCLOSURE

5.1 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

5.1.1 Socio-Economic Aspects

The purpose to carry out socioeconomic baseline of proposed project area is to covers the demography, administrative and political settings, religious and cultural, economic aspects, infrastructure and facilities, security situation, gender, and NGOs. Main objective of Socio-Economic survey is to find out he possible impact of the proposed project population, socio economic survey is carried out and to point out the living standard and socio-economic characteristic of the peoples. The settlements, along he proposes alignment in which socioeconomic survey was conducted as per methodology described in below.

5.1.2 Methodology Adopted for Data Collection

To study the socio-economic conditions of the project area mainly secondary sources of data were used. During the socio-economic survey, 144 households were selected as sample size from different villages for data collection from District Gilgit and District. These households were selected by using systematic random sampling technique, which is a type of probability sampling. By using Standard Statistical Formula, the sample size was calculated with using a confidence level of 95% and confidence interval10%.. Interviewing technique was used as a tool for data collection. People were informed about the goal of the project, the size of its infrastructure, during the socio-economic survey. In particular, local people's apprehensions about the proposed project have been discussed. Extensive sessions of questions and answers were held to clarify the works and activities related to the project in detail.

5.2 STUDY AREA SETTLEMENTS

During the field survey following settlement coming along the alignment in different villages were noticed and are mentioned in table 5.1 below:

Project Affected Persons (PAPs)					
Sultan Abad					
Name	**CNIC**	**Mobile**	**Occupation**	**Total area**	**Land type/category**
M.Hussain	71501-3571965-3	3554386042	Teaching	30Kanal	House and Agriculture land
Imamdad	71501-0209495-7	316583367	Tailor	3Kanal	House and Agriculture land
Gulam Rasool	42101-1508452-7	3100500728	Driver	27Kanal	House and Agriculture land
Fahim Hussain	71501-2665965-1	3125628170	Student	3Kanal	Agriculture land
M.Yaqoob	71501-2035135-5	3555409296	Teacher	40Kanal	House and Agriculture land

Ali Madad	71501-0765664-3	3118964788	Labour	3Kanal	House and Agriculture land
Gulam Naseer	71501-1283548-7	3468487602	Electrician	30Kanal	House and Agriculture land
Skindar Hayat	-	3463544846	labour	9Kanal	House and Agriculture land
Mohd Alam	71501-8599498-9	3115828707	Businessman	4Kanal	House and Agriculture land
Amin Hayat	35202-5226292-3	3239901116	Businessman	12Kanal	House and Agriculture land
Qasim Shah	71501-0207392-3	3155560855	Driver	14Kanal	House and Agriculture land
Hanzel Village					
M.Saleem		3446209200	Shopkeeper	2Kanal	Shop, 1 Masjid
M.Wazir	71501-2408494-7	3446209200	Shopkeeper	35 Marla	Land and shop
Zubair Ahmed	71501-9770646-7	3411933618	Shopkeeper	3Kanal	Fish Farm, Hotel
Sharot Village					
Mustaq c/o Malik Martakab Khan	71501-9123450-9	3151885071	Tyre shop	10 " 12"	Shop
Shakiote Village					
Mujeeb Ullah	71501-26219710-3	3449132781	Shopkeeper	14"15"	Shop
Sadaqat	75040414181	3445594078	Shopkeeper	30"60"	Shop
Phander Village					
Anwarulhah	71407-632384-3	3555120526	Shopkeeper	15"15"	2 Shop
M.Ayub	7140198-9842179-5	3555150182	Shop keeper	14"12"	2 Shops
Safdar	71401-5501532-9	3554110849	Shop keeper	14"12"	2 Shops
Mumtaz Khan	71401-6744668-3	3555172825	Shop keeper	14"12"	3 Rooms
M.Nadir	71401-424258689-5	3555684861	Shop keeper	14"12"	2 Shops
Shawali	71401-34043603-1	3555608146	Shop keeper	14"12"	2 Shops
Shah Iranwali	71401-3770469-9	3222133778	Shop keeper	14"12"	Shop
zar muh		355541E+11	Shop keeper	14"12"	2 Shops
Teru Village					
Zia Ali	71401-4964465-5	3555187566	Shopkeeper	13"15"	Shop
Mehram Shah		3555473439	Shopkeeper	13"15"	2 Shop
Abinas Shah	71401-5343708-7	35554193228	Shopkeeper	13"15"	

Ibrahim		3555641887	Shopkeeper	13"15"	Shop
Rahim Shah		3555208264	Shopkeeper	13"15"	Shop
Shimran Village					
Dalar Khan	71401-6015084-5	3555152631	Shopkeeper	15"13"	Shop
Raza Khan		3555134298	Landlord	14"14"	Shop
Maqsood	71401-2309955-3	3555204693	Woodwork	2.5Kanal	Shop land

TABLE 5.1: LIST OF SETTLEMENTS IN THE PROJECT AREA

5.3 ADMINISTRATIVE SETUP

GB administrative set-up largely mimics the set-up existing in rest of Pakistan with a provincial administration headed by Chief Secretary and assisted by a provincial secretariat encompassing core and line departments. However, being a newly established province, the Secretariat and departments are in process of development and evolution

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GB administrative set-up essentially imitates the set-up that exists in the rest of Pakistan with a provincial administration headed by the Chief Secretary and supported by a provincial secretariat that comprises departments of the centre and row. Nevertheless, the Secretariat and departments are in the process of development and evolution as a newly established province.

Currently there are 17 departments under Secretariat, each headed by a Secretary. As a norm, the Secretaries for key posts like P&D, Finance, Home Department etc. are from Federal Services and often from outside the region. Gilgit–Baltistan consist of 10 Districts, Baltistan division consist of four 4 and Six 6 in Gilgit divisions (including Diamer region). The number grew from 7 to 10 after two Districts were added in Baltistan and the Hunza-Nagar District was split. There is further division of Districts into Tehsils and union councils. Deputy Commissioner of every District has authority to regulate the Districts, consist of different other government department which are headed by Deputy Directors headed by Deputy Commissioners. Gilgit Region and Baltistan Region and most of the departments have Directors for each region who oversees the Deputy Directors at the District and Assistant Directors at the Sub-District level.

The local government system is based on a Legislative Council (Provincial Assembly), elected by people in all six Districts through voting, headed by a speaker. Technocrats and women members are later elected/selected through a proper system. Chief Secretary is administrative head of all departments, controlling all the affairs on behalf of Chief Minister, Government of Pakistan. Inspector General of Police heads the police department, with deputy superintendents in all six Districts.

5.4 DEMOGRAPHY

5.4.1 Population and Family Size

Total population coming along the alignment is around 50,000 (fifty thousand) from both Districts of Gilgit division. As per methodology mentioned above it was indicated that household size consists of average 8 people. Based on the social survey the gender wise distribution of the 144 respondent's families is given in Table 5.1.

GENDER AND AGE OF POPULATION OF PROJECT AREA(PA)

S.No	Age Groups Years	Male		Female		Total	
		No	Percent	No	Percent	No	Percent
1	0--4	63	10%	42	8%	105	9%
2	5--9	70	11%	55	11%	125	11%
3	10--19	90	14%	86	17%	176	15%
4	20-39	180	28%	144	28%	324	28%
5	40--49	155	24%	115	22%	270	23%
6	50--59	55	9%	44	8%	99	9%
7	60 and above	20	3%	32	6%	52	5%
Total		633	100%	518	100%	1151	100%

TABEL 5.2: GENDER AND AGE OF POPULATION OF RESPONDENTS OF PROJECT AREA

After the social survey, it was concluded that the major population fall in the age group between 20-39 and this age group is basically responsible for all routine activities.

5.4.2 Marriage and Marital Status

Marriage within cousins or close relatives is more preferable in both District, and these people are very sincere and committed with their spouse. But some villages are very liberal, they allow their son and daughter to do marriage according to your likeness, but in some area neither the groom nor the bride is allowed to choose his or her life partner. Mother has very little role in decision making for their son and daughter, males are dominant in both areas. As per social survey, the majority of respondents (i.e. 79.33%) are married and only 2.23 % are separated from their wives while 18.44% are single/unmarried.

Marital status of respondent in surrounding of PA

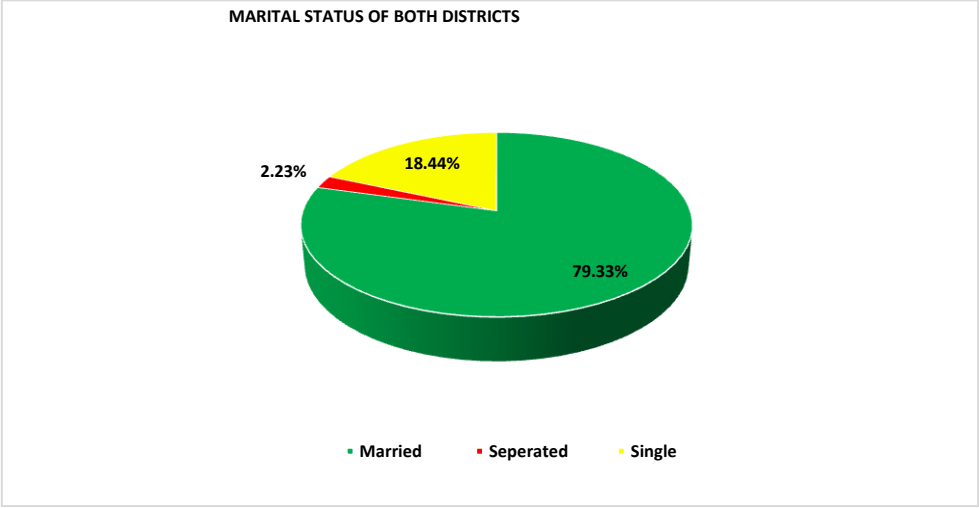

FIGURE 5.1: MARITAL STATUS OF RESPONDENT AROUND PROJECT AREA

5.4.3 Literacy

After critical data collection from the respondents of different villages along the alignment, its revealed that literacy rate within both Districts are emerging. In most of the villages male literacy rate is superior to female because of few restrictions made by the elderly peoples. But due to media influence people are getting awareness regarding education importance. According to the United

Nations Educational, Scientific and Cultural Organization (UNESCO), Pakistan at 55% has one of the lowest literacy rates in the world, and stands 160th among world nations. According to the census of 1998, the educational indicators for GB are below national average with a literacy rate of 37.85% (Male 52.62% Female 21%). But if we see the present scenario women literacy rate is emerging day by day, locals prefer their females to get education and stand equally among mans. Below figures show the education level of respondents.

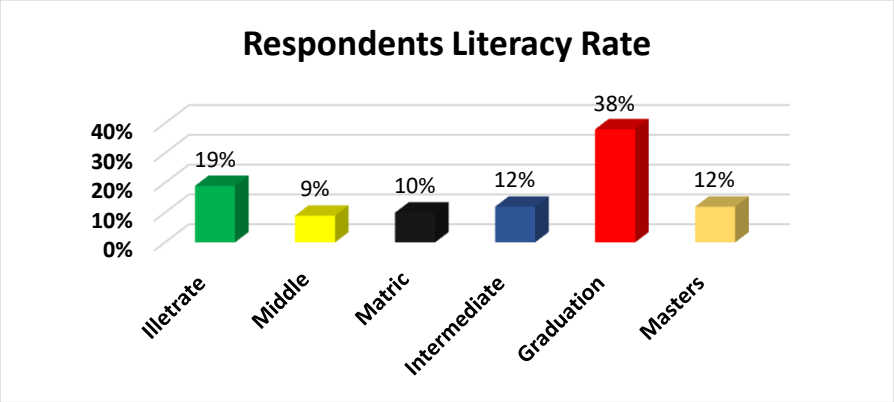

FIGURE 5.2: LITERACY RATE OF RESPONDENTS

5.4.4 Housing

To find out the living standard of the area, housing characteristic is the major indicator for assessing. Most of the houses at project area were belongs to the one independent owners, less rented properties were indicated, and few were found as joint ventures. The construction of houses was ordinary, with moderate standard building made of cement and bricks. After carrying out social survey it was found that from the sample size of household 64.3% houses were pacca 4 made from brick ,stone and mortar ,whereas 35.7 were semi pacca made up of made of clay, inferior bricks and plastered with mortar.

The majority of the respondents have 1-2 rooms in their houses; few of them are having 3 or more rooms. The type of the toilet used by the household indicates living conditions and is strongly related to the health and hygiene of the household members. Most of the people (98%) have flush type of latrine while only 2% is using open types such as fields or barren land.

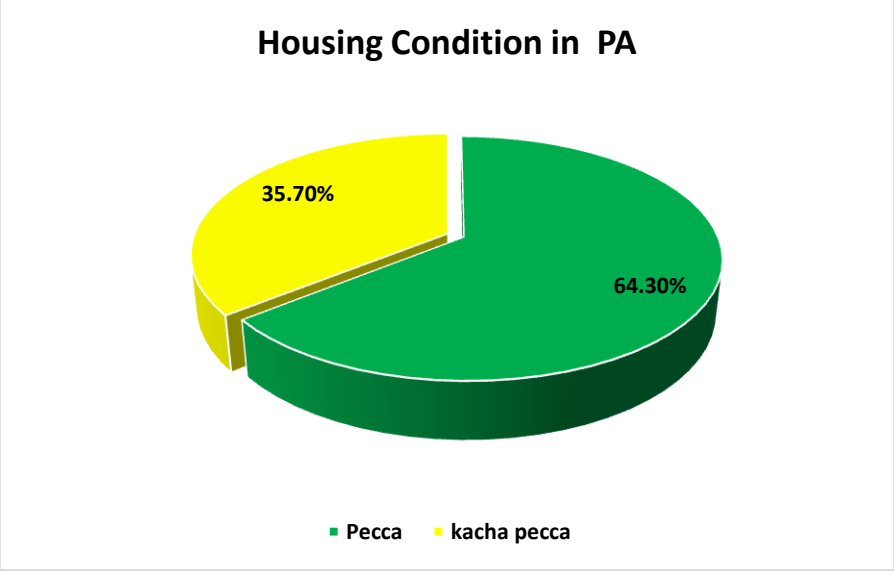

FIGURE5.3: CONDITION OF STRUCTURE WITHIN PROJECT VICINITY

5.5 ECONOMIC ASPECTS

Below figure indicates the job forms of the respondents in the AOI. Working as a labor is the main source of income throughout the AOI (i.e. 44.9%), followed by school, private employment, shopkeepers, and govt. Several respondents have multiple occupations therefore; the question was multiple response questions. Hence, the percentage in the graph below is not showing a total of 100%.

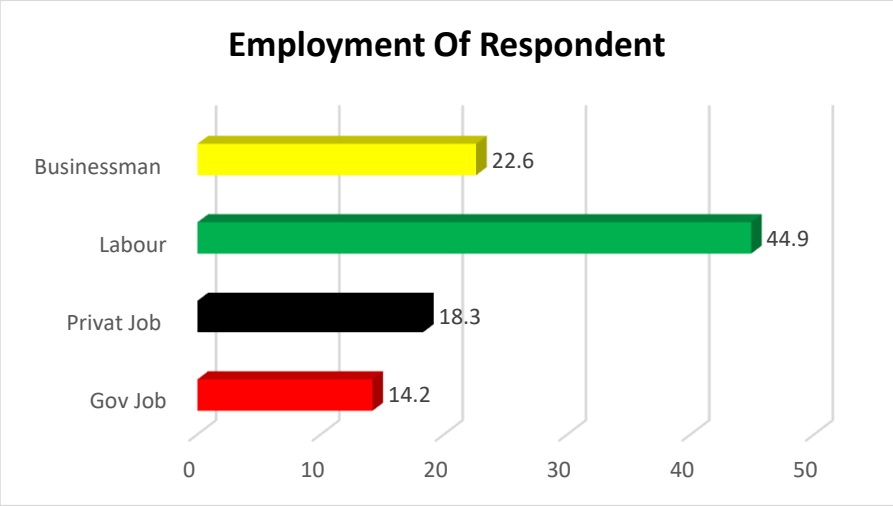

FIGURE 5.4: EMPLOYMENT RATE OF RESPONDENTS WITH PROJECT AREA

5.5.1 Income Levels

During the field survey within the periphery of project area, income level of each household was thoroughly examined because income is an indicator of assessing the livelihood / well-being of the household. The major source of income in villages of both Districts was from crops and live stocks. For rest of the population which do not have any farm and are landless their main sources of income were business, shopkeeper, government employment, private employment, and labouring. The highest group of income was noticed in District Gilgit, where 66% has monthly income of Rs25k-30k and 30% has monthly income of Rs 15k-20k.only 4% people earn Rs 6k-10k per month. whereas on the other hand 44% people of DistrictGhizer has monthly income of Rs25k-30k, 15% has monthly income of Rs 15k-20k and 41 % people earn less than Rs 10k per month. Below figure shows the comparison of average income of both District

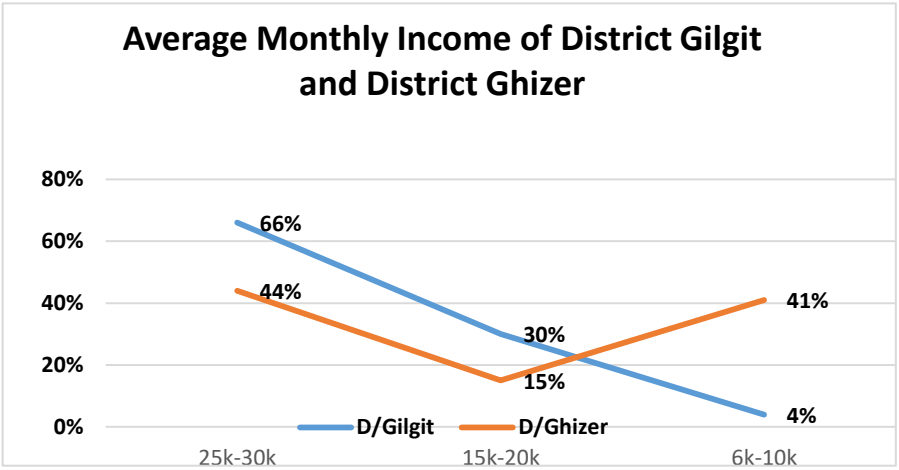

FIGURE5.5.5: AVERAGE MONTHLY INCOME OF DISTRICT GILGIT AND DISTRICT GHIZER

5.6 AMOUNT BORROWED

Based on social survey, out of 144 respondents, 10 respondents took loan for different purposes. Results shows that 6 respondents borrowed amounts from Rs. 25k to 40k while remaining 4 respondents borrowed Rs. 15k to 20k.

5.6.1 Purpose of Money Borrowed

The money borrowed by the residents was mainly used for education, marriages , children health, trade. The entire respondent's borrowed money from their parents, so they have no interest to pay.

5.7 AGRICULTURE PRACTICE

Based on social survey It is concluded that, most of respondent have their own agriculture land but due to less individual land which can't full fill the requirement and agriculture activities within both District are practiced on limited scale because of mountainous terrain and harsh climatic patterns. Only maize and wheat are preferable to be grown in those area and few vegetable and fruit for domestic use only not for commercial. The average landholding size is about 2-3 kanal per family of all the villages along the alignment in both Districts. The land owned by individuals in project area, Individual land under cultivation is also used for fodder collection and grazing livestock whereas communal land is used for grazing, collecting fodder, supplying of fuel wood, peat, etc. To attain the maximum output in crop production, optimum cropping pattern is preferable in the areas. The main source of irrigation for the villages of both Districts is spring waters.

5.7.1 Agriculture

The agriculture sector in the Gilgit-Baltistan is showing positive growth but at slow rate due to inherent constraints of poor infrastructure and small holdings. Majority of population is engaged in this sector even then the area has deficit of food grains. A mix of different activities is followed in the farming system. There may be variation in farm size or in the status of minor crops in the overall cropping practices but the general combination of crops; livestock and other farm related activities are more or less the same. Approximately more than 90% of rural population is depending upon this occupation. Land use statistics shows that 85 thousand hectares of land is under cultivation, out of which 60 thousand hectares are under cereals and vegetables and 25 thousand hectares are under fruits in the entire Gilgit - Baltistan (GB agriculture statistics 2009).

5.7.2 Principal Crops and Cropping Pattern

Cropping pattern and intensities are considered as measures of the level of agricultural development of an area. Generally, the cropping pattern options open to farmers depend upon the availability of irrigation water. In the project area, farmers tend to grow uni-seasonal crops due to severe weather conditions in winter and flooding season (July-August). Mostly, they grow wheat, maize, onion, tomato and potato. The agriculture land near the lake and upstream of the lake along the Ghizar River has heavy moisture conditions, which sometimes results into low crop yield while in Chhashi village, the same cropping system is adopted but the agriculture land is irrigated through seepage water.

5.7.3 Livestock

Livestock in the project area is not only a source of income but also serve dietary purposes. Large herds of yaks, cattle, sheep and goats are found in Gilgit-Baltistan. However, physical condition and general health of animals are not satisfactory, especially in winter due to shortage of fodder. Bullocks are the main source of farm power but they are hardly capable of drawing plough due to poor health. Animal's diseases are causing considerable losses to livestock. Productivity of cattle is generally low because of severe weather conditions and lack of proper food. Meat, milk, butter and eggs are the main livestock products but most of these are consumed at household level.

5.8 ARCHEOLOGICAL AND CULTURAL ASPECTS

5.8.1 Religion

Majority of the people are Muslims belonging to different communities. i.e sunnie, shias and ismailies. As per social survey carried out in all villages of project area, more than 55 percent are sunni, rest 45% belongs to shias and ismailies sect.

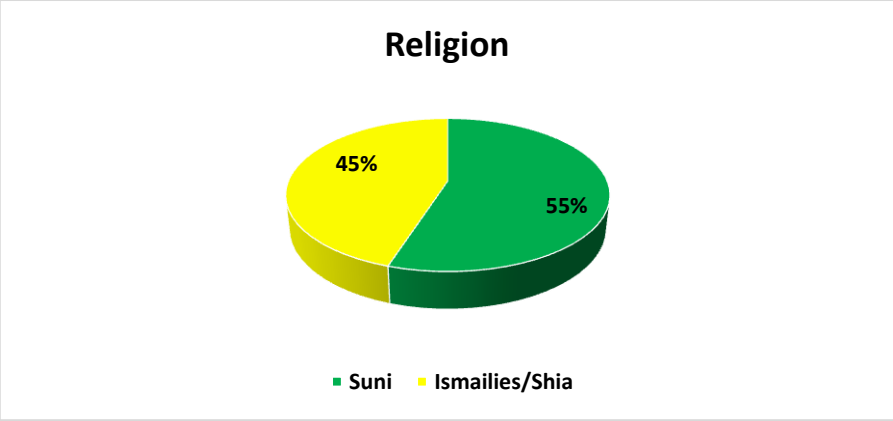

FIGURE 5.6: SECT BASED DISTRIBUTION WITH PROJECT AREA

5.8.2 Archaeology

Within the Project Area two archaeology sites were identified during the baseline survey.In District Gilgit (Hanzal stupa) is located where as in District Ghizer Gupis Fort is located,both sites are approx. 50m away from new alignment ROW..Both archaeology site is far from project sites so there is no direct impact foreseen on these archaeological features, however some valley was seen along the alignment for tourist potential .Some valleys with potential Attractions like:

- Gahkuch Mushkay
- Hoper (Picnic Point)
- Khalti Lake
- Phandar Lake
- Shandoor Lake
- Langer site

5.8.3 Family System

A majority of the people in Gilgit Baltistan prefer to live in a joint family, which could comprise anywhere between a group of two or more, even over 20 members sometimes. The commanding position in a family is held by the eldest earning male member. He consults other adult members on

important issues, but it is his decision that ultimately prevails. However, a lot of importance is also given to the advice of the eldest retired members of the family. There is equal share of each and every member of the family in the available resources in the form of money, food and other requirements and locals feels better in joint family system as compare to nuclear family.

During the discussion with the locals, it was clarified that large family size is also treated as the strength of the family. It is the duty of woman to take care of her home. As such, from her very childhood, a girl child is taught cooking, cleaning and dish washing by her mother and other ladies in her family. She is also taught to attend to guests and strangers politely and elegantly because it is thought to greatly reflect upon her upbringing. The traditional arranged marriage has long been an integral part of the Gilgit Baltistan culture as against love marriage. It is the concept in which the parents and family members search for the prospective bride or groom, through their acquaintances or relatives.

5.8.4 Festivities

Cultural and religious festivals are celebrated in both District, religious festival include: Eid-ul-adha, Edi-ul Fitr and Eid Miladunnabi (the birth anniversary of Prophet Muhammad-Peace be upon Him). There are some other important events that are unique to various understanding cultures that are celebrated with complete peace and brotherhood.

5.8.5 Tourism/Recreational Areas

In the project surrounding (Phandar Lake) ,(Yasin Valley) and Shandoor Polo Park have great scenic values. A large number of tourist visits the area every year. The local communities get employment as tourist guides and transporters.

5.8.6 Cultural and Religious Resources

According to the census based physical survey, the project area has 6 mosques,8 jamat khanas, 3 shrines and 4 graveyards. All of the mosques and jamat khanas do not have any historical or architectural values, and located away from the project area.

5.9 INFRASTRUCTURE FACILITIES

5.9.1 Educational Facilities

The results from social survey shows provide information regarding education facility in project area. The education facility in the project area shows the literacy rate of that area, in Ghakush and in Gilgit city have all level education facilities, university, collage, schools for both genders. But in the villages those lies along the alignment have one primary school which is at distant and in few villages there is no education facility, so the locals send their children to Gilgit city.

5.9.2 Health Facilities

If we talk about health facility along the alignment than proper heath facility is only available in Gilgit city, and in District Ghizer capital Ghakuch but the remaining villages along the alignment only have access to the small dispensaries, which don't have enough skill and medication to secure a patient ,so the locals transfer their patient to Gilgit city and Gahkuch for proper health facility.

5.9.3 Civic Facilities

Wastewater is disposed off in the open spaces just outside the houses. There is no proper sewerage system exists of all the three villages. No street lights and play grounds exist in the project area. However, public water supply is available in Gilgit city and in Ghakush but in other villages local are forced to drink Gilgit River water, therefore, they are suffering different water borne disease especially they are facing kidneys issues. There is no bank and post office along the alignment only shops exist. Other civic facilities available in the villages are given in Table 5.2.

S.No	Villages	Drainage System	Street Lights	Grocery Shops	Play Ground	Medical store	Gas	Electricity	Telephone Line	Water Supply
1	Gilgit city	✓	✓	✓	✓	✓	X	✓	✓	✓
2	Baseen	X	X	✓	X	X	X	X	X	✓
3	Henzal	X	X	✓	X	X	X	X	X	✓
4	Gulapur	X	X	✓	X	X	X	X	X	X
5	Sherqilla	X	X	✓	X	X	X	X	X	X
6	singal	X	X	✓	X	X	X	X	X	X
7	Dama Gahkuch	X	X	✓	X	X	X	X	X	X
8	Yangal	X	X	✓	X	X	X	X	X	X
9	Gipus	X	X	✓	X	X	X	X	X	X
10	Pingal	X	X	✓	X	X	X	X	X	X
11	Phandar	X	X	✓	X	X	X	X	X	X
12	Teru	X	X	✓	X	X	X	X	X	X
13	Bersat	X	X	X	X	X	X	X	X	X

TABLE 5.3: LIST OF CIVIC FACILITIES IN DIFFERENT VILLAGE AROUND THE ALIGNMENT

5.9.4 Sanitation / Drainage Facilities and Solid Waste

There is no proper sanitation system in both District, no proper waste management system, thus cleanliness standard of both areas are poor. Waste water generated from houses in the end becomes the part of the river.

5.9.5 Sources of Drinking Water

Water supply exist in few villages of District Gilgit , but in District Ghizer most of villages get water to fulfil their daily drinking requirement from river water or natural springs

5.10 SECURITY SITUATION AND MOVEMENT OF THE FOREIGNERS

The present scenario of both District regarding security and safety is average. During the survey we came to know that there is no threat to the foreigner visiting area, the all local community is in favour of foreigner to visit their area, by this tourism potential would increase. In the project area there is a reasonably liberal atmosphere for women. The local culture recommends modest dress for both men and women.

5.11 NGOS

Agha khan foundations as an NGO are working in different villages within the project area.

5.12 PUBLIC CONSULTATION

Consultation with the stakeholders is a tool for managing two-way communication between the project sponsor and the public. Its goal is to improve decision-making and build understanding by actively involving individuals, groups and organizations which have a stake in the project. Public consultations were held with different stakeholders and community to discuss different aspects of the Project, including expected impacts on the physical, biological, and socio-economic environment of the proposed Project area.

The main objectives of consultation process are:

- Identification of problems and needs
- Collaborative problem solving
- Information, connection and distribution
- Comments, reaction and feedback on project
- Documentation of improvement procedures expected by the local community.

5.13 IDENTIFICATION OF MAIN STAKEHOLDERS

There are two types of stakeholders related to the project i.e. primary and secondary stakeholders. Primary stakeholders are those which are directly affected by the project activities and secondary stakeholders are those which are affected indirectly. There are primary stakeholders around the project area are local resident community along the road, shop keepers and pedestrians. However, secondary stakeholders are institutional stakeholders of the project areas. The consultant tried to contact with all the stakeholders and shared their views and concerns and also interacted with the community based organizations that can support the community.

Categories of stakeholders consulted
The stakeholders contacted during the consultations belong to different categories of people
Categories of stakeholders consulted

Sr. No.	Category
1	Government Institutes
2	Local Residents
2	Business / shop owners
3	Pedestrians
4	Representative of markets

TABLE 5.4:CATEGORIES OF STAKEHOLDERS CONSULTED

5.14 ISSUES BRIEFED DURING PUBLIC CONSULTATION

In the project area, all the possible stakeholders were identified during the survey.

Sr. No.	Stakeholders	Stakes/apprehensions
1	Local residents	Air pollution, exit/entry problems, and disturbance of utilities, security/safety issues, and waste material.
2	Shop owners	Noise, air pollution, exit/entry problems, disturbance of utilities, security/ safety and decline in business including fear about dismantling of their shops falling
3	Motorized transport users	Appropriate diversion, management and pollution.
4	Non-Motorized transport users	Appropriate detour, management, and pollution.
5	Pedestrians/people using Pedestrian	Appropriate diversion.

	bridges	
6	Businessmen	Short term effects on business due to blockage of roads

TABLE 5.5: OBSERVATION RAISED FROM STAKEHOLDER REGARDING PROJECT

5.15 MEETINGS HELD WITH STAKEHOLDERS

A Meeting was organized on 17th October, 2019 at Deputy Commissioner Office chaired by Deputy Commissioner (Gilgit) with different following government institutions to discuss the Project and socio-economic impacts of the Project.

S. No.	Name / Designation	Department
1	Deputy Commissioner	As represented Department of Land and Revenue, Gilgit
2	District Forest Officer	Department of Forest, Wildlife and Environment, Gilgit
3	Deputy Director (Livestock)	Department of Agriculture, Livestock and fisheries, Gilgit
4	Executive Engineer	Department of Water and Power, Gilgit
5	Deputy Director (Industries)	Department of Mineral & Industries, Gilgit
6	Assistant Director (EIA)	Environmental Protection Agency, Gilgit
7	Assistant Director (Works)	Gilgit Development Authority
8	Range Forest Officer	Department of Forest, Wildlife and Environment, Gilgit
9	Assistant Director	Department of Tourism, Gilgit
10	Assistant Director (Fisheries)	Department of Agriculture, Livestock and fisheries, Gilgit

TABLE 5.6: LIST OF INSTITUTIONAL STAKEHOLDER

FIGURE 5.7: PICTORIAL VIEW OF INSTITUTIONAL STAKEHOLDER

5.16 ROAD SIDE FOCUS GROUP DISCUSSION, KEY INFORMANT INTERVIEWS &MEETING WITH COMMUNITIES

A series of roadside and focus group discussions were carried out with local communities to brief about the salient features of the project including its location, purpose, funding arrangements and implementation activities and to find out their opinion. Both male and female respondents were included in the consultation process on community level. People from different age groups, from both genders were interviewed. The following communities / areas were consulted: -

Sr. No.	Area Name	Type of Consultation	No. of Person	Category
1	Sultanabad, Gilgit City (Jammat Khana)	Public Meeting	60	Teacher , Shopkeeper, Landlord
2	Baseen	Key informant interviews	8	Labors, shopkeepers, local citizen
3	Henzel	Focal group discussion	15	Restaurant owner, Shopkeepers, Tourist
4	Mujahid colony	Focal group discussion	10	Local residents
5	Sherqilla	Key informant interviews	8	landlord, Residents
6	GahKuch, Ghizer	Public Meeting	20	Shopkeepers, Land lord
7	Gipus	Focal group discussion	17	Locals residents
8	Pingal	Key informant interviews	10	Shopkeepers
9	Phander	Key informant interviews	8	Restaurant owner, Shopkeepers, Tourist
10	Teru	Public Meeting	6	locals
11	Barsat	Focal group discussion	11	Shopkeepers, labor

TABLE 5.7: LIST OF PUBLIC CONSULTATION CARRIED OUT IN DIFFERENT VILLAGES OF DISTRICT GILGIT AND DISTRICT GHIZER

FIGURE 5.8: PICTORIAL VIEW OF CONSULTATION FROM GENERAL PUBLIC


FIGURE 5.9: PICTORIAL VIEW OF CONSULTATION FROM SHOPKEEPRS

5.17 OBSERVATIONS / CONCERNS OF LOCAL COMMUNITIES

The observations of the people are listed below:

- Proper land should be acquired through the competent authorities from land owners and compensate the communities on present land rates. The payments should be completed before starting construction activities, as the payments of land acquisition of KKH are still stuck / pending with National Highway Authority.
- Proper tree plantation should be planned and implemented during the construction phase along the alignment of project area. Presently the local communities planted the tress on different patches along the existing road side from Gilgit to Teru (Ghizer).
- Electric Transmission Lines should be shifted properly.
- Natural habitat should be preserved during construction and implementation phase of the project and trout farms not be disturbed.
- Bridges and Culverts may be constructed for the movement of local communities and animals.
- Village connectivity with road through bridges should be improved.
- There must be proper system for construction waste management and its final disposal specially lubricant leakages;
- Proper Traffic diversion plan during construction phase should be provided in the design
- Proper management of traffic during construction and operation stages must be done to avoid disturbance to people;
- The labour and employment opportunities should be created for the local people;
- Proper waste disposal of labour camps.
- There must be calculated and mitigated minor disturbance in the ecological and biodiversity patterns of the project area.

5.18 CONCLUSIONS

- During public consultations, people were made aware of the benefits of the project and were invited to express their viewpoints on the subject. Several issues were raised by the community during the consultation, which will be incorporated in Environmental and Social Management Plan including with mitigation measures. Residents of the project area were very much supportive to the implementation of the proposed project. The project will have positive impacts on community

and environment. Keeping in view the development for future perspective, it can be anticipated that after the implementation of the proposed project, the project area will be improved by environmentally, socially and economically.

CHAPTER 6
SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section provides the analysis of the potential impacts during preconstruction/design, construction and operational phases of the proposed project on the physical, biological and socio-economic environment of the project area. The significance of these impacts has been assessed through Matrices approach based on the severity and likelihood of occurrence of the individual potential impact. Moreover, mitigation measures have also been proposed based on the regulatory requirements and guidelines. Environmental impacts have been considered not only as they pertain to road ROW, but also to the site associated with the road project.

6.1 IMPACT MATRICES

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
- Reversible and Irreversible impact

Characterization of potential impacts during construction and operation stage of the project has been classified based on the above characteristics and is given in Table 6.1&6.2.
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 6.3 & 6.4). The following scale has been used for the evaluation of potential impacts on different environmental settings:

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

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

TABLE 6.1: CHARACTERIZATION OF ENVIRONMENTALLY POTENTIAL IMPACTS FOR CONSTRUCTION PHASE "EIA OF GILGIT-SHANDOORROAD (216 KM)"

Environmental Component	Impact Characteristics														
	Direction		Duration		Location		Frequency		Extent		Significance			Reversibility	
	Positive	Negative	Long	Short	Direct	Indirect	Cont.	Intermittent	Wide	Local	Large	Moderate	Small	Rev.	Irrev.
Local Economics	☆		☆			☆	☆		☆		☆				☆
Tourism	☆		☆			☆	☆		☆		☆				☆
Air Quality		●	●		●		●			●			●	●	
Water Quality		●	●			●		●		●			●	●	
Noise		●	●		●		●		●				●	●	
Flora	☆		☆		☆		☆			☆			☆		☆
Fauna		●	●		●		●			●			●		●
Traffic Situation	☆		☆		☆		☆		☆		☆				☆
Lifestyle and Culture	☆		☆			☆	☆		☆			☆			☆
Community Development	☆		☆		☆		☆		☆		☆				☆

TABLE 6.2: CHARACTERIZATION OF ENVIRONMENTALLY POTENTIAL IMPACTS FOR OPERATION PHASE "EIA OF GILGIT-SHANDOOR ROAD (216 KM)"

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

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

									A									
12	Construction of Roads	LA	LA	LA	LA	La	LA	LA	LA	LA	LA	LA	MB	MB	LA	LA	LA	LA

TABLE 6.3: ENVIRONMENTAL IMPACTS EVALUATION MATRIX DURING THE CONSTRUCTION PHASE

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

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	O	O	LA	LA	O	LA	LA	MB	O	MB	O
2	Generation of waste Water	O	LA	O	LA	LA	O	O	O	O	O	LA	O	O	O	O
3	Generation of Solid Waste	O	LA	LA	LA	LA	O	LA	O	O	LA	LA	LB	O	O	O
4	Traffic Control	O	O	O	O	O	O	LA	O	O	O	O	MB	O	MB	HB
5	Maintenance of infrastructure	LA	LA	LA	LA	LA	LA	LA	LA	LA	LA	LA	MB	LA	MB	LB
7	Maintenance of Road	O	LA	O	LA	O	MA	LA	LA	O	LA	O	MB	O	O	MB
8	Road Accidents	O	O	O	O	O	O	O	O	O	LA	LA	O	O	O	LA

TABLE 6.4: ENVIRONMENTAL IMPACTS EVALUATION MATRIX DURING THE OPERATIONAL PHASE

Legend
O - Insignificant / no impact LA = Low Adverse MA = Medium Adverse HA = High Adverse NA: Not Applicable LB: Low Beneficial MB: Medium Beneficial HB: HighBeneficial

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.

6.2 PRE-CONSTRUCTION / DESIGN PHASE

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

6.2.1 Topography

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, culverts. 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.

6.2.2 Land Acquisition 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. Land required for the proposed project is mostly hilly land with shortly scattered population. The total affected persons (APs) in the project area are estimated to be approximately 1500-1800. Few villages are also coming in the ROW of the Project. This impact will be permanent and negative in nature.

Mitigation measures will involve careful alignment and route selection by the designer to minimize the impacts by avoiding the residences of these families. For the land coming in the ROW, the affected people will be compensated accordingly.

6.2.3 Changes in Land Value

The proposed Project is expected to increase the existing land values after widening of the road , especially in villages where little or no road infrastructure is present and the seasonal drains with gravels on their beds are used as access road to their residences. Land owners will have an opportunity to sell their land on increased prices and start new businesses. This impact will be major positive in nature.

6.2.4 Social Issues

Due to the proposed Project, entry/exit problems and bifurcation of settlements, shops and agricultural land/fields may occur for the residents as well as hindrance in hindrance in movement and transportation. This will result in causing inconvenience to the residents/farmers and affect their daily

activities; also reducing the frequent interactions between families. This impact is permanent and low negative in nature.

To mitigate this impact, the provision of 16 bridges, 03 open tunnels and 12 snow galleries. The channel wise location of all the bridges, open tunnels and snow galleries are given below in Table 6.5.

Sr. No.	RDs From	RDs To	Structures
1	0+720	1+090	Bridge
2	16+320	16+480	Bridge
3	39+750	39+780	Bridge
4	49+510	49+750	Bridge
5	62+260	62+360	Bridge
6	67+000	67+050	Bridge
7	79+090	79+170	Bridge
8	86+060	86+130	Bridge
9	107+040	107+100	Bridge
10	113+640	113+670	Bridge
11	135+740	135+800	Bridge
12	150+860	150+910	Bridge
13	161+600	161+660	Bridge
14	177+780	177+860	Bridge
15	188+750	188+810	Bridge
16	195+010	195+170	Bridge
17	90+600	90+900	Open Tunnel
18	153+300	153+900	Open Tunnel
19	156+660	157+400	Open Tunnel
20	23+900	26+800	Snow Gallery
21	31+200	31+450	Snow Gallery
22	46+400	46+800	Snow Gallery
23	96+320	96+500	Snow Gallery
24	124+150	124+310	Snow Gallery
25	138+400	138+800	Snow Gallery
26	148+800	149+200	Snow Gallery
27	153+900	154+000	Snow Gallery
28	154+000	155+700	Snow Gallery
29	173+800	174+400	Snow Gallery
30	174+500	174+900	Snow Gallery
31	175+600	176+050	Snow Gallery

TABLE 6.5: CHANNEL WISE LOCATION OF BRIDGES, OPEN TUNNELS AND SNOW GALLERY

The locations of the project, alignment, culverts, open tunnels and bridges have been discussed with the communities in the consultation meetings held during the month of October 2019. The participants of the meetings are agreed and satisfied with the proposed locations and no revision is required in the design for any additional provision of underpass.

6.2.5 Physical Cultural Resources

Since no Physical Cultural Resource is falling within the Right of Way (ROW) of the proposed alignment of the project, so there is no need for relocation of such resource. Cultural resources such as graveyards, mosques and Jammat-Khanasare situated in nearby communities and are visited by local people.

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

6.2.6 Natural Resource Management

Due to the proposed Project, about approximately 30,000 to 40,000 numbers of trees of various species will be affected. Out of these, almost 25% trees are fruit trees and the rest of 75% trees include Phulai, Kikar, Eucalyptus, Poplur, Shahtoot, Bair, China Berry, Neem etc. This may have an adverse effect on the ecological habitat of the project area. This impact will be permanent and moderate negative in nature.

The proposed mitigation measures will include:

- Incorporate technical design measures to minimize removal of these trees, if possible such as change in alignment
- Plan for compensatory planting for eight to ten trees against each fallen tree of similar floral function
- Provision of compensation in the Project Budget for the loss of trees to the affected people;
- Disallow introduction of invasive/ exotic species and native species should be recommended for plantation
- Provision of animal corridors for the free movement of faunal species, especially, near the attractive sites such as grazing lands, and water bodies. Care should also be taken for provision of crossings for the free movement and access to River Indus of pastoralists coming in the area of influence of the project during different seasons.

6.2.7 Air Quality and Noise Level

Due to the construction of the proposed project, noise and air pollution and associated health risks may increase. This impact is permanent and moderately negative in nature.
Mitigation measures will include:

- Incorporate technical design features that enable continuous traffic flux and avoid congestions e.g. sign boards, speed limits and bays
- Consider noise barriers in sensitive areas (populated areas through which the proposed road will pass) in the form of high boundary walls (concrete or wood) and earth barns etc.
- Plantation plan for tall species of trees on either side of proposed Road.

6.2.8 Solid Waste Management

Proper solid waste management system is required for the efficient handling of waste and reduction of waste related impacts. Impacts due to solid waste are expected to be temporary and minor negative in nature.

Mitigation measures will include:

- Planning for disposal sites with reasonable distance from the human settlements
- Disallow sitting for work and labour camps, including waste dump sites, in a distance closer than one (1) kilometre to any inhabited areas;

- Incorporate technical design features for refuse collection containers at sites that would minimize burning impacts
- Devise plan(s) for safe handling, storage and disposal of harmful materials
- Burning of waste will not be allowed in any case.

6.2.9 Excavation of Earth

The excavation of earth from burrows areas and for clearance of ROW may result in change of edaphic characteristics of soil. Loss of fertile top soil may affect adversely on the 5-10% agriculture land of the project area. For the construction of proposed project, approximately 1000-1500 Acres of land will be acquired with a width of 11～12 meter. This impact is permanent but major negative in nature.

Mitigation measures will include:

- Burrow pits will not be located on agricultural land unless completely unavoidable; and
- Contractor needs to obtain approval for excavation and submit the plan of rehabilitation of the site after excavation;
- The top 1 ft soil will be stored for future use in rehabilitation of the site

6.2.10 Public Utilities

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.
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.

6.2.11 Change in Hydrologic Regime

The project has an extensive network of drainage channels/ nullahs falling in to the River Gilgit. High fluctuation in groundwater table is observed during monsoon season. Natural streams, Wells and hand pumps in villages are the main source for drinking water. For the crossing of drains and water courses, small bridges and culverts should be constructed.

Mitigation measure would involve:

- Proper design of bridges on nullahs 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
- Provision of sufficient sizes of drains to take design flows.
-

6.2.12 Loss of Agricultural Land

Due to the proposed project, minor agricultural land will be affected and crop yield will be disturbed. This impact is insignificant in nature. No Mitigation measures are required.

6.2.13 Surface and Ground Water

As the proposed project is running along the River Gilgit, so the surface water may get contaminated due to the surface runoff during construction and operation phase. Ground water may also get contaminated from the wastewater generation from the construction camps.

Mitigation measures will include:

- To control the surface water runoff and sedimentation loading, cut of drains, cascades, chutes and sedimentation ponds should be incorporated in the design;
- Planning of location of construction camps must be at an appropriate distance from the surface water bodies;
- Septic tanks and soakage pits should be designed to cater the wastewater from the construction camps.

6.3 CONSTRUCTION PHASE

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

6.3.1 Topography

The project area does not have plane topography. Extensive work is involved for preparation and clearing of the land. This may involve blasting, dismantling of damaged pavements ,cutting and filling of the land in the ROW and burrow pits and may lead to erosion of top soil cover. This impact is permanent and minor negative in nature. In addition to proper landscaping, construction of stone pitching/rip rap across the embankments, and the following mitigation measures will help to minimize the impacts of the Project.

Mitigation measures will include:

- Where the use of agricultural land is unavoidable, the top 1 ft of the plough layer will be stripped of and stockpiled for redressing the land after the required burrow material has been removed;
- Where deep ditching is to be carried out, the top 1m layer of the ditching area will be stripped and stockpiled. The ditch will initially be filled up with scrap material from construction and then levelled with the stockpiled topsoil;
- Low embankments will be protected from erosion by planting indigenous grasses that can flourish under relatively dry conditions;
- High embankments will be protected by constructing stone pitching or a riprap across the embankment;
- Ditches or burrow pits that cannot be fully rehabilitated will be landscaped to minimize erosion and to avoid creating hazards for people and livestock; and
- Landowners will be compensated according to the terms of lease agreements negotiated with them and the restoration actions agreed upon by the Contractor will be duly carried out.

6.3.2 Soil

The project area is a rolling terrain with fertile silty land prone to soil erosion. 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 burrow areas and quarries, soil erosion may occur resulting in degradation of landscape. This impact is, however, of temporary and moderate negative in nature.

Mitigation measures will include:

- Low embankments will be protected by planting trees and grass that can flourish in relatively dry conditions;
- High embankments will be protected by constructing 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 bounded area away from water courses
- Provision of impervious platform with oil and grease trap for collection of spillage during equipment and vehicle maintenance
- Collection of oil and tube drips in container during repairing construction equipment vehicles
- Providing impervious platform and collection tank for spillage of liquid fuel and lubes at storage area
- Decanting and or controlled disposal of oil and grease as collected at collection tanks of maintenance yard and chemical storage areas
- All spoils will be disposed of as desired and the site will be restored back to its original conditions before handing over
- Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the legal prescriptions for dumpsites
- In areas with strong sheet flow, high embankments will be provided with chutes and drains/culverts to minimize soil erosion. Stone pitching and retaining walls will be made at high embankments in critical areas
- As applicable and needed, plantation of grasses and shrubs will be done for slope protection;
- Soil erosion checking measures such as the formation of sediment basins, slope drains, 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 burrowing materials.

6.3.3 Blasting

Blasting may be required where the alignment is passing through the hills. Blasting will generate short-term impacts such as noise and vibration, and long-term potential impacts on land stability. To minimize the short term impacts, control blasting should take place at predetermined times notified to communities and local residents. Blasting should also be conducted in accordance with best international practices, in which the explosive charges are controlled to minimize the vibrations and noise. To minimize the long term impacts, geological and soil conditions should be carefully assessed to avoid blasting in sensitive locations. Moreover, Blasting Management Plan has been prepared for the project and has been attached as an **Annex -XII** in the report.

6.3.4 Construction Camps / Construction Sites

Due to the proposed 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. Table 6.6 summarizes potential impacts and proposed avoidance and mitigation measures associated with construction camps.

Potential Impact	Proposed Avoidance and Mitigation Measures
Environmental	
• Temporary habitat loss or disturbance; • Temporary visual intrusion; • Noise level increase at a single location and associated disturbance to wildlife and human receptors; • Waste generation; • Discharge of sanitary effluent and rainwater run-off to water courses.	• Individual trees and shrubs of high conservation value to be marked and preserved wherever possible or transplanted if the root conditions are suitable for such an operation; • Reinstate any temporary facilities to pre existing conditions in ecologically sensitive areas; • Implement landscaping plan for all facilities in areas where high landscape value and visual vulnerability to the proposed activities warrants site-specific landscape restoration measures; • Limit the working hours of noisy activities when near identified sensitive receptors to normal daytime working hours; • Operate equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary; • Eliminate tonal, impulsive or low frequency noise through noise control engineering techniques where practicable (fitting of mufflers, damping, etc.), and substitute for a different method if necessary (e.g., instead of hammering actions, use hydraulics); • Provide adequate warnings of impeding works to all potential receptors within a 1 km corridor surrounding the right-of-way via public notices and local news; • Implement Waste Management Plan to include procedures for the classification, storage and disposal of all construction wastes and the training of employees who handle hazardous materials; • Ensure that discharge of sewage from temporary construction facilities to surface courses does not impact surface water ecology. This will be achieved through the provision of treatment facilities and by enforcing the discharge standards.
• Social	

Potential Impact	**Proposed Avoidance and Mitigation Measures**
• Worker camp sitting: consultation surrounding potential construction camp sites revealed concerns regarding the location (in particular, proximity to towns and villages) of proposed sites for Worker Camps; • Tension between Communities and Workers: cultural differences, behaviour of construction workers, potential disregard for local cultural norms at camp sites could lead to increased tension between local communities and the workers and camps. The scale of this impact will depend on successful implementation of mitigation measures and in part on the origin of the workforce staying in construction camps. Some communities have expressed particular concerns in this regard.	• In order to minimize social disturbances as a result of construction workers, existing camps from previous projects were identified as a first preference. State land was a second preference for Worker Camp locations, followed by land where there is a willing lessee; • The project will seek to avoid sitting camps where their presence might contribute to any conflicts between villages; • Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different sociocultural values; • Training will be provided to all staff, both national and expatriate, on camp management rules and overall discipline and cultural awareness. This will include, in appropriate languages: • A briefing on Camp Rules; • A community relations orientation to increase awareness about the local area, cultural sensitivities and the project Code of Conduct; • The construction contractor is required to develop a Construction Camp Management Plan to address: • Discipline; • Community liaison; • Ethnic tensions; • Market distortion (see employment and local sourcing mitigation); and • Communicable diseases. •
Camp Location	
• The final location and number of sites will be determined by the construction contractors and agreed with the NHA.	• The construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption.

TABLE 6.6: SUMMARY OF WORKER CAMP IMPACTS & MITIGATION MEASURES

Some additional mitigation measures will include:

- 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

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

6.3.5 Health and Safety

- **Occupational Health and Safety**

Health risks and worker's 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.

Mitigation measures will include;

- Obligatory insurance against accidents for labourers/workers;
- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- Layout plan for camp site, indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents;
- Work safety measures and good workmanship practices are to be followed by the contractor to ensure no health risks for labourers;
- Protection devices (ear muffs) will be provided to the workers doing job in the vicinity of high noise generating machines;
- Provision of adequate sanitation, washing, cooking and dormitory facilities including light up to satisfaction;
- Proper maintenance of facilities for workers will be monitored;
- Provision of protective clothing for labourers handling hazardous materials, e.g. helmet, adequate footwear for bituminous pavement works, protective goggles, gloves etc;
- Ensure strict use of wearing these protective clothing during work activities;
- Elaboration of a contingency planning in case of major accidents;
- Instruct foremen to strictly enforce the keeping out of non-working persons, particularly children, off work sites;
- Adequate signage, lightning devices, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads.

- **Community Health and Safety**

The construction activities and vehicular movement at construction sites and access service roads may result in road side 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 labour works with different transmittable diseases may cause spread out of those diseases in the local residents. The burrow pit areas located near the residential, settlements, may cause accident for the people moving near to those areas.

Mitigation measures will include:

- There should be proper control on construction activities and Oil spillage leakage of vehicles;
- The Burrow areas should be fenced properly and banned for the movement of the residents;

- The labour works with different transmittable diseases should be restricted within the construction site;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity & social links;
- Seeking cooperation with local educational facilities (school teachers) for road safety campaigns;
- Provision of proper safety and diversion signage, particularly at urban areas and at sensitive/accident-prone spots;
- Setting up speed limits in close consultation with the local stakeholders; and
- If identified, consider additional guard rails at accident-prone stretches and sensitive locations (schools);
- The communicable disease of most concern during construction phase, like sexually-transmitted disease (STDs) such as HIV/AIDS, should be prevented by successful initiative typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health service;
- Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which includes;
- Prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements;
- Eliminate any unusable impounding of water;
- During construction work, pedestrian and vehicular passages should be provided for crossing near settlement;
- Bridges and other structures have to be structurally stable enough to bear maximum ground acceleration recorded for the area in past;
- Fencing should be strong enough so that it cannot be broken easily by local people for making passages;
- Discharge of any wastewater at upstream of the point of public supply should be restricted;
- Batching plants should be installed away from settlements;
- Use of water should not disturb public water availability. Source of water should be selected carefully.

6.3.6 Burrow / Open Pits

Burrow/ open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments. Burrow/ Open pits may also result in potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the project area. Plan for closure and rehabilitation of the burrow pit sites will be prepared and implemented. This impact is permanent and minor negative in nature.

Mitigation measures will include:

- Conversion of burrow pits into fish farms and care in selection of burrow areas.
- Necessary permits must be obtained for any burrow pits from the competent authorities;
- No excavations are allowed within distance of 500 m to ROW;
- In burrow 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 burrow pit shall be regularly checked to prevent / mitigate impacts on adjacent lands; and
- In case burrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites.

6.3.7 Pollution Prevention and Abatement

Pollution Prevention technologies and practices will be applied in construction phase according to the International good practices and national and international recognized standards. National Environmental Quality standards (NEQS) will be adopted as performance indicators. Different types of waste, especially construction waste, are expected to be generated in large quantities from different activities of the proposed project. Small quantities of hazardous waste may also be generated. During the construction phase, gaseous emission may occur from a wide variety of activities. The impacts of different project activities and their appropriate preventive and abatement techniques and mitigation measures are discussed below:

- **Air Quality**

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, temperature of surrounding air and atmospheric stability.

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

- Asphalt plants that generate toxic emissions which contain unburnt carbon particles, sulphur compounds and dust from batch preparation
- Quarry areas that generate fugitive dust during crushing
- Traffic diversion routes marked along dirt tracks that generate fugitive dust when in use by vehicular traffic
- Transportation of materials and other construction activities that create dust emissions.

During construction, the continuous operation of machinery and movement of heavy trucks and vehicles may generate gaseous emissions and have a minor 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.

- **Air Sensitive Receivers**

Air sensitive receivers of the project area include general public, dispensary-nursery, School, Mosques, Jammat Khana, fruit gardens etc. Any other premises or places having similar sensitivity to the air pollutants may also be considered to be the sensitive receptors/receivers. Based on the criteria set out above, the representative ASRs have been identified close to the Project Site and a brief description of the representative ASRs is presented in Table 6.7.

Sr. No.	ASRs	Stake Mark	Location
1	Thick population	K0+000~K1+000	Sultanabad
2	Scattered population	K6+000~K6+600	Konodas
3	Thick population	K10+000~K12+000	Skarkoi
4	Scattered population	K18+800~K21+000	Hanzel
5	Scattered population	K34+000~K36+000	Bargo

Sr. No.	ASRs	Stake Mark	Location
6	Thick population	K44+000~K46+400	Sherqilla
7	Thick population	K54+800~K56+000	Japuky
8	Scattered Population	K57+000~K58+000	Gitch
9	Scattered Population	K60+800~K62+000	Singal
10	Thick population	K76+000~K78+000	Gahkuch
11	Thick population	K112+800~K116+000	Gupis
12	Scattered Population	K116+600~K118+400	Hamardas & Chartoi
13	Scattered Population	K120+000~K122+000	Jandrote Bala
14	Thick population	K123+400~K124+600	Khalti
15	Thick population	K170+000~K174+000	Phander
16	Scattered Population	K185+000~K187+000	Teru

TABLE 6.7: AIR SENSITIVE RECEIVERS (ASRS)

Mitigation measures will include:

- All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions
- Open burning of solid waste from the Contractor's camps should be strictly banned
- 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)
- Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and rEPAir is needed to minimize the hazardous emissions
- Quarry areas and asphalt plants should be located at least 500m downwind from populated areas, wildlife habitats and contractor's camps to minimize the impact of dust 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 to reduce level of dust emissions
- NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works
- Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants e.g. providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards.
- 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;
    - All excavation work should be sprinkled with water;
    - 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
    - Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases.

- **Noise**

Noise is 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 are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers asphalt plants and other equipments. The above machinery is expected to generate noise levels that would be severe in the areas whereas previously no roadside construction is done as in the case of the proposed project. Noise generated by construction machinery is likely to affect sensitive receptors located within 50 meter of the proposed Road. This impact is temporary and minor negative in nature.

Noise Level dB (A)	Situation
194	Lung damage
180	Ear drum rupture
150	Absolute limit with ears protected
150	Maximum of instantaneous noise
135	Absolute maximum with ears unprotected
100	Prolonged noise causing permanent damage
90	Factory work for an 8-hour day, 5 days a week
85	Ear protection should be worn
80	Noise on building or construction sites
70	Normal road traffic near residential areas

TABLE 6.8: MAXIMUM LIMITS OF NOISE LEVELS

Above 65 dB (A) ear protection devices should be worn.

According to Table 6.9 given below, which presents the damage risk criteria for hearing loss, noise level above 110 dB(A) can be tolerated for half an hour only.

Sr. No.	Maximum Allowable Duration per day (Hours)	Noise-Level in dB (A)
1	8	90
2	6	92
3	4	95
4	3	97
5	2	100
6	1.5	102
7	1	105
8	0.5	110
9	0.25 or less	115(Max.)

TABLE 6.9: DAMAGE RISK CRITERIA FOR HEARING LOSS

- **Noise Sensitive Receivers**

Representative noise sensitive receivers (NSRs) were identified during the site visit of the project area. As some of the part of the project area is highly residential with the structures along the roads on both sides of the existing alignment, therefore, the first layer of these noise sensitive receivers

provides acoustic shielding to those receivers behind them. The noise sensitive receivers include the following:

Residential Uses: All domestic premises including temporary housing
Institutional Uses: Schools
Worship Places: Mosques, Jammat Khana
Others: Dispensary, Hospitals

S.N	ASRs	Stake Mark	Location
1	Thick population	K0+000~K1+000	Sultanabad
2	Scattered population	K6+000~K6+600	Konodas
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4	Scattered population	K18+800~K21+000	Hanzel
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14	Thick population	K123+400~K124+600	Khalti
15	Thick population	K170+000~K174+000	Phander
16	Scattered Population	K185+000~K187+000	Teru

TABLE 6.10: NOISE SENSITIVE RECEIVERS (NSRS)

All 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:

- 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
- Confining excessively noisy work to normal working hours in the day, as far as possible;
- Providing the construction workers with suitable hearing protection like ear cap, or earmuffs and training them in their use
- Preferably, restricting construction vehicles movement during night times;
- Heavy machinery like percussion hammers and pneumatic drills should not be used during the night without prior approval of the Client
- Vehicles and equipment used should be fitted, as applicable, with silencers and properly maintained
- Use of low noise machinery, or machinery with noise shielding and absorption;
- Contractors should comply with submitted work schedule, keeping noisy operations away from sensitive points; implement regular maintenance and rEPAirs; and employ strict implementation of operation procedures
- Noise barriers in sensitive areas in the form of high boundary walls (concrete or wood), earth berms, etc. in front of schools, hospitals and mosques;
- Public hearings to discuss appropriate solutions and materials to control noise (e.g. mud or brick walls, bushes, etc.)
- Locating the rock crushing, concrete mixing, and materials shipment yards at least 2km from residential areas, particularly schools, hospitals, and nursing homes will also help reduce local

noise levels. Such activity taking place near or through villages will broadening Consultants continuous noise in the 70–80 dB (A) range or above.

6.3.8 Waste and Hazardous Waste

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. As the project deals with the construction of the road, so no hazardous waste will be generated during the construction waste. But the handling and storage of oil, asphalt/bitumen may be a source of environmental pollution as a 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.
Mitigation measures will include:

- Wastewater effluent from contractor's workshop and equipment washing yards would be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams.
- Training of work force in the storage and handling of materials and chemicals that can potentially cause soil contamination.
- Solid Waste generated during construction and camp sites will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan.
- Proper labelling of containers, including the identification and quantity of the contents, hazard contact information etc.
- Emergency Response plan should be prepared to address the accidental spillage of fuels and hazardous goods.
- Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies.
- Reusing bitumen spillage.
- Disposing non-usable bitumen spills in a deep trench providing clay linings at bottom and filled with soil at the top (for at-least 0.5m).
- Used oil should be collected in separate containers stored on impervious platform with restricted access and must be sold to licensed contractor and the burning of waste oil should be strictly restricted.
- Segregating and stockpiling scarified/ milled bituminous material and reusing this material in sub grade/shoulders.
- Collecting and stockpiling excessive bituminous material for reuse or controlled disposal.
- Training of employees involved in the transportation of hazardous material regarding emergency procedures.
- Providing the necessary means for emergency response on call 24 hours/day.
- The sewage system for camps will be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters.
- Lined wash areas will be constructed within the camp site or at site, for the receipt of wash waters from construction machinery.

6.3.9 Green House Gas (GHG) Abatement

The main sources of greenhouse gases (CO2, CH4, NOx etc) during the construction activities of the proposed Road 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 and other climatic changes on regional and global scale.

Mitigation measures will include:

- Regular motioning of the vehicles for engine efficiency.
- Avoid any unnecessary work and transportation.
- Alternative energy resources should be considered where possible.
- NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works.

6.3.10 Resource Conservation

Almost all the materials to be used in the construction of Road 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. Although plenty of water is available in the project area but its use might affect the community water consumption. Bitumen is not locally produced and its sources are not locally available so its sustainable use is prerequisite.

Mitigation measures will include:

- Wastage of water should be reduced by training the workers involved in water use.
- Wastage of water should be controlled through providing proper valves and through controlling pressure of the water.
- Water jets and sprays should be used for watering surfaces rather than using overflow system.
- Source of water should be carefully selected. Water use should not disturb the existing community water supplies:
  - Unnecessary equipment washings should be avoided.
  - Use minimum amount of bitumen for road surfacing.

6.3.11 Energy Efficiency

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. For conservation of energy, efficiency of the engines and burning processes is very important. Electricity shortage is not expected but the sustainable use of diesel and residual fuel is necessary.

Mitigation measures will include:

- Ensure adequate insulation to reduce heat loss through batching plants.
- Regularly monitor CO and CO2 content of the flue gases to verify that combustion systems are using practical excess air volumes.
- Maintain clean heat transfer surfaces in asphalt batching plant.
- Regular service of the vehicles and bathing plants will reduce the mechanical losses of energy.

6.3.12 Surface and Ground Water

Surface water (Gilgit River and watershed streams) might get contaminated due to the disposal of construction waste generated during the project activity; earth and stone work activities, this contamination will not only endanger the aquatic life but may also result in jeopardizing the health of natives that use this water for meeting domestic requirement. In addition to that, waste, if left

unattended will result in forming leachate that will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it. Also the water for construction and consumption may affect local water demand.
There is a possibility that various materials like fuel, lubricant oil and other oily products, which are used during the construction phase may contaminate groundwater, if they are not handled properly. During the construction phase, the sanitary wastewater will be generated at the workers' camp(s). If this wastewater is allowed to stagnate in water ponds on the site, it can percolate into the soil, thereby, contaminating groundwater. This impact is temporary and minor negative in nature.

Mitigation measures will include:

- Protection of surface and groundwater reserves from any source of contamination such as the construction and oily waste that will degrade its potable quality.
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements; water required for construction is obtained in such a way that the water availability and supply to nearby communities remain unaffected.
- For construction purposes, water shall be drawn from surface water bodies on priority and as available.
- Regular water quality monitoring according to determined sampling schedule.
- The contractor shall ensure that construction debris do not find their way into the drainage or irrigation canals which may get clogged.
- Work on irrigation canal areas will be kept to a minimum, protective walls be (reconstructed);
- To maintain the surface water flow/drainage, proper mitigation measures will be taken along the Road, like drainage structures in urban areas.
- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond.
- Construction work close to the streams or other water bodies will be avoided, especially during monsoon period.
- Take precautions construct temporary or permanent devices to prevent water pollution due to increased siltation.
- Wastes must be collected, stored and taken to approved disposal site.
- Maintenance workshop, material yard, crushers, asphalt plant and construction camps should not be sited within 1 km of water resources.
- Septic tanks, settling ponds, washing yards shall be established to control the wastewater and sediment loadings near construction camps.

6.3.13 Biodiversity Conservation

Trees are vital ecosystem, which perform variety of functions for the improvement of environment such as reduction in air pollution, noise abatement, cooling effect on earth, supply of oxygen etc. Due to the proposed Project, approximately 30,000 to 40,000 of trees of different species and belonging to different age groups will be cut due to the proposed Project.

The trees coming in the ROW are mostly Bhaid (Willow), Eucalyptus, Khail, Kikar, Walnut, Poplar, Thoth (Mulberry) etc. Establishment of contractor's camps and warehouses for storage of equipments, 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 and cause quaintly causing 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 fulfil the camp's requirements).

This may affect the ecological habitat of the Area. This impact will be permanent and moderate negative in nature

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Mitigation measures will include:

- The indigenous trees most suited to the tract will be re-planted in ROW. The land requirement for plantation has already been included in the ROW of the road.
- Flowering and fruiting shrubs will be planted along the road to beautify the landscape. Planting would however be done keeping in view the principles of landscape designing.
- An awareness campaign targeted on the neighbourhood farmers shall be run to popularize the planting of trees.
- Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides.
- The contractor's staff and labour 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's 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.
- Compensation for trees required to be cut on account of their coming in the ROW of Road must be paid to farmers/owners in accordance with market rates.

6.3.14 Fauna

The usual fauna found in the project area have already been mentioned earlier in Section-4. Due to the implementation of the proposed Project, the free movement of fauna would be disturbed as the construction of the road 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.

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.

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.

Mitigation measure will include:

- Plantation of large number of trees along the proposed project 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;
- Burrow 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.
- Alternate nesting facilities shall be tried for those birds disturbed during hatching season.

6.3.15 Disposal of Mucking Material

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. 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.

6.3.16 Disruption of Existing Public Utilities

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.
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.

6.3.17 Traffic Management

Due to the proposed construction activities, proper traffic management may pose a challenge in the project area, particularly, where the construction of bridges, open tunnels, culverts will take place. This may result in traffic jams and cause inconvenience to the people passing through the project area due to movement of vehicles carrying construction materials. It will also increase the traffic load on the existing road network, thus deteriorating the existing condition of the road. Also, the movement of vehicles along the haulage routes may cause soil compaction and alteration of percolation, vegetation pattern and damage to properties and utilities. This impact is temporary and minor negative in nature.

Mitigation measures will include:

- Proper traffic management plan will be needed to avoid traffic jams/public inconvenience.
- Movement of vehicles carrying construction materials should be restricted during the daytime to reduce traffic load and inconvenience to the local residents.
- Coordinated planning of traffic diversions by the traffic police and the Transport
- DEPArtment in accordance with the construction programme with advance warnings to the affected residents and road users.
- Construction vehicles, machinery and equipment will move or be stationed in the designated ROW to avoid un-necessary compaction of soil.
- Availability of continuous services of the police in the diversion and control of traffic.

6.3.18 Waste Disposal

Due to construction activities, waste will be generated at construction and contractors camp site. This may result in health risk to work force and public, if disposal site is improperly selected and operated. This impact is temporary and minor negative in nature.

Mitigation measures will include:

- The waste generated from the camp site will be disposed off through Municipal Committee;
- Burning of waste will be prohibited; and
- Solid Waste will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan.

6.3.19 Economic Activity

Due to the construction of the proposed Project, economic activity will be generated in the project area as the labourers 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.

6.3.20 Lifestyle and Culture

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 farmer's/livestock raisers etc. may arise. This impact is temporary and minor negative in nature.

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

- Timely and full public consultation and announcement of mobilizing equipment.
- Establishment of formal links with affected communities.
- Seek assistance from and cooperation with local NGOs.
- Familiarize outside labourers on local etiquettes.
- Local labour should be employed for construction works.
- Water supply and sanitation facilities, Contractor's workforces should exacerbate the existing shortages and environmental hazards; contractor should primarily seek their own sources of water in due distance (min. 1 km) from local user's wells.

6.3.21 Impacts of Heavy Vehicles On Existing Road Network

The plying of heavy vehicles on the existing road network may result in air pollution (if unpaved roads), noise pollution due to tire-road friction especially near sensitive receptors (residential areas, school, health facility etc.), and damage to roads and traffic congestion. However, the impacts would

be temporary and moderate negative in nature for which the following mitigation measures are proposed:

- Any vehicle with an open load carrying area used for transport of potentially dust producing materials shall have properly fitted side and tailboards. Materials having potential to produce dust shall not be loaded to a level higher than the side and tail boards and shall be covered with clean tarpaulin in good condition. The tarpaulin shall be properly secured and extended to at least 300 mm over the edges of the sideboard and tailboard.
- Where dust emissions are high, diversion tracks, if required, shall be overlain with shingle or surface treated. Diversion roads in built-up areas shall be established and scheduled to minimize traffic congestion.
- The Contractor shall not use any vehicles either on or off road with grossly excessive noise pollution. In case of built-up areas, noise mufflers shall be installed and maintained in good condition on all motorized equipment under the control of the Contractor.
- The Traffic Management Plan shall be prepared, which will comprise strengthening and widening of the existing minor and major roads or construction of new temporary roads.
- The traffic on the existing roads shall be managed by NHA in cooperation with the local traffic police department in order to avoid traffic accidents and congestions causing unnecessary delays.

6.4 ANTICIPATED IMPACTS DURING OPERATIONAL PHASE

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

6.4.1 Biodiversity Conservation

- **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 in two rows on either side of the road (except the bridges), 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.

Presence of adequate flora will absorb CO2 gas, through photosynthesis, emitted from an expected large number of cars, vehicles and public transport, thus purifying air of hazardous particles.
Mitigation measure will include planting of approximately 320,000 numbers of plants along both sides of the road, in accordance with the tree plantation plan.

Although it shall take 10-15 years, before these plants become trees, this planting on road, shall not only compensate for the loss of trees, but shall contribute towards improvement of flora and environment of the tract.

- **Plantation Plan**

Single rows of plants will be raised on both side of the proposed project i.e. Western side and Eastern side. Trees will be planted at a distance of 2 meters from the road. This row will consist of large,

shady and evergreen trees. No invasive species would be introduced. Recommended trees are given in Table 6.11

Sr. No.	Common name	Scientific name
1	Bhaid (Willow)	Salix tetrasperma
2	Thoth(Mulberry)	Morrus alba
3	Ilenthus	Ilenthusspp
4	Khail	Pinusroxburghii
5	Poplar	Populus alba
6	Kikar	Acacia nilotica
7	Palosa/Phulahi	Acacia modesta
8	Walnut	Juglansregia
9	Frash	Tamarixaphylla
10	Eucalyptus	Eucalyptus camaldulensis
11	Ber	Zizyphusmoritiana

TABLE 6.11: TREES TO BE PLANTED IN FIRST (OUTER) ROW

The saplings planted in the project area against the trees affected would be properly maintained with the help of Forest Department throughout their initial growth period in terms of water requirement and necessary nutrients. Therefore, proper care of newly planted trees will need special care;

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

- **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 road. This impact is permanent and minor negative in nature. Noise and air pollution caused due to heavy and fast traffic on road, shall be a source of disturbance to the fauna of the area and especially to the avifauna of the area, which is an another minor negative impact. Raising of dense plantation of shady trees on both sides of the road shall provide resting, nestling and roosting habitat to the fauna and especially to the avifauna which is a major positive impact.

6.4.2 Surface and Ground Water

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, may be sometimes washed into groundwater during rains etc.

6.4.3 Pollution Prevention and Abatement

Pollution Prevention technologies and practices will be applied in operation phase according to the International good practices and national and international recognized standards. National Environmental Quality standards (NEQS) will be adopted as performance indicators.

During the construction phase, gaseous emission may occur from vehicles and road maintenance works. The impacts of different project activities and their appropriate preventive and abatement techniques and mitigation measures are discussed below:

- **Air Quality**

Improvement in road condition will help reduce traffic related emissions in the short term by allowing a smoother traffic flow. However, in the longer run, increased traffic levels and congestion will lead to PM10 pollution levels above the international standards, which may result in causing public health risks, nuisance and other impacts on bio-physical environment.

These conditions will result in the rise of vehicular emissions (CO, NOx, SOx, PM10) associated with the adverse effects on the environment and human. This impact is permanent and positive, in case of improvement of road conditions and minor negative, when traffic volume is increased.

Mitigation measures will include:

- Setting up of a system to monitor air quality along project area in accordance with the applicable standards/limits.
- Helping the owners and occupants of the affected premises to identify and implement special measures such as hedges and vegetation to reduce air pollution.
- Roadside tree plantations as applicable and feasible under harsh climatic conditions; plants should be selected in accordance to their ability to absorb emissions.
- Regular road maintenance to ensure good surface condition.
- Speed limits at sensitive locations.
- Monitoring air quality at defined schedule.
- Regular vehicle checks to control/ensure compliance with NEQS.
- Enforcement and penalties against traffic rules violators.

- **Noise**

During the operational phase, 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.

Mitigation measures will include:

- According to monitoring results, additional sound barriers in form of trees and hedges will be discussed with the affected people and planted if agreed.
- Signs for sensitive zones (health centers / educational institutions etc.) to disallow the use of pressure horns.
- Enforcement and penalties against traffic rules violators.

- **Wastes/ Hazardous Waste**

During operation phase Non-hazardous waste may be road sweepings or small quantities of municipal waste from road offices. No hazardous waste is expected to generate in operation phase except during road maintenance works. Transportation of hazardous waste is also expected and must be regulated.

Mitigation measures will include:

- Solid Waste generated during from offices will be properly disposed of 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.

6.4.4 Road Safety

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.

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.

6.4.5 Deterioration of Vehicles

During the operation of the proposed road, 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.

6.4.6 Community Development

Improved communication infrastructure will promote new business opportunities and tourism in the attached area of the project. 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.

CHAPTER 7
ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The goal of the Environmental Management and Monitoring Plan (EMMP) is to ensure that all the necessary corrective actions are carried out to counter any adverse environmental impacts and that enhancement measures are used where feasible and practical. One of the aims of the monitoring program is to actually observe and analyse these impacts, thereby providing the information to help in the modification of mitigation measures to reduce the risks, hazards and associated with this development Projects

7.1 ENVIRONMENTAL MANAGEMENT

To implement the recommendations and suggestions for environmental protection included in chapter 6, comprehensive management plan is needed. 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 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 EIA 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 programme 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.

For effective environmental management, the Client should assign the necessary responsibilities to Deputy Director Environment (EALS), which should be responsible for Environmental Monitoring of the proposed Project. The Deputy Director (DD) Environment will be assisted by an Environmental Engineer and a Sociologist in implementing the mitigation measures proposed in the EMP.

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. Obligation of the contractor, to safeguard, mitigate adverse impacts and rehabilitate the environment should be addressed through environmental provisions in the contract document as already highlighted in report and through adequate implementation at site.

7.2 INSTITUTIONAL RESPONSIBILITIES

Following functionaries will be involved in the implementation of EMP:

- EALS (NHA).
- Environmental Engineer (EE)/Officer of Supervision Consultant (SC).
- Environmental Engineer/Officer of Contractor.

The duties/responsibilities of the functionaries are discussed below:

7.2.1 Responsibilities of NHA

NHA (EALS) will be responsible for the environmental management and supervisory affairs during the construction phase of the proposed Project. Director Environment (EALS) will designate the Deputy Director Environment who will look after the environmental related issues during the construction phase.

The responsibilities of DD Environment are as follows:

- Coordinating and planning of activities of EALS.
- Monitoring progress of the project as per planned schedule of activities.
- Exercising oversight over the implementation of environmental mitigation measures by the contractor.
- Guiding the Environmental Specialist by providing appropriate environmental advice and solutions;
- Documenting the experience in the implementation of the environmental process.
- Preparing training materials and implementing programs.
- Maintaining interfaces with the other lined departments/ stakeholders.
- Reporting to the EPA on status of EMP implementation.

7.2.2 Responsibilities of Environmental Engineer

Environmental Engineer/specialist of SC will oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with SSEMP/EMP as mentioned in the contract documents. The Environmental Engineer/Specialist will also provide assistance to the Contractor's Staff to implement EMP. Site Specific Environmental Management Plan (SSEMP) will be prepared by the contractor under the supervision of EE of SC. The SSEMP would be approved by the EALS (NHA) and EPAGilgit Baltistan. EE of SC will provide guidance to the contractor's EE for implementing each of the activity as given in EMP. EE of SC will be responsible for record keeping providing instruction through the "Resident Engineer (RE)" for corrective actions and will ensure the compliance of various statutory and legislative requirements. EE will maintain the close coordination with the contractor and EALS for successful implementation with environmental safeguard measures. However, overall responsibilities of EE of SC are as follows:

- Directly reporting to the RE.
- Discussing various environmental issues and environmental mitigation, enhancement and monitoring actions with all concerned directly or indirectly.
- Review contractor's SSEMP as part of their work program.
- Inspect, supervise and monitor all the construction and allied activities related to the EMP for the project.
- Visiting construction sites including incomplete construction work sites, where there is no contractor's activities, active construction work sites, completed areas of work sites as well as ancillary sites such as burrow areas, quarries, asphalt and crusher sites, hot mix plant sites, construction camps and work shop areas etc. to ensure contractors compliance with EMP stipulations and conditions of statutory bodies.
- Assist the RE to ensure the environmental sound engineering practices.
- Assisting contractor and EALS in all matters related to public contacts including public consultation pertaining to environmental and community health & safety issues.
- Assisting EALS to carry out environmental monitoring.
- Organizing training to the EE of contractor and field staff.

- Preparing and submitting monthly and quarterly environmental progress/compliance reports to the EALS.

7.2.3 Responsibilities of Contractor

Site Environmental Engineer of contractor will carry out the implementation of the mitigation measures at construction site. Contractor will be bound through contract documents to appoint the Site Environmental Engineer/Specialist with relevant educational background and experience. The responsibilities of EE of Contractor are as follows:

- EE of contractor will prepare SSEMP, monitoring plan, traffic control/diversion plan, and asphalt and batching plant area plans and will submit all the plans to the EE of SC.
- EE of contractor will be responsible for the implementation of EMP and to take effective measures against corrective actions plan.
- EE will prepare the compliance reports as per schedule and will submit it to the SC.
- Provision of proper Personal Protective Equipment's (PPEs) to the workers and train them for their proper use.
- EE will conduct the environmental and health & safety trainings to the workers/labour.

7.2.4 Non-Compliance of EMMP

The implementation of the proposed SSEMP involves inputs from various functionaries as discussed earlier. The contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of project, for which contractor will be paid on the basis of monthly compliance reports. However, if the contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, NHA (EALS) will be responsible for enforcing compliance of contractor with the terms of the contract, including adherence to the EMP.

For minor infringements, an incident which causes temporary but reversible damage, the contractor will be given 48 hours to rectify the problem and to restore the environment. If restoration is done satisfactorily during this period, no further actions will be taken. If it is not done during this period, NHA (EALS) will arrange for another contractor to do the restoration, and deduct the cost from the offending contractor's next payment. For major infringements, causing a long-term or irreversible damage, there will be a financial penalty up to 1% of the contract value in addition to the cost for restoration activities.

7.3 ENVIRONMENTAL ACTION PLAN

The Environmental Action Plan provides the framework for the implementation of the mitigating measures and environmental management during the construction and operation phases of the proposed project. Tables 7.1 portray impacts, mitigations measures and the responsible organizations for the implementation of the mitigation measures during the construction and the operation phases respectively.

Sr. No.	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	Supervision
A: Design/ Pre-Construction Phase					
1.	**Alignment selection**	• Accidents due to improper design; • Resettlement issues of local people; Disturbance to properties/businesses; and • Tree cutting	• 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.	Design Consultant	NHA
2.	**Social Issues**	• Bifurcation of settlements; and Inconvenience in daily business and social activities	• Provision of 16 No. bridges, 3 open tunnels and 12 snow gallery for the connectivity of the settlements with consultation of the local residents.	Design Consultant	NHA
3.	**Physical and cultural resources**	• Disturbance to people visiting public; properties i.e. mosque, schools, jammat khana, shrines, and graveyards etc.	• Incorporate technical design features to avoid any interference with cultural heritage site and public property as far as possible; and • Provide pedestrian and vehicular underpasses in the design to minimize the social issues.	Design Consultant	NHA
4.	**Biodiversity Conservation and NRM**	• Cutting of approximately 30,000 to 40,000 trees of various species i.e. Guava, Phulai, Kikar, Eucalyptus, Bakain, Taman,Kau, etc;	• Incorporate technical design measures to minimize removal of these trees; • Plan for compensatory planting for eight trees against each fallen tree of similar floral function.	Design Consultant	NHA

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
		• Disturbance of movement of animals due to fragmentation of habitat	• Provision of compensation in the Project Budget for the loss of trees to the affected people according to Land Acquisition Act, 1894 and the environmental Protection Act of EPA, Gilgit Baltistan. • Disallow introduction of invasive/ exotic species and native species should be recommended for plantation; and • Provision of animal corridors for the free movement of faunal species, especially, near the attractive sites such as grazing lands, and water bodies. Care should also be taken for provision of crossings for the free movement and access to River Indus of pastoralists coming in the area of influence of the project during different seasons.		
6.	**Shifting of Public Utilities**	• Disturbance to the public may occur.	• 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.	Design Consultant	NHA
7.	**Identification of site for construction camps, asphalt & batching plant and crushers**	• Disturbance to the public may occur; and • Tree cutting may involve for the construction of camp site, asphalt and batching plant site.	• Site must be 1km 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.	Design Consultant	NHA

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	Supervision
8.	**Excavation of Earth**	• Result in change of edaphic soil characteristics; • Loss of fertile top layer of soil; • Air quality may also deteriorate; and • Stockpile generated during excavation which may be a nuisance.	• Designer will not propose the burrow pits on agricultural land unless completely unavoidable; • Burrow pits must be 500 m away from ROW; and • A detailed Plan for quarry management and Rehabilitation of Burrow Pits must be formulated by the designer..	Design Consultant	NHA (EALS)
			B: Construction Phase		
1.	**Site clearing or Leveling/tree cutting**	• Loss of vegetation may occur; • Soil erosion & instability of the soil; • Surface water pollution; and • Occupational health of workers and community may be affected.	• Assure minimum disturbance to native flora during construction especially where the asphalt, batching and crushing plants will be installed; • Minimize the amount of clearing. Clear small areas for active work one at a time; • Clear without destroying large plants and turf where possible and preserve them for replanting in temporary nurseries; • Move earth and vegetation only during dry periods. Store topsoil for re-spreading. If vegetation is required to be removed during wet periods, disturb ground only just before actual construction; • Install temporary erosion control features when permanent ones will be delayed especially near River Gilgit and nullahs. Use erosion control measures such as hay bales, mulches, straw, or fabric barriers;	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
			• Re-vegetate with recovered plants and other appropriate local flora immediately after equipment's are removed from a section of the site; and • Stockpiling spoil at designated areas and at least 5m away from traffic lane.		
2.	**Construction crews and camps**	• Construction and operation of crew camps may pollute the surface & groundwater; and • Workers working at site may rise conflicts with the locals.	• Explore off-site accommodation for crew. Keep camp size to a minimum; • Avoid as much clearing of vegetation as possible, for example, by creating defined foot paths; • The contractor will provide plan for removal and rehabilitation of site upon completion; • Photographical and botanical inventory of vegetation will be prepared before clearing the site; • Provide temporary sanitation on site, such as pit latrines (assuming the water table is low enough and soil and geology of appropriate composition); • Use local or regional labor; Screen potential crew members for HIV/AIDs, tuberculosis and other communicable diseases; • Maintain emergency response system; • Locate sock age pits for sewage at least 50m away from any ground water extraction source/hand pump; • Strictly prohibit poaching, and cutting of trees;	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
			• Provide adequate quantities and good quality of food; • Provide septic tanks for treating sewage from toilets before discharging through soakage pit; • Drinking water should meet the NEQS and WHO Guidelines; • Provide gas cylinder for cooking; • Water used for construction purpose should be clearly demarcated; • No domestic pets or livestock should be allowed on the site.		
3.	**Material extraction/ quarrying**	• Change in landscape may occur by quarry and burrow areas; • Water ponds may be formed where reproduction of mosquitoes may occur; and • Deterioration of air quality	• Identify the most environmentally sound source of materials that is within budget; • Use material from local road cuts first, if possible; • On removal of material, the area should be restored and be treated with erosion control measures; • Take photos of site before initiating excavation so restoration can match original site characteristics as much as practically possible. Restore site quarries and gravel pits so that they are not visible to the road users; • Top soil fertile layer stockpiles shall be convex and not more than 2-meter high. Stockpile should be shaped so that no surface water ponding can take place.	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
			• Monitor adherence to plans and impacts of extraction and modify as necessary; • Restore area so it is suitable for sustainable use after extraction is completed; • Install drainage structures to direct water away from pits; • Controlled blasting should be done at predetermined times; • Implement safety protocols to minimize risks from falling rock or debris, or accidental falls from cliffs • Discuss with local community the option of retaining quarry pits as water collection ponds for cattle, crops, or similar uses; • In case burrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites; • Convert the burrow pits into fish farms and take care in selection of burrow areas; • Provide temporary side drains, catch water banks or sedimentation basin to avoid or minimize erosion and prevent sedimentation to receiving water bodies; and • A detailed Plan for quarry management, Rehabilitation of Burrow Pits and Blasting Management must be implemented by the contractor.		

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
4.	**Construction material storage, handling and use**	• Soil contamination may occur due to mishandling of oil and asphalt; • Water may also be contaminated due to the oil spillages if the water source is nearby the storage yard; and • Health risk to workers.	• Material shall be appropriately secured to ensure safe passage between the destinations during transportation. Loads shall have appropriate cover to prevent spillage and contractor should be responsible for any clean up resulting from any failure; • Material from burrow site should be directly transported and deposited to the site where it has to be used. Stockpiles should be positioned and sloped to create least visual impact. No foreign material generated or deposited should remain on the site after completion of the activity and the areas affected by stockpiling should be reinstated; • Over spray of bitumen products outside the road surface on the road vegetation should be prevented, especially to the area where agricultural land is located on either sides of the proposed road; • Concrete mixing on the ground shall not be allowed; • Concrete and asphalt batching plant should be equipped with primary or secondary emission control system such as bag filters or cyclones or separators etc.; • Avoid using sites for storage that drain directly into sensitive areas including agricultural land and water bodies (i.e. Rivers and Nullahs/irrigation channels); • All runoff from batching plant should be strictly controlled and cement-contaminated water should be collected, stored and disposed off at the designated site; • Used empty cement bags should be collected and stored to deliver to solid waste contractor for recycling;	EE of CC	EE of SC and DD Environment of EALS

			• Contaminated water storage facilities should not be allowed to over flow and appropriate protection from rain should be implemented; • Materials shall not be loaded to a higher level than the side and tail boards and shall be covered with a good quality tarpaulin; • Soil contamination by asphalt will be minimized by placing all containers in caissons; • Collection of oil and lube drips in container during repairing construction equipment vehicles; • Provide impervious platform and collection tank for spillage of liquid fuel and lubes at storage area. • Used oil should be sold to local licensed contractors; and • Decanting and or controlled disposal of oil and grease as collected at collection tanks of maintenance yard and chemical storage areas.		

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
5.	**Handling/ transportation of hazardous materials**	• Toxicity, soil contamination and air pollution are the major impacts which may occur by mishandling of hazardous waste.	• Prevent dumping of hazardous materials specially near River and nullahs; • Proper labeling of containers, including the identification and quantity of the contents, hazard contact information etc; • Emergency Response plan should address the accidental spillage of fuels and hazardous goods; • Immediate collection of spilled oils/fuels/lubricants through collection of contaminated soils and skimming oils from surface water through appropriate technologies; • Disposing non-usable bitumen spills in a deep trench providing clay linings at bottom and filled with soil at the top (for at-least 0.5m); and • Prohibit use of waste oil as cooking fuel.	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
6.	**Use and maintenance of heavy equipment and machineries**	• Soil structure may get affected by using the heavy machinery away from the provided routes; and • Noise pollution may generate.	• Minimize use of heavy machinery; • Source-control of noise through proper maintenance of haul equipment's; • Set protocols for vehicle maintenance and prevent fuel tank leaks by: • monitoring and cross-checking fuel level deliveries and use; • checking pipes and joints for leaks; • tightening generator fuel lines; • preventing over-filling of main storage and vehicle tanks; • Heavy equipment should not be parked under the tree to avoid soil compaction and damage to the roots of the trees; • Traffic management plan shall be prepare in cooperation with local traffic police in order to avoid the accidents. • Well maintained equipments will be used to avoid the air and noise pollution especially near the following sensitive receptors: Schools, Mosques, Jammat Khana and Scattered populations. • Noise barriers should be provided for sensitive receptors coming within 100m; like, Schools; Mosques , Jammat Khana and settlements; • Provide impervious platform and oil and Grease traps for collection of spillage from construction equipment vehicle maintenance platform;	EE of CC	EE of SC and DD Environment of EALS

			• The heavy machinery should not be parked haphazardly at undesignated location nor should they be parked idle; • The heavy machinery must be operated mostly at night time and must be used least during prayer timings in mosques and school timings; and		

Sr. No	**Environmental Activity**	**Impacts**	**Mitigation**	**Responsibility**	
				Implementation	**Supervision**
7.	**Handling of solid waste**	• Solid waste may be generated from the active construction sites and also from the camp sites.	• Training of site personnel in waste management and chemical waste handling procedure; • Bitumen waste should be stored in closed containers and placed in a fenced storage area with paved floor; • Recording system for the amount of waste generated, recycled and disposed; Proper storage and site practices to minimize the potential for damage or contamination of construction material; • General refuse should be stored in enclosed bins to separate from construction material; • A reputable waste collector should be employed by the contractor to remove the general refuse from the site; and • Presently, there is no engineered landfill site in the project Area, so best practice should be followed dispose off the solid waste by the contractor.	EE of CC	EE of SC and DD Environment of EALS

8.	**Excavation, cutting, and filling**	• Soil erosion may occur at the site where excavation will be done; and • Soil un-stability and surface water contamination may also occur.	• Cover stockpile with plastic sheeting, prevent run-off with hay bales, or use similar measures; • Place fence around excavation; and safety procedures should be followed; • Construction crews and supervisors shall be alert for buried historic, religious, and cultural objects and provide them with procedures to follow if such objects are discovered. Provide incentives for recovery of objects and disincentives for their destruction; • Ensure excavation is accompanied by well-engineered drainage; • Do not fill the flow-line of a watershed as occasional rains may create strong water flows in channels; • Balance the cuts and fills whenever possible; • High embankments will be protected by constructing stone pitching or rip rap across embankments; • Water sprinkling should be carried out at the temporary access road and all the areas prone to dust generation; and • A detailed Plan for proper management of earthworks will be implemented by the contractor.	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
9.	**Water Resources Management**	• Contamination of water bodies (River Gilgit and natural nullahs) due to construction waste reaching these areas during the project construction	• Protection of surface and groundwater reserves from any source of contamination such as the construction and oily waste that will degrade its potable quality; • Best practice should be followed to dispose of solid waste to sustain the water quality for domestic requirements; • Water required for construction shall be obtained in such a way that the water availability and supply to nearby communities remain unaffected; For construction purposes, water shall be drawn from surface water bodies on priority and as available; • Regular water quality monitoring according to determined sampling schedule must be done for the water bodies i.e. (River Gilgit and nullahs). • The contractor shall ensure that construction debris do not find their way into the drainage which may get clogged; • To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas; • Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond for treatment prior to its discharge in water bodies i.e. (River Gilgit and seasonal Nullahs). • Construction work close to the streams or other water bodies will be avoided, especially during monsoon period;	EE of CC	EE of SC and DD Environment of EALS

			• Take precautions construct temporary or permanent devices to prevent water pollution due to increased siltation; • Wastes must be collected, stored and taken to approved disposal site; and • Maintenance workshop, material yard, crushers, asphalt plant and construction camps should not be sited within 1 km of water resources; and • Septic tanks, settling ponds, washing yards shall be established to control the wastewater and sediment loadings near construction camps.		

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
10.	**Traffic control**	• Traffic jams and congestion may take place and cause inconvenience to the people during construction	• Efforts should be made to accommodate the traffic along the existing road, as far as practically possible; • Provision of signboards directing the drivers about the diversion; • Providing and maintaining traffic management comprising diversion warning, guiding and regulatory signage, flagmen, channelizes and delineators, lightening etc.; • Contractor staff could be trained and put on the duty to manage the traffic during the construction activities taking place along the road; • Availability of continuous services of the police in the diversion and control of traffic; and • Temporary bypass, if possible, should be avoided if it involves clearing of land; and • Max allowable speed for heavy machinery on the site should not exceed 20km/hr.	EE of CC	EE of SC and DD Environment of EALS

11.	**Health & Safety of Workers at active construction and camp site**	• Health problems or immediate risk may take place.	• Providing basic medical training to specified work staff and basic medical service and supplies to workers; • Layout plan for camp site, indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents; • Work safety measures and good workmanship practices are to be followed by the contractor to ensure no health risks for laborers; • Protection devices (ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines; • Provision of adequate sanitation, washing, cooking and dormitory facilities including lighting up to satisfaction; • Proper maintenance of facilities for workers will be monitored; • Provision of protective clothing for laborers handling hazardous materials, e.g. helmet, adequate footwear for bituminous pavement works, protective goggles, gloves etc; • Ensure strict use of wearing these protective clothing during work activities; Availability of safe drinking water for the workers; • Elaboration of a contingency planning in case of major accidents; • Adequate signage, lightning devices, barriers and persons with flags during construction to manage traffic at construction sites, haulage and access roads;	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
			• Timely public notification on planned construction works; • Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity & social links; • Seeking cooperation with local educational facilities (school teachers) for road safety campaigns; • Provision of proper safety signage at sensitive/accident-prone spots; • Setting up speed limits in close consultation with the local stakeholders; • Screen potential crew members for HIV/AIDS, tuberculosis and other communicable diseases.		
11.	**Running of asphalt mix plants, crushers, etc.,**	• Dust generation from construction machineries causing health risks to operating workers, impact on bio-physical environment.	• Ensure precautions to reduce the level of dust emissions from, hot mix plants, crushers and batching plants will be taken up, e.g. providing them, as applicable, with protection canvasses and dust collection/extraction units. • Mixing equipment will be well sealed and equipped as per existing standards; • Wet scrubbers will be used in asphalt plant to minimize the dust pollution and wastewater ponds will be formed/constructed with baffle walls to trap the oil and grease generating from the wet scrubber outlet;	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
			• Water will be sprayed in the lime/cement and earth mixing sites; and • PPEs like dust masks shall be provided by the contractor to ensure no health risks for operators.		
12.	**Implementation of Plantation Plan**	• Clearing of vegetation from the area may cause environmental impact.	• The indigenous trees and local species which most suited to the tract like will be re-planted; • Exotic or alien/invasive species of plants should not be introduced as a compensation of plants to be removed; • Flowering and fruiting shrubs will be planted along the road to beautify the landscape. Planting would however be done keeping in view the principles of landscape designing; • An awareness campaign targeted on the neighborhood farmers shall be run to popularize the planting of trees; • Maximum transplantation of trees to be affected; • Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides;	EE of CC	EE of SC and DD Environment of EALS

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
			• The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes. They will use the specified paths and tracks for movement and will not be allowed to trespass through farmlands; Construction vehicles, equipment's 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 proposed road must be paid to farmers/owners in accordance with market rates.		

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
			C: Operational Phase		
1.	**Road maintenance**	• Deterioration of road and associated structures and accidents of hazardous material.	• 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; • Fill mud holes and pot-holes with good quality gravel; remove fallen trees and limbs obscuring roadways; and • Use water from settling basins and retention ponds for road maintenance.	NHA (EALS)	External Monitor
2.	**Accidents of hazardous material**	• Oil spill may occur which in turn may be a cause to accidents.	• In case of any accidental spill, there should be a relevant department 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 hazardous substance.	NHA (EALS)traffic police	External Monitor
3.	**Use and maintenance of equipment**	• Water and soil pollution may occur.	• Install concrete pads, drains, and oil/water pits in areas where vehicle and equipment maintenance and fueling will occur regularly.	NHA (EALS)traffic police	External Monitor
4.	**Vehicle management**	• Noise and air pollution may occur.	• Vehicle with excessive noise should be prohibited to travel on the road especially near the communities; and • Public should be educated about the noise and air pollution.	NHA (EALS)traffic police	External Monitor

Sr. No	Environmental Activity	Impacts	Mitigation	Responsibility	
				Implementation	**Supervision**
5.	**Floral species maintenance**	• Chances of damage of saplings due to road accidents and improper maintenance.	• The saplings planted in the project area against the trees cut should be properly maintained throughout their initial growth period in terms of water requirement and necessary nutrients. Therefore, proper care of newly planted trees will need special care; • An awareness campaign targeted on the neighborhood farmers will be carried to popularize the planting of trees, and saplings should be provided on subsidized costs; • Organic farming will be encouraged to minimize the use of chemical fertilizers and pesticides; • Raising of dense plantation on both sides of the Road will not only mitigate the ill effects of construction of Road on flora, but it will also improve the landscape of the area and enhance its aesthetic beauty. Enough space is available on both sides of the Road for raising sufficient number of plants on each side.	NHA (EALS)and PAKEPA	External Monitor
6.	**Faunal species conservation**	• Limitations in the movement of faunal species.	• Maintenance of animal/livestock crossings provided to facilitate their movement; • Speed limits near the animal corridors provided along the whole alignment wherever necessary;	NHA and PAKEPA	External Monitor
7	**Road Safety**	• Possibility of road accidents	• Enforcement of speed limits, installation of speed guns and enforcement of penalties for the violators.	Road Police	External Monitor

TABLE 7.1: ENVIRONMENTAL MANAGEMENT PLAN

7.4 ENVIRONMENTAL MITIGATION

To minimize the negative impacts that will arise due to increased vehicular activity on the proposed project and to enhance the landscape of the area, the mitigation measures would include; plantation along the whole stretch of the road as a noise barrier. Following plantation plan would be followed:

One row of plants will be raised on either side of the proposed Road (Gilgit to Teru Village). Plant to plant distance will be kept as 2 meters, so there will be 500 plants in one row of one Km length. As total road stretch is 216 km in length, therefore, number of plants to be raised one kilometre length, on both sides will be 1000.

Moreover, the trees and shrubs will be raised all along the proposed road, two each on western and eastern sides, with a total of about 320,000 plants. Native species would be planted and no invasive/ exotic species would be introduced. So more than 8 times of the trees affected shall be replaced in this section of the road.

7.4.1 Plantation Cost

A total of 320,000 plants will be raised in lieu of nearly 30,000 to 40,000 trees to be affected due to construction of the proposed road. Thus the number of plants to be raised is more than 8 times the plants to be removed/ transplanted. The cost of plantation includes the cost of equipment and initial planting and maintenance for first four years.
The cost of re-plantation may be summarized as below:

- Cost for raising 320,000 plants and their Maintenance — Rs.250.00 million
- Cost of Equipment: — Rs.8.98 million
- Total cost for raising 320,000 Plants and their maintenance for 4 years including equipment — Rs.258.98 million

7.5 ENVIRONMENTAL TECHNICAL ASSISTANCE

In order 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.

NHA (EALS) will train the SC to effectively implement the EMP, and SC will train the contractor to prepare the site specific EMP and its implementation. The contractors will train its staff about the best environmental management practices at the construction site and implementation of the EMP.

The training modules will include air, noise and water pollution monitoring, social awareness, Environmental Laws, “National Environmental Quality Standards (NEQS)”, Usage of personal protection equipment’s, and health and safety related issues on the construction site.

The contractor will train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of Sexually Transmitted Infections (STI) HIV/AIDS and in general health and safety matters, and on the specific hazards of their work. Training should also consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation. Training of trainers is also a basic element of training.

7.6 MONITORING MECHANISM (MM)

Monitoring of environmental components and mitigation measures during construction and operation stages is a key component of the EMP to safeguard the protection of environment. The objectives of the monitoring are to (i) monitor changes in the environment during various stages of the project life cycle with respect to baseline conditions; and (ii) manage environmental issues arising from construction works through closely monitoring the environmental compliances. A monitoring mechanism is developed for each identified impact and it includes:

- Location of the monitoring (near the project activity, sensitive receptors or within the project influence area)
- Means of monitoring, i.e. parameters of monitoring and methods of monitoring (visual inspection, consultations, interviews, surveys, field measurements, or sampling and analysis)
- Frequency of monitoring (daily, weekly, monthly, seasonally, annually or during implementation of a particular activity)

The monitoring program will also include regular monitoring of construction activities for their compliance with the environmental requirements as per relevant standards, specifications and EMP, the purpose of such monitoring is to assess the performance of the undertaken mitigation measures and to immediately formulate additional mitigation measures and/or modify the existing ones aimed at meeting the environmental compliance as appropriate during construction. The environmental parameters that may be qualitatively and quantitatively measured and compared are selected as 'performance indicators' and recommended for monitoring during project implementation and operation stages. These monitoring indicators will be continuously monitored to ensure compliance with the national standards and comparison with the baseline conditions established during design stage. The list of indicators and their applicable standards to ensure compliance are given below:

- Air Quality (PM), SO2, NO2, and CO) NEQS, Pakistan 2014.
- Noise Levels – NEQS, Pakistan 2014.
- Surface Water Quality – NEQS, 2014.
- Groundwater Quality – NEQS, 2014.

During the preconstruction period, the monitoring activities will focus on (i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and (ii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out in good time.

Construction environmental monitoring is a function of supervision, and the essential purpose is to ensure adherence to the EMP. The monitoring is a day to day process, which ensures that departures from the EMP are avoided or quickly rectified, or that any unforeseen impacts are quickly discovered and remedied. Specific actions in the EMP that are to be monitored are included in the Monitoring Plan. During construction, environmental monitoring will ensure the protection of landslide, side slopes, and embankment from potential soil erosion, burrow pits restoration, quarry activities, sitting of work sites and material storages, sitting of batch, concrete and asphalt plants especially close to the nature reserve, preservation of religiously sensitive locations, community relations, and safety provisions.

Post monitoring evaluation will be carried to evaluate the impacts of the project during first 3 years of operation of the project. Regular monitoring of the condition of the road surface, bridges, culverts, drainage structures and slope protection structures is important from an environmental management point of view, but takes place as part of regular road maintenance. In addition to this activity,

information on the locations, type and consequences of traffic or traffic related accidents is required, in co-operation with traffic police. Recommended air, noise and water quality monitoring, greening and landscaping and community feedback are also included in the Monitoring Plan.

The monitoring plan and details of monitoring locations for environmental condition indicators of the project during the construction and operation stage are presented in Table 7.2a.

7.6.1 Monitoring Schedule / Performance Indicator

The monitoring schedule has been developed based on the possible occurrence of adverse impacts and required mitigation actions. However, this schedule is subject to change depending on the analysis results obtained. The performance indicators and protocol for changing the monitoring schedule is given below:

- **Tree Plantation**

The 75% survival rate of re-plantation shall be monitored on the first year of the operation phase. If the survival rate is found below 75%, necessary measures will be taken to increase the survival rate and monitoring shall be again conducted taken up each year of operation. This cycle should continue until the 75% survival rate is achieved.

Soil Erosion and Drainage Congestion
No significant soil erosion problem is anticipated due to the project either in the construction phase or in the operation phase. However, in the construction phase, some localized soil erosion may be noticed owing to construction activities. However, if soil erosion is noticed during construction and operation phase, the corrective action shall be initiated and frequency of check be increased to assess the tendency of occurrence.
The cross drainage structure shall be free from siltation. Visual check shall be made periodically to identify any drainage congestion or water logging along the road. Appropriate corrective action shall be taken to clear the congestion and prevent reoccurrence.

- **Air and Noise Quality**

Due to the variability of the construction activities e.g; changes in batch composition, type of construction activity and other anthropogenic influences, the ambient air quality of the project area may change. If the air quality with respect to any parameter exceeds by more than 25% of its last monitored value, the monitoring frequency shall be doubled and cause of the increase investigated. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

Similarly, due to the variability in traffic movement, e.g; changes in traffic volume, traffic compositions and other anthropogenic influences, the noise quality in the project area is likely to change. If the noise quality exceeds by 20% of the applicable ambient noise quality standard or 5% of its last monitored value, the monitoring frequency shall be increased and the cause of the increase investigated. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

- **Water Quality**

No significant change in water quality is perceived due to the project in the operation phase. However, in the construction phase, the monitored values for pH, BOD, COD, TDS, DO and Oil & Grease might

change owing to construction activities. Hence, it is suggested that if the monitored value for any water quality parameter exceeds by more than 20% of its last monitored status the monitoring frequency shall be increased.

7.6.2 Monitoring and Mitigation Plan

The Environmental Mitigation and Monitoring Plan provides the framework for the implementation of the mitigating measures and monitoring during the construction and operation phases of the proposed Project (Table 7.2 a) whereas, (Table 7.2b) gives estimate for monitoring of the environmental quality parameters during both (construction and operational) phases of the proposed project.

Sr. No.	Environmental Activity	Location	Means of Monitoring	Frequency	Responsibility	
					Implementation	Supervision
A: Construction Phase						
1.	**Vegetation Clearance**	Construction site	Visual inspection of loss of vegetation, soil erosion & instability, surface water pollution and occupational health of workers and community	Weekly	EE of CC	EE of SC
2.	**Top Soil**	Construction site	Visual inspection of top soil of 30 cm depth should be excavated and stored properly	Beginning of earth works	EE of CC	EE of SC
		Construction site	Visual inspection for the stored top soils to be used as cladding material over the filled lands	Immediately after filling and compaction of dredged materials	EE of CC	EE of SC
3.	**Erosion**	Side slopes of the embankments and material storage sites	Visual inspection of occurrence of erosion and erosion prevention measures	At the end of filling activity	EE of CC	EE of SC

Sr. No	Environmental Activity	Location	Means of Monitoring	Frequency	Responsibility	
					Implementation	Supervision
4.	**Operation of Burrow and quarry site**	Quarry Sites	Visual inspections of quarry sites/ burrow areas for change in landscape and creation of water ponds.	Monthly	EE of CC	EE of SC
5.	**Excavation of Earth**	Construction site	Visual inspection for soil erosion & stability.	Weekly	EE of CC	EE of SC
6.	**Material Supply**	Material Supply Sites	Inspection of possession of official approval or valid operating license of suppliers materials (asphalt, cement, quarry and burrow material)	Before the agreement for supply of material is finalized.	EE of CC	EE of SC
7.	**Land slide/ Rock fall control**	Active rock fall sections and steep mountainous slopes	Visual Inspection	Monthly	EE of CC	EE of SC
8.	**Storage and handling of materials**	Material storage yard/Work area and Construction camps	Visual Inspection of storage facilities	Monthly	EE of CC	EE of SC
9.	**Local roads**	Approach Roads and wooden bridges	Visual inspection to ensure local roads are not damaged	Monthly	EE of CC	EE of SC

Sr. No	Environmental Activity	Location	Means of Monitoring	Frequency	Responsibility	
					Implementation	Supervision
10	**Traffic safety**	Construction site	Visual inspection to see whether proper traffic signs are placed and safety barriers and flagmen's for traffic management are engaged	Monthly	EE of CC	EE of SC
11	**Air Quality**	Active site and near the sensitive sites and settlements, asphalt plant downwind and upwind	Air Quality Monitoring Mobile Lab	Quarterly	EE of CC	EE of SC
		Material storage & active sites	Visual inspection to ensure water sprinkling is being implemented	Daily	EE of CC	EE of SC
		Asphalt Plant	Visual inspection to ensure asphalt plant is located >500 m from residential areas.	Monthly	EE of CC	EE of SC
12.	**Noise**	Near the sensitive sites and settlements	Noise meters	Quarterly	EE of CC	EE of SC
		Construction sites	Visual inspection of conditions of equipment in use	Weekly	EE of CC	EE of SC

Sr. No	Environmental Activity	Location	Means of Monitoring	Frequency	Responsibility	
					Implementation	Supervision
13.	**Surface Water Quality**	At water body near the bridge construction sites one upstream and one down stream	Sampling and analysis of surface water quality	Monthly	EE of CC	EE of SC
14.	**Groundwater Quality**	Drinking water sources near the camp site	Sampling and analysis of groundwater quality	Quarterly	EE of CC	EE of SC
15.	**Drinking Water and Sanitation**	Construction camps and construction sites	Visual inspection of safe water and sanitation facilities for the construction workers on the site	Weekly	EE of CC	EE of SC
16.	**Solid waste**	Construction camps and construction sites	Visual inspection that solid waste is disposed at designated site	Weekly	EE of CC	EE of SC
17.	**Floral and Faunal Monitoring**	In the project area	Visual inspection	Daily	EE of CC	EE of SC
18.	**Cultural and archeological sites**	At work sites	Visual inspection	Daily	EE of CC	EE of SC
19.	**Reinstatement of work site**	At work sites	Visual Inspection	After completion of all works	EE of CC	EE of SC
20.	**Safety of Worker**	At work sites	Inspection of usage of Personal Protective Equipment	Daily	EE of CC	EE of SC

		Camp office	Accident/Incident reporting record	Monthly	EE of CC	EE of SC
B: During Operation Phase						
21.	**Surface Water Quality**	River Gilgit, streams and nullahs	Sampling and laboratory analysis	Yearly	NHA(EALS)	External Monitor
22.	**Groundwater**	At the Baseline Monitoring Sites	Sampling and Laboratory analysis	Yearly	NHA(EALS)	External Monitor
23.	**Air Quality**	At the baseline monitoring sites	Air Quality Monitoring Mobile Lab	Quarterly	NHA(EALS)	External Monitor
24.	**Noise Quality**	Close to the sensitive receivers	Noise meters	Quarterly	NHA(EALS)	External Monitor
25.	**Landscape**	Along project alignment	Visual inspection of long-term degradation of natural landscape at land strips and slopes adjacent to road. Development of landslides, rock falls and other natural hazardous process change of drainage patterns, erosion and degradation of vegetation.	Quarterly	NHA(EALS)	External Monitor

TABLE 7.2 (A): ENVIRONMENTAL MITIGATION AND MONITORING PLAN

KEY: CC Construction Contractor; NHA (EALS) National Road Authority; EE Environmental Engineer; SC Supervision Consultant.

Components	Parameters	**No. of Samples** (No. of Samples x Frequency x Year)	Frequency	Responsibility	Duration	Cost (Rs.)
Construction Phase (2 years)						
Air Quality	CO, NOx, SOx, PM_{10}	5x4x2 = 40	Quarterly	EE of CC and SC	24 hours	1500, 000/-
Surface Water Quality	Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium	4x2x2=16	Quarterly	EE of CC and SC	-	192,000/-
Ground Water Quality	pH, Dissolved Oxygen, TSS, TDS, Alkalinity, BOD_5, COD, Turbidity	4x4x2 = 32	Quarterly	EE of CC and SC	-	288,000/-
Noise Level	-	12x4x2= 96	Quarterly	EE of CC and SC	24 hours	576,000/-
TOTAL						**2,556, 000/-**
Operation Phase (2 years)						
Air Quality	CO, NOx, SOx, PM10	8x4x2 = 64	Quarterly	NHA	24 hours	1,800, 000/-
Ground Water Quality	Total Coliforms, Fecal E. Coli, Total Colonial Count, Fecal Enterococci, pH, TDS, Total Hardness, Nitrate, Chloride, Sodium	4x1x2 = 8	Annually	NHA	-	96,000/-
Surface Water Quality	pH, Dissolved Oxygen, TSS, Alkalinity, BOD_5, COD, Turbidity	4x1x2 = 8	Annually	NHA	-	72,000/-
Noise Level	-	20x4x2 = 160	Quarterly	NHA	24 hours	960,000/-
TOTAL						**2,928,000/-**
GRAND TOTAL						**5,484,000/-**

TABLE 7.2-B: BUDGET ESTIMATE FOR ENVIRONMENTAL MONITORING DURING THE CONSTRUCTION AND OPERATION PHASES

KEY EC – Environmental Committee, NHA – National Roads Authority

7.7 ENVIRONMENTAL MONITORING, MITIGATION COST

The cost required to effectively implement the mitigation measures is important for the sustainability of the Project both in the construction and operation stages of the Project.

These costs are summarized as below:

Environmental Monitoring Cost =	5,484,000/-
Environmental Training Cost =	1,500,000/- (lump sum)
Tree Plantation Cost =	102,643,200/-
Total =	**109,627,200**
Say =	**109.627 Million Rupees**

7.8 ENVIRONMENTAL TRAINING PLAN

Training of professional and managerial staff is an important aspect to develop better understanding and insight towards the Environmental pollution, their impacts and requirements of EIA and EMMP. The training would also provide an opportunity to the project personnel, already familiar with the environmental and social consideration, to upgrade their knowledge pertaining to management/monitoring practices to be followed properly for handling mitigation measures to overcome potential Impacts/issues during all three stages of project implementation. In a nutshell the environmental training ensures to introduce that project on execution and operational/maintenance stages would not result in degradation of Environment but help achieving goals set for sustainable development in the overall economic policies of the country. Under the overall supervision of the project proponent (in this case EALS of NHA), the Environmental engineer of contractor/Environmental specialist of NHA would be mainly responsible to impart training to all project personnel on environmental and social issues and their mitigation measures proposed in the EIA to effectively implement the EMP. The NHA would also provide training to the contractor's environmental/project engineers and staff to highlight/incorporate environmentally benign working practices for implementation of EMP so as to reduce the environmental impacts at the site. For the purpose of imparting training, the training course needs to be designed as under:

- Introduce broad principles of Environmental Laws/Regulations,
- Define common terminology& National Environmental Quality Standards,
- Help create awareness/knowhow about parameters regarding dust/pollution control through testing/monitoring air quality, water quality and noise quality and
- Promote more sustainable environmental practices within the workplace.
- The training modules should also take care of methodology for
  - Launching campaign for social awareness among the general public /project affected people
  - Keeping the project staff and labors informed regarding health and safety related issues on the construction site and utilization of personal protection equipment.

A Week long training needs to be organized to cover the program mentioned above. The contractor's Environmental engineer would be liable to train employees/ labors. The training should cover the following aspects/topics specific to site conditions.

CHAPTER 8
CONCLUSION AND RECOMMENDATIONS

8.1 GENERAL

This section presents conclusions of the EIA study of Gilgit to Shandoor top Project. The overall objective of the project is to further strengthen the connections between Gilgit to Shandoor and part of CPEC (china and Pakistan) and promote the common development. This rehabilitation of existing road will improve the communication network between the Province Gilgit and Chitral Areas of Province Khyber Pakhtunkhwa.

Total length of Proposed Project is about 216 Km starting from Gilgit and ends at Shandoor Top. The section is part of CPEC is consisted by single dual carriageway and Grade 2 roads, among which the 2-lane single road. The conclusions mentioned below are based on the findings of detailed environmental assessment, which has been carried out as per requirement of EPA Gilgit-Baltistan.

8.2 IDENTIFICATION OF MAIN ISSUES AND CONCERNS

During the field surveys, significant efforts were made to identify the main social, cultural and environmental issues related to the construction of the proposed road. Various government departments and agencies were also contacted for obtaining salient information along with area resident/stakeholders. Following is the list of main issues and concerns:

- Cutting of trees/bushes falling within the proposed ROW.
- Disturbance to the public movement during construction.
- Reduction in the daily routine activities of local residents during construction.
- Noise and air pollution due to the operating of construction machinery during construction phase of the Project.
- Solid waste generation during construction.
- Oil spillages from construction machinery, resulting in soil and groundwater contamination; and
- Surface water body (River Gilgit, main watershed area and nullahs) contamination by the soil erosion and construction activities. Table 8.1 summarizes the environmental impacts of the project

S.No	Resources	Envisaged Impacts	Construction Phase	Operational Phase
1.	**Physical Resources**	Burrow/Open Pits	Minor negative	x
		Land Acquisition	Permanent & major negative	x
		Dismantling of Structures	Permanent & major negative	x
		Relocation of Existing Utilities	Permanent & major negative	x
		Change of Land use	Permanent and moderate negative	Permanent and moderate negative
		Soil Erosion	Temporary & minor negative	x
		Disposal of Spoil	Temporary & minor negative	x
		Surface and Groundwater	Moderate negative	Minor negative
		Air Pollution	Moderate negative	Minor negative

		Dust	Moderate negative	x
		Noise	Moderate negative	Minor negative
		Topography	Minor negative temporary	x
		Disposal of Mucking Material	Minor negative temporary	x
2.	**Ecological Resources**	Loss of vegetation	Permanent & Moderate negative	Major positive
3.	**Social & Cultural Resources**	Relocation of Population	Permanent &Major Negative	x
		Disturbance to People	Temporary & Moderate negative	Minor Negative
		Disruption of Existing Utilities	Minor negative	x
		Traffic Management	Minor negative	Major positive
		Health & Safety of workers and Public	Temporary & Moderate negative	Minor Negative
		Economic Activity	Major positive	Major positive

TABLE 8.1: SUMMARY OF ENVIRONMENTAL IMPACTS

X=No impact

8.3 CONCLUSIONS

After the construction of the proposed road, people living in the project area and the road user/ travellers will get the following benefits:

- Less time will be required for travelling and reaching the destination.
- To accelerate the economic activity by providing smooth access to national wide markets.
- During the construction phase, local labour will be accommodated in the construction activities.
- To provide sustainable delivery of a productive and efficient national road system contributing to decrease the transportation cost.
- To provide the livelihood and to educate the poor people of the project area.
- It is in favour of social stability and border defines of the homeland.
- It will act as a trade link between Pakistan and China.

Results of the EIA Study have shown that the impacts of the project activity on the physical environment will be negligible. However, there will be significant impacts on the biological and social environment. These impacts will be reduced by proper and judicious compensation to the affected and by implementing an appropriate tree plantation plan. This plantation along either sides of the road will enhance the aesthetics as well as the environmental conditions of the project area.