



Improvement, Widening & Upgradation of Jaglot – Skardu Road

ENVIRONMENT IMPACT ASSESSMENT STUDY REPORT

September 2019



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Document history

Improvement, Widening & Upgradation of Jaglot – Skardu Road

CONDITIONAL SURVEY REPORT

This document has been issued and amended as follows:

| Version | Date | Description | Created by | Verified by | Approved by |
|---------|----------|------------------------------------|----------------|--------------|------------------|
| 01 | 02/10/18 | First Issue to AER | Mehwish Akhtar | Shahid Iqbal | Dr. Shahid Nasir |
| 02 | 29/05/19 | Revised EIA Study Report to NHA | -do- | -do- | -do- |
| 03 | 02/09/19 | Updated EIA Study Report to GB-EPA | -do- | -do- | -do- |

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List of Abbreviations

| | |
|-----------------------|--|
| EIA | Environmental Impact Assessment |
| EPA | Environmental Protection Agency |
| IEE | Initial Environmental Examination |
| NHA | National Highway Authority |
| FWO | Frontier Works Organization |
| AER | Assistant to Employer's Representative |
| PEPA | Pakistan Environmental Protection Act |
| NEQS | National Environmental Quality Standards |
| PAI | Project Area of Influence |
| PAP | Project Affected People |
| GB | Gilgit Baltistan |
| AADT | Annual Average Daily Traffic |
| ADT | Annual Daily Traffic |
| NOC | No Objection Certificate |
| GOP | Government of Pakistan |
| WHO | World Health Organization |
| USEPA | United States Environmental Protection Agency |
| PPC | Pakistan Penal Code |
| LAA | Land Acquisition Act |
| MVE | Motor Vehicle Examination |
| R&D | Research & Development |
| LAC | Land Acquisition Collector |
| NBS | National Building Codes |
| AASHTO | American Association of State Highway and Transportation Officials |
| ASTM | American Society for Testing & Materials |
| ACI | American Concrete Institute |
| RD | Road |
| EIRR | Economic Internal Rate of Return |
| NPV | Net Present Value |
| WWF | World Wildlife Fund |
| PMD | Pakistan Meteorological Department |
| ROW | Right of Way |
| NO_x | Nitrous Oxides |
| GSS | Gas Semi-Conductors |
| TW | Tap Water |
| SW | Surface Water |
| AKRSP | Agha Khan Rural Support Program |
| JICA | Japan International Cooperation Agency |
| RFO | Range Forest Officer |
| XEN | Executive Engineer |
| EMMP | Environmental Management & Maintenance Program |



| | |
|----------------|---|
| O&M | Operation & Maintenance |
| SSEMP | Specific Site Environmental Management Plan |
| CC | Construction Contractor |
| DSC | Design and Supervision Consultant |

Glossary

Biodiversity

Biodiversity is the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.

Deterioration

Deterioration is a term used to define the process of being gradually worse.

Renewable Resources

A renewable resource is a substance of economic value that can be replaced or replenished in the same or less amount of time as it takes to draw the supply down. For example, solar energy is powered by heat the sun never runs out.

Ecology

Ecology is a simple term used in biology to define the relationship of living organisms with one another and their physical surrounding.

Protected Area

A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values.

Endangered Species

An endangered species is a species which has been categorized as very likely to become extinct.

Flora

Flora is biological name of plants (of particular regions or habitats).

Fauna

Fauna is biological name of animals (of particular region, habitat and geologic period).

Particulate Matter

Particulate matter is the term for solid or liquid particles found in the air. It is the sum of all solid and liquid particles suspended in air many of which are hazardous. This complex mixture includes both organic and inorganic particles, such as dust, pollen, soot, smoke, and liquid droplets. These particles vary greatly in size, composition, and origin.

Ambient Air

Ambient air is atmospheric air in its natural state. It refers to any unconfined portion of the atmosphere or outdoor air

Seismology

It is the study of earthquakes and seismic waves that move through and around the earth.

Wetlands

A wetland is an area of very wet, muddy land with wild plants growing in it.

Executive Summary

Jaglot-Skardu Road exists along the east bank of River Indus, running along both sides of the river within Baltistan area. The road frequently suffers severe damages caused by rainfall, flood and landslide. The road line crosses over two main rivers, Gilgit River in the vicinity of Gilgit and Indus near Skardu.

The straight-line portion of the existing road is 3.8m - 4.2m wide whereas the curved portion is 4.5m - 5.0m in width. The condition just meets the requirement of one-way traffic. The vehicle running from one direction has to stop and give way to the vehicle from the opposite direction; otherwise, the former vehicle cannot get through unless the tires on one side tread on the shoulder.

In this project, it is planned to widen and improve the class as well as the geometrical characteristics of the road. The total length of the road is 163.821 km. Major objectives of the project are summarized as under:

- Uninterrupted traffic flow & increase in capacity.
- Elimination of delays and vehicle accidents.
- Increase in safety and overall efficiency of transport system.
- Saving in energy (fuel) consumption.
- Reduced travelling time by up to 5 hours.
- Better drainage and erosion control.

Project Location

The Project of Jaglot- Skardu Road is located in northeast of Pakistan i.e. Gilgit-Baltistan province. It starts from Jaglot and ends at Skardu. Jaglot is situated 45km south east of Gilgit at the junction where Skardu and Gilgit ways split up on the Karakoram Highway (KKH).

Skardu is the capital of Skardu District of Gilgit Baltistan region. It is located at an altitude of 2500m in the Skardu valley which is 10 km wide and 40 km long.

Requirement of EIA for Proposed Project

- (a) Environmental Impact Assessment (EIA) is compulsory for any venture amounting to more than PKRs. 50 Million as per Pakistan Environmental Protection Act (PEPA-1997), and its amended version (Gilgit-Baltistan Environmental Protection Act, 2015) adopted by GB-EPA, which states that:
“No proponent of a Project shall commence construction or operation unless he has filed with the Federal Agency an initial environmental examination or, where the Project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained approval from the Federal Agency in respect thereof.”
- (b) According to Pakistan Environmental protection Agency (Review of IEE and EIA) Regulations 2000, the proposed project falls under category D (Transport) of Schedule II, which requires EIA before commencement of construction.

All other rules and regulations/laws related to the project along with the legal/administrative framework have been included in chapter 2 of this report.

The Proponent and Consultant

The proponent of the Project is NHA while Finite Engineering has been engaged to prepare EIA. The addresses are given in Table 1, as under:

Table 1: Project Proponent and Consultant Information

| Proponent Contact Address | Consultant Contact Address |
|---|---|
| GM Design, National Highway Authority (NHA), 27 Mauve Area, G-9/1, Islamabad Tel: +92-51 9032901 | Head Environment Division Office # 22, Second Floor, Ghausia Plaza, Main Jinnah Avenue, Blue Area, Islamabad Tel: +92-51-2604350 Fax: +92-51-2604351 |

The EIA study thus carried out is summarized as under:

Approach and Methodology

The study is based on data collected from primary source i.e. directly through site survey and secondary source i.e. published information/ literature review. Meetings were held with stakeholders. Consultant team visited the various sites of the project area to collect data regarding base line profile for physical, biological and socio-economic conditions. Brief discussions were held with community members and wide range of project affected people along the project road. The purpose of this approach was to obtain a fair and impartial impression of people's perceptions about the project and its environmental impacts.

Base line status of Environmental/Social conditions

Baseline conditions of project area have been studied in relation to physical, biological/ ecological and socioeconomic environments prevailing in the whole project area. The description of these conditions is based on review of secondary data obtained during stakeholder consultations, previous studies, site data collected through field survey based on questionnaire prepared by the Consultant which was conducted in the project area and its surroundings. Overview of the different environmental conditions investigated during the survey is summarized as under:

Physical Environment

a. Topography & Geology

The proposed project area is a highly mountainous road with a rolling and hilly terrain. The Karakoram, Hindu Kush and the Himalayas are distributed in the project area. The mountains are continuous with perennial snow or glacier on high-altitude mountain peaks. The project lies in two Districts i.e. Skardu and Gilgit (Jaglot). The road route spreads along the Indus valley except for the section about 4 km near the starting point. The Indus is on the right of Jaglot-Skardu Road all along before Ayub Bridge and on the left after Ayub Bridge.

The starting point, Jaglot, is near the Gilgit River at an altitude of around 1290m whereas the end point, Skardu, is at an altitude of about 2230m. The whole route tends to be low at the starting point, high at the end point, and on the upgrade

successively in general. This conclusion could also be drawn clearly from the fact that the road runs from the lower reaches to the upper reaches along the Indus.

b. Land & Land Use

Land uses in the project area can be classified as land under cultivation (small farms) and small settlements comprising of mosques, dispensaries, hotels, shops, houses etc. The cultivated areas are quite small but some of them would be required for the proposed project. Also, some of the settlements along the road would also be abolished and relocated.

c. Climate

The project area falls in two Districts namely Skardu and Gilgit (Jaglot). Amongst the towns by which the project alignment passes, only Skardu and Gilgit, have meteorological records. These records reflect the basic climatic characteristics along the road.

Generally, the climate of the area is dominated by extreme cold winters with heavy snowfall and hot summers. Temperature generally range from -2°C to 40°C. Data regarding rainfall/precipitation, relative humidity, wind characteristics was also collected through secondary source and is included in the report.

d. Air & Noise Quality

The data regarding air and noise quality of the project area is also included in the report. Based on the data from the actual tests performed in the project area, the results indicate that all the parameters at the selected points for air quality are within the allowable limits of NEQS while for noise they slightly exceed the limits during daytime.

e. Water Sources

Surface water is mainly available from the springs and streams in the area. Water from River Indus, flowing through the project area, is also used for many purposes.

Biological Environment

a. Flora

Flora of the project area includes wood trees, fruit trees, grasses, herbs, shrubs and different medicinal plants. Majority of the wood trees include willow, pine, and deodar. Fruit trees are dominated by apples, apricots and almonds. Haplophyllum juss (a medicinal plant for fever treatment with vernacular/English name as Plant of Mosquito) which was common in the past is now rare.

b. Fauna

Fauna of the project area includes snow leopards, woolly flying squirrel, Markhors, Musk Deer, Brown Bears, Grey Wolf, and Red Fox etc. Birds include the Golden Eagle, Lammergeyer, Griffon Vulture, Laggard Falcon, Peregrine Falcon, Kestrel, Sparrow hawk and Snow cock.

Socio - Economic Environment

Assessment of socio – economic condition of the project area, forming an important part of the base line environment, has been made on the basis of data collected from secondary source (desk review of available reports, documents etc.) and primary source (field survey).

A field survey was carried out to collect Socio-economic and cultural data through semi – structured questionnaire and focused group interviews with residents, shopkeepers, village heads, land owners, pedestrians, farmers & laborers in the project area.

Anticipated Impacts & Mitigation Measures

The proposed project is expected to induce potential impacts on the physical, biological and socio-economic environments in the project area of influence (PAI). The significant environmental impact assessments in PAI together with their mitigation measures during construction stage are summarized below:

Potential Impacts in PAI during Construction Stage

a. Loss of Agricultural Crops:

- Acquisition of agricultural land would induce permanent but highly adverse impact on crop production as a result of project implementation.

Mitigation Measures:

- Adequate compensation is provided to make up for the loss of agricultural crops of various types to Project Affected Persons (PAP).
- The worth of various crop types should be determined in consultation with revenue department on market price.

b. Loss of Trees:

- A highly negative impact of permanent nature to be caused by proposed project is the loss of trees within the ROW of the road alignment. A large number of trees of all types (wood and fruit trees) are anticipated to be cut within the ROW of the project.

Mitigation Measures

- Plantation of trees (in the ratio of 1 tree cut \approx 10 trees) to maintain/restore the landscape and forest cover in the project area.
- Adequate compensation for the loss of trees including fruit trees based on value to be determined by Revenue/Forest Department should be paid to the land owner.

Environmental Management and Monitoring Plan

A framework for Environmental Management and Monitoring Plan (EMMP) is prepared for all the potential environmental impacts induced due to implementation of various project activities. The EMMP is formulated for impacts in three stages of project implementation i.e. during pre-construction, construction and operational stages.

Implementation of EMMP is estimated to cost approximately/roughly PKR173 million excluding the cost of compensation to the Project Affected People (PAP).

Conclusions

The major findings of the EIA study are concluded as under:

- The project route alignment does not fall within any environmentally-sensitive, protected area, or biological corridor of the country.
- Trees/plants including fruit trees, herbs/shrubs etc. are likely to be removed from within the existing road width in the project area.
- Local residents affected due to earlier projects complained that they have yet to be paid compensation for damages inflicted to their property as well as loss of their livelihood. They pointed out with concern that this time too they would face the same repercussions (i.e. non-payment of compensation or delayed payment).

Recommendations

Major recommendations are summarized as under:

- Prompt compensation should be paid to PAP. Moreover, the payment in earlier cases should be expedited on top priority basis, so that their confidence could be restored in concerned authorities.
- Temporary labor camps should be developed at nearby locations and should be facilitated with proper drainage facilities. EMMP is required to implement in letter and spirit the measures suggested to avoid damages to local dwellers near the project site.
- Adequate provision in the project/budget should be made for the amount to be incurred on EMMP/EMP.

1 Introduction

This report provides an Assessment of Environmental Impacts to be induced by a project planned to be implemented for upgradation, widening and improvement of the existing Jaglot-Skardu Road located in Northern Areas of Gilgit Baltistan. The project brief including details of Environmental Impact Assessment (EIA) are described below:

1.1 Project Background

Existing Jaglot-Skardu road was constructed as a strategic road providing link between Northern areas and Pakistani borders of Kashmir. It also facilitates an important trade link between Skardu and Sino-Pakistan border. The existing road connects the Skardu District in Gilgit Baltistan region with Gilgit (the capital of GB) in the North and Islamabad (the capital of Pakistan) in the South via Karakoram Highway (KKH). The road takes off from Jaglot a town situated 45 km away from Gilgit on south bound direction of KKH (i.e. N-35) and terminates at Skardu after covering a distance of about 164 km. Jaglot-Skardu road runs along the east bank of River Indus and has been constructed by cutting the almost vertical face off mountains at both sides of the river in the Baltistan area.

Presently, the traffic volume on Jaglot- Skardu road is more than 500 AADT. The existing road is a single carriageway facility. There are dangerous blind curves and sharp gradients, causing serious accidents and impediment to two- way traffic. The incoming traffic either stops to let the other vehicle pass or other vehicle has to cross with one side wheels on the shoulders. The average speed is 20-25 km. The road is subjected to heavy wear and tear due to frequent rains, hill torrents and landslides and is presently in a very poor condition. It is therefore proposed to undertake a project for upgradation and widening of existing road as well as improvement of its road geometry.

1.2 Project Description

Jaglot-Skardu Road is formed along the east bank of Indus, by almost cutting off all the mountains at both sides of the river within the Baltistan area. The road frequently suffers severe damages caused by rainfall, floods and landslides. The road line crosses over two main rivers, Gilgit River in the vicinity of Gilgit and Indus near Skardu.

The straight-line portion of the existing road is 3.8m - 4.2m wide and the curved portion 4.5m - 5.0m wide. The condition just meets the requirement of one-way traffic. The vehicle running from one direction has to stop and give way to the vehicle from the opposite direction otherwise; the former vehicle cannot get through unless the tires on one side tread on the shoulder. This increases the travelling time and also becomes a cause of fatal accidents along the way. Also, the road is subjected to heavy wear and tear due to frequent rains, hill torrents and landslides.

The project aims at improving, widening and upgrading the Jaglot-Skardu road in terms of its class and the geometrical characteristics of the road. The total length of the road is 163.821 km. The project also includes construction of 37 new bridges and structures for drainage and erosion control. The project of improvement, widening and upgradation of Jaglot- Skardu road holds

immense importance as it will result in reduced travelling time from 8 hours to 3 hours concomitantly making the traffic smooth and safe. Moreover, structures incorporated in the project for drainage and erosion control will also prove to be effective in combatting the naturally occurring landslide induced erosion and poor drainage constraints.

1.3 Project Location

The Project of Jaglot- Skardu Road is located in northeast of Pakistan i.e. Gilgit-Baltistan province. Jaglot – Skardu Road starts from Jaglot and ends at Skardu.

Jaglot is located at the junction of three mightiest mountain ranges (Karakoram, Hindukush and Himalayas) in the Gilgit District on the Karakoram Highway (KKH). It is situated 45km south east of Gilgit at the point where Skardu Road touches KKH.

Skardu is the capital of Skardu District of Gilgit Baltistan region. It is located at an altitude of 2500m in the Skardu valley which is 10km wide and 40km long. Skardu holds a strategic importance being the gateway for Karakoram Range of 8000m height.

Jaglot – Skardu Road is not only a unique road to connect Gilgit and Skardu, but also Skardu and Islamabad. It also links Sino-Pakistan Border and thus has attained an important strategic position.

The location map is shown in Figure 1, below:

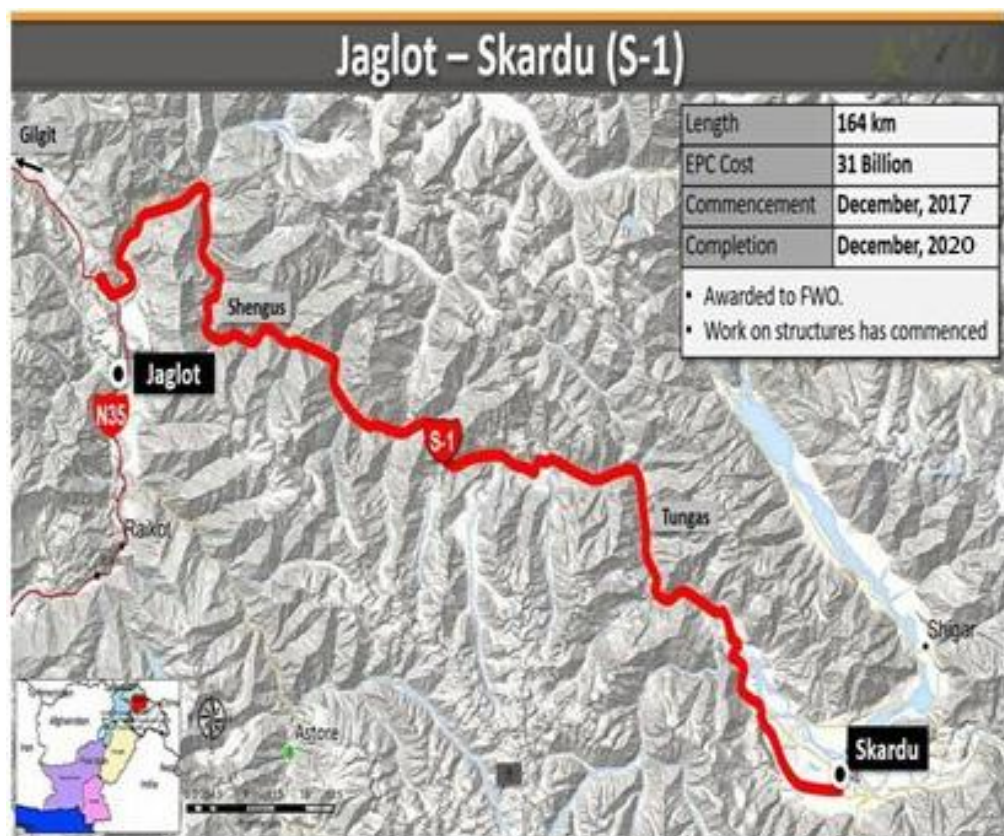


Figure 1: Location of the Proposed Project (Jaglot-Skardu Road)

1.4 Requirement of EIA for the Proposed Project

Under PEPA-1997, Environmental Impact Assessment (EIA) is a mandatory requirement for any project costing PKR 50 Million and above. PEPA- 1997 has been amended and adopted by Government of Gilgit-Baltistan through an act called “Gilgit-Baltistan Environmental Protection Act (GB- EPA-2015)”, which states that:

“No proponent of a Project shall commence construction or operation unless he has filed with the Federal Agency an initial environmental examination or, where the Project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained approval from the Federal Agency in respect thereof.”

The project envisaging upgradation, widening and improvement of Jaglot-Skardu Road, falls under category D (Other projects) specified in Schedule II of Pak-EPA Review of IEE and EIA Regulations 2000. It therefore requires EIA before implementation.

1.5 Objective of EIA Study

The assessment of the potential impacts of a proposed project on the surrounding environment is termed as Environmental Impact Assessment (EIA). All the long and short term, positive and negative impacts of the project are taken into consideration in this report. An EIA study helps to predict the effects of the project on the environment and suggests measures to mitigate the impacts through an Environmental Management and Monitoring Plan (EMMP).

The objective of this Environmental Impact Assessment (EIA) report is to identify possible environmental impacts associated with the proposed improvement, widening and upgradation of the Jaglot – Skardu road in Gilgit-Baltistan.

Main objectives of EIA are as follows:

- Identification of related laws applicable to the project and legal requirement of EIA.
- Development of baseline of present state of physical, biological and operational environment of the project.
- Assessment of potential environmental impacts during the project planning, construction and operational phases
- Proposal of mitigation measures.
- Preparation of Environmental Management and Monitoring Plan.

1.6 Legal Framework of Environmental and Social Considerations

Pakistan Environmental Protection Agency established at Federal level was responsible for monitoring and examination of environmental and social considerations/aspects of a project. All over Pakistan PEPA’s functions and environmental jurisdiction was administered through an Act called Pakistan

Environmental Protection Act of 1997. However, after the passage of the 18th amendment, the powers and function of PEPA were relegated to the provinces, wherein Provincial Environmental Protection Agency in each of the four provinces was established to enforce regulation for protection of environment. With the establishment of the GB Government/GB Legislative Assembly, PEPA-1997 has been amended and approved as GB-Environmental Protection Act-2015 by the GB Legislative Assembly. The rules and guidelines provided under PEPA (Review of IEE and EIA) Regulations 2000 are applicable for the projects being undertaken/ implemented in GB.

In the light of legal policies and legislations, ordinances, strategies, acts, standards etc. considered for carrying out EIA are outlined in Section 2 of this report.

1.7 The Proponent and the Consultant

The proponent of the Project is NHA while Finite Engineering has been assigned the responsibility for the preparation of EIA as a part of complete feasibility to be submitted to NHA. The addresses are given in Table below:

Table 2: Project Proponent and Consultant Information

| Proponent Contact Address | Consultant Contact Address |
|--|--|
| GM Design, National Highway Authority (NHA), 27 Mauve Area, G-9/1, Islamabad Ph.: +92-51 9032901 | Head Environment Division Office # 202, Second Floor, Ghausia Plaza, Main Jinnah Avenue, Blue Area, Islamabad Ph.: +92-51-2604350 Fax: +92-51-2604351 |

1.8 Study Team

A multidisciplinary team of experts was assigned to carry out this study. The team comprises of the following:

Table 3: Study Team

| Name | Position |
|------------------------|--------------------------------|
| Shahid Iqbal | Team Leader |
| Usman Haider Muhammadi | Senior Environmental Scientist |
| Zufishan Anjum | Environmental Scientist |
| Kifayat Ullah | Geological Engineer |
| Asim Saeed | Civil Engineer |
| Rana Bilal | Civil Engineer |
| Mehwish Akhtar | Environmental Engineer |

1.9 Scope of Study

The scope of the EIA Study includes collection and scrutiny of data related to physical, biological and socio-economic environment of the project area and to prepare the baseline environmental profile. It also aims at the identification, and assessment/evaluation of the potential environmental impacts to be induced on short and long-term basis by the proposed project on its immediate surroundings.

Considering the nature and extent/levels of the impacts, appropriate mitigation measures along with the cost implications have been incorporated in the EIA Report. This report would be submitted through National Highway Authority to GB Environmental Protection Agency (GB- EPA) for approval, after which NOC for the proposed project would be issued by the GB EPA to the proponent of the project i.e. NHA. Subsequent to NOC, the Contractor under the supervision of project proponent as well as consultants for construction supervision (in this case is said to be CPM-Finite JV) would be bound to follow the mitigation measures set forth in the EIA report during the execution and operation of project activities on the site. The clearance or NOC for the project would be obtained by NHA from GB-EPA.

1.10 Study Approach & Methodology

The study is based on data collected from primary source i.e. directly through site survey and secondary source i.e. published information/ literature review for which references are provided at **Annex-A**. For field/ site survey data, questionnaire was formulated which is attached at **Annex-B**.

1.10.1 Study Approach

The study has been conducted in accordance with Gilgit-Baltistan Environmental Protection Agency (EPA)/Pakistan Environmental Protection Agency Guidelines provided in PEPA (Review of IEE and EIA) Regulations 2000 and other rules and GB-Environmental Protection Act 2015. The study is aimed at finding the possible ways, for the protection, conservation, restoration of the environment and the improvement of life of people through sustainable means who are likely to be affected due to improvement, widening and upgradation of Jaglot – Skardu Road. The study approach involves efforts made to assess the potential impacts on Physical, Biological and Socio-economic environment of the project area. The EIA study involves collection of primary data through field surveys and site visits. The secondary data is gathered by conducting meetings with officials of relevant Government Departments. Discussions are held with stakeholders including government officials and a wide range of end users in project area under District Gilgit and Skardu. The main purpose of this approach was to obtain a fair impression about the people's perceptions of the project and its environmental impacts along with proposed mitigation measures.

a. Methodology

EIA of the project is largely based on the information and data obtained in the stakeholder meetings held to discuss and co-ordinate the project activities and other issues highlighted by the local community and project affected

people (PAP). Besides, the following methodology was adopted for carrying out the EIA study of the proposed Project:

b. Data Collection Planning

Data collection plan as well as schedule of meetings with all the GB Departments based in Skardu was developed through consultation with EIA Survey team, project engineering staff of the consultants/contractors. The plan included identification of specific data requirements and their sources; determining time schedules and responsibilities for their collection and indicated the logistics and other supporting needs for the execution of the data acquisition plan. The team members from the Consultants (Finite Engineering (Pvt. Ltd.) with local experts carried out detailed site visits for obtaining primary information about the physical environment, land use pattern and socio-economic activities.

c. Data Collection

The data as planned by survey team was collected for Physical, Biological and Socio-cultural environment. The Field survey of the project site was conducted to collect data from the concerned departments through consultative meetings and interviews based on questionnaires with general public/PAP. The site visit to the project area along with its surroundings was carried out with the help of locals who were more aware about ground realities. The meetings were also held with the concerned stakeholders to seek information regarding the base line environmental conditions data in the project area as well as their comments on construction of the Jaglot- Skardu road. The baseline profile including nature and type of environmental conditions prevailing in the project area was established by sifting through the published material provided by the stakeholders in the meeting.

Following activities were performed for data collection:

- a. Site Reconnaissance.
- b. Detailed site visits.
- c. Review of Literature/ Secondary data source.
- d. Public Consultations and interviews.
- e. Field Observations & Findings.
- f. Physical Environment

Physical environment includes geology, topography, soil, hydrology, and drainage, and water, air and noise quality of the project area. A summary of data collected is given below:

Geology/ Topography

The project area is a hilly, mountainous and a rolling terrain. The geology/topography including soil investigations were studied to establish the baseline condition of the project area. The likely impacts on topography to be caused by the Project during the construction and operational phases were also assessed. The secondary data from literature review/reports and meetings with relevant departments was obtained for the geological assessment.

Climate

The Project Area can be climatically divided into summer and winter seasons. Gilgit-Baltistan region is dominated by cold, extreme winters with a lot of snowfall. According to Akbar et al. (2011), District Gilgit is covered with Snow Mountains. The combination of three great mountains range is also situated in this District. Maximum temperature ranges from -10 to above 40 °C. In summer, temperature is hot whereas cold in winter. The rainfall ranges from 120 to 240 mm.

Located on the back of the Peak of Karakorum Mountains, Skardu has a frigid cold climate in winter and pleasant in summer. Highest precipitation is observed in April. A large amount of snowfall in the area is also very common. Amongst the towns by which the project alignment passes, only Skardu and Gilgit, have meteorological records. These records reflect the basic climatic characteristics along the road. These records of Skardu basically reflect the climatic characteristics along the road.

Air and Noise Quality

Ambient air quality measurements were considered essential to provide a description of air pollution by incorporating baseline data against which changes can be measured and to assess the potential impacts of the proposed construction activities on air quality.

Water Quality

The objective of the water quality testing was to determine water quality before construction. It has been observed that the surface water quality is expected to be affected in the post construction period of proposed project. The extent of surface water contamination around the project area was assessed based on the test results of physical, chemical and microbiological parameters for surface water.

Hydrology

The Jaglot-Skardu Road runs along the right bank of River Indus, up to Sapper Shaheed bridge and thereafter along left bank of the river. The River crosses between the Himalayas and Karakoram Mountains and takes in numerous glaciers converges with the Gilgit River near Jaglot and then flows southwestwards through Pakistan before emptying into the Arabian Sea near Karachi. The proposed alignment mainly passes through mountainous region of Karakorum ranges with steep slopes and high cliffs. There are several major and minor water streams, and waterways crossing the alignment.

The objective of hydrological investigation is generally to analyze the flood from the water stream crossings and assess the runoff flux of a certain recurrence interval (also known as return period T) to Culverts and Bridges so as to adopt appropriate design and take necessary protective measures through proposed alignment.

There are many major and minor water crossing and natural streams, for which hydraulic structures like bridges and culverts of various dimensions have been proposed. These hydraulic structures have been designed on the basis of Intensity–duration–frequency (IDF) relationship of rainfall amounts. For major water crossing bridges have been proposed and for minor water crossings, box

culverts have been proposed. However, in cultivated areas pipe culverts are provided.

Biological Environment

The biological environment of project area was studied by conducting a survey in the project area, involving the locals. All other data was collected from Government Departments such as GB-EPA and Forest/Agricultural/Wildlife Office.

Socio-Cultural Environment

The Consultants utilized a combination of secondary data/reports, field investigations, census data, structured interviews with PAP on site, maps, etc. to generate the data required for description of the existing social environment and assessment of the potential impacts due to the construction of the proposed project. Data was collected on the following aspects as given below:

- a. Demography
- b. Education
- c. Literacy Rate
- d. Religion
- e. Languages
- f. Health Facilities
- g. Land Acquisition

d. Identification and Evaluation of Environmental Impacts

The potential impacts of the proposed project on the physical, biological and socio-economic environment prevalent in the project area have been assessed/identified at the design, construction and operational phases.

e. Mitigation Measures and Implementation Arrangements under Environmental Management and Monitoring Plan (EMMP)

The mitigation measures have been proposed to reduce/ control or avoid the predicted impacts to be induced by the Project during design, execution and maintenance phase. A work plan providing framework for EMMP has also been formulated for the project.

1.11 Components of the Report:

This EIA Report has been prepared following the Pakistan Environmental Protection Agency Guidelines adopted by GB-EPA for Environmental Assessment. The report is formatted into the following sections:

▪ Chapter 1: Introduction

The project background, need, location, objectives, methodology and need of EIA study is provided in this chapter.

▪ Chapter 2: Policy, Legal and Administrative Framework

This chapter provides an overview of National Legislation and Policy Framework which applies to the proposed project. The project is expected to obtain all the regulatory clearances and to also comply with the National/ Gilgit-

Baltistan legislations regarding environment in the region.

- **Chapter 3: Description of the Project**

This delivers information regarding proposed project location, size, components and major alternatives which are being considered.

- **Chapter 4: Environmental Baseline Profile**

The environmental and social setting of the project is discussed in detail in this chapter. It includes the physical, biological and social environment.

- **Chapter 5: Public Consultation**

Major stakeholders and their related concerns are identified and discussed in this chapter.

- **Chapter 6: Environmental Impacts and Mitigation Measures**

This chapter identifies potential impacts due to the improvement, widening and upgradation of the Jaglot-Skardu road. It also states the proposed mitigation measures for adverse impacts on the project area.

- **Chapter 7: Environmental Management and Monitoring Plan**

Institutional arrangements for the implementation of proposed mitigation measures are outlined in this chapter.

- **Chapter 8: Conclusion and Recommendations**

The major conclusions and the recommendations are mentioned in this chapter.

2 Policy, Legal and Administrative Framework

2.1 General

This section deals with the current legislation, policies and administrative framework related to protection of environmental pollution/deterioration and biodiversity in Pakistan particularly including GB. Under the framework, it has become mandatory for the sectorial projects, listed herein, to comply with all the legal procedures concerning environment enacted through law in Pakistan. The Project for improvement, widening and upgradation of Jaglot-Skardu Road (hereinafter termed as Jaglot-Skardu road project) is required to undergo the Environmental Impact Assessment (EIA) in accordance with the provisions stipulated in the legislation which is in vogue both at federal and provincial (GB) level administered by relevant EPA (in present case GB-EPA). Moreover, the relevant environmental policy, guidelines formulated by Federal/Gilgit-Baltistan (as the case may be) Environmental Protection Agencies as well as the appropriate administrative frameworks has been duly incorporated in the section. In addition, the role and responsibilities of the Proponent (in this case NHA), the Ministry of Climate change (established after 18th Constitutional Amendment described later) and other Agencies/Departments concerning the Environmental Protection have also been described in brief in the succeeding paragraphs.

As the Jaglot-Skardu Road Project is located in Gilgit-Baltistan, the laws/regulations promulgated by the Government of Gilgit-Baltistan for the protection of environment and the functions of GB-EPA have also been highlighted in this section.

2.2 Existing Legislative Framework

Government of Pakistan (GOP) and Gilgit-Baltistan have promulgated laws/acts, regulations and standards for the protection, conservation, rehabilitation and improvement of the environment. In addition to this, both have also developed environmental assessment procedures governing developmental projects following the same lines. Gilgit Baltistan assembly under *Schedule 4* of "Gilgit-Baltistan (Empowerment and Self- Governance) Order 2009" can make laws under 18th amendment made in the constitution of Islamic Republic of Pakistan. Gilgit Baltistan has its own Environmental Protection Agency (GB-EPA), who is the responsible authority for policy making on environmental protection according to the Environmental Protection Act, 2015. Following are the excerpts of the laws and procedures relevant to the proposed project as enacted/adopted by the Government of GB.

2.2.1 Gilgit-Baltistan Environmental Protection Act, 2015

The Act was enacted in 2015, 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) studies. Section 16 of the Act stresses the need to carry out environmental impact assessment study prior to construction or operation of any project enlisted under Schedule I and II of GB-Environmental Protection Act, 2015.

This EIA study has been carried out in the light of policy guidelines of the Preparation of IEE/EIA Reports under the procedures and practices formulated by the Pak EPA/GB-EPA. The major provisions/clauses of this Act are similar to that of Pakistan Environmental Protection Act, 1997. Minor amendments/changes have been made viz:

- The Name of Act has been changed into “Gilgit-Baltistan Environmental Protection Act, 2015”.
- For the words “Federal Government”, wherever occur, the word “Government” shall be substituted indicating the Government of Gilgit-Baltistan;
- For the word “Council”, wherever occurs, the Gilgit-Baltistan Environmental Protection Council shall be referred to.

All the other clauses, sub-clauses, sections and sub-sections are almost same.

In accordance with Clause 4 of The Regulations (of Review of IEE/ EIA 2000), an EIA for the proposed project needs to be submitted to Gilgit-Baltistan Environmental Protection Agency for review and approval of EIA Report.

2.2.2 Pakistan Environmental Protection Act (PEPA) of 1997

The above laws did not cover all the environmental issues. The penalties under these laws were very small and became ineffective to control the environmental degradation. However, Pakistan Environmental Protection Act (PEPA) of 1997 was enacted repealing the Pakistan Environmental Protection Ordinance, 1983. The PEPA 1997 provides the basic legal framework for implementation of National Conservation Strategy 1992, protection and conservation of species, wildlife habitats and biodiversity, conservation of renewable resources, establishment of standards for the quality of the ambient air, water soil, marine & noise pollution. The PEPA, 1997 has prescribed penalties for violating its provisions. Under the Act, Pak EPA and Provincial EPAs have been vested with more powers to impose penalties for possible breaches through the establishment of Environmental Tribunals and appointment of Environmental Magistrate. According to the 18th Amendment in 1973 Constitution, the PEPA 1997 has been confined to Federal Area and provinces have been allowed to formulate their own legislations on subject of environment.

Assessment of Environment is mandatory under Section 12 of PEPA, 1997. No project ensuing construction or any change in physical environment can be implemented unless an Initial Environmental Examinations (IEE) or an Environmental Impact Assessment (EIA) is conducted by the proponent of the Project and approved by the EPA. The section 12(6) of the Act states that this provision is applicable only to those categories of projects as provided in Pakistan Environmental Protection Agency Review of IEE and EIA

Regulations, 2000.

2.2.3 Pakistan Environmental Protection Agency Review of IEE/ EIA Regulations, 2000

Pakistan Environmental Protection Agency (Pak-EPA) under the powers conferred upon it by the Act, formulated The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 (hereinafter termed as the Regulations). These were adopted by the GB-EPA. The Regulations provide detailed guidelines to prepare reports regarding IEE/EIA of a project and submit the same to the concerned EPA for their review. Under the Regulations, the projects requiring IEE and EIA have been categorized depending upon their potential to cause environmental degradation on implementation. Project listed in Schedule-I are designated as potentially less damaging to the environment and those listed in Schedule-II as having more potential to make adverse effects on the environment. Schedule-I projects require an IEE to be conducted, provided they are not located in environmentally sensitive areas. For the schedule-II projects, conducting an EIA is necessary. The Jaglot-Skardu Road Project falls in the schedule-II, but not Section-D covering "Transport", as the project involved reconstruction and maintenance of the existing road. Since it was more suited to Section J of schedule-II, hence an EIA has been conducted. The Project, located in Gilgit-Baltistan, falls in the jurisdiction of GB-EPA. Salient features of the regulation, relevant to the proposed Project are listed below:

1. Categories of projects requiring IEE and EIA are issued through two schedules attached with the Regulations.
2. A fee, depending on the cost of the project, has been imposed for review of EIA and IEE.
3. The submittal is to be accompanied by an application in prescribed format included as schedule IV of the Regulations.
4. The EPA is bound to conduct a preliminary scrutiny and reply within 10 days of submittal of report a) confirming completeness, b) asking for additional information, or c) requiring additional studies.
5. The EPA is required to make every effort to complete the review process for IEE within 45 days and of the EIA within 90 days, of issue of confirmation of completeness.
6. EPAs accord their approval subject to following conditions:
 - Before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions.
 - Before commencing operation of the project, the proponent is required to obtain from EPA a written confirmation of compliance with approved conditions and requirements of the EIA.
7. An EMP is required to be submitted with the request for obtaining confirmation of compliance.
8. The EPAs are required to issue confirmation of compliance within 15 days of receipt of request and complete documentation.
9. The EIA approval will be valid for three years from the date of

accord.

10. A monitoring report is required to be submitted to the EPA after completion of construction, followed by annual monitoring reports during operations.

2.2.4 National Environmental Quality Standards (NEQS), 2000/ 2010

The Pakistan Environmental Protection Council first approved the National Environmental Quality Standards (NEQS) in 1993. The NEQS revised later in 1995, 2000 and 2010 respectively provide information on the permissible limits for discharges of municipal and industrial effluent parameters and industrial gaseous emissions in order to control environmental pollution. The same NEQS were followed by the GB-EPA.

Drinking Water Quality Standards

In pursuance of the statutory requirement under clause (c) of sub-section (1) of section (6) of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency with prior approval of the Pakistan Environmental Protection Council, has published the National Standards for Drinking Water Quality in 2010. WHO Drinking water quality guidelines and USEPA standards are being used for bench marking purpose along with the National Standards for Drinking water quality since January, 2013.

Air Quality Standards

In pursuance of the statutory requirement under clause (e) of sub-section (1) of section (6) of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency with prior approval of the Pakistan Environmental Protection Council, has revised the NEQS for Ambient Air in 2010, which became effective in January, 2013.

Noise Quality Standards

In pursuance of the statutory requirement under clause (c) of sub-section (1) of section (6) of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency with prior approval of the Pakistan Environmental Protection Council, has revised the NEQS for Noise in 2010. These standards have been established for four different categories which include residential area, commercial area, industrial area and silent zone. These standards vary according to the day and night timing, day time hours are 6:00 am to 10:00 pm and night time hours are 10:00 pm to 6:00 am. USEPA standards and World Bank guidelines along with National Environmental Quality Standards for Noise are being used as bench mark purpose since January, 2012.

2.2.5 National Environment Policy, 2005

In March, 2005 Government of Pakistan launched its National Environmental Policy, which provides a framework for addressing the environmental issues. Section 5 of the policy commits for integration of environment into development planning as instrument for achieving the objectives of National Environmental Policy. It further states in clause (b) of

subsection 5.1 that EIA related provisions of Environmental Protection Act, 1997, will be diligently enforced for all developmental projects. 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.

2.2.6 Environmental Assessment Guidelines

Pak-EPA has also published environmental assessment procedures and guidelines in October, 1997, which contains the following sets of information relevant to the project proposed for EIA study.

Guidelines for Policy and Procedures

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

Guidelines for the Preparation / Review of Reports

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

Sectoral Guidelines: Major Road

These guidelines present issues/impacts commonly arising due to the approaching road project, the mitigations to reduce/eliminate these impacts and the need for environmental management and monitoring plan to protect the environment.

Guidelines for Public Consultation

These guidelines deal with possible approaches to public consultation and techniques for designing an effective program of consultation that involves all major stakeholders and ensures that their concerns are incorporated in any impact assessment study.

2.3 Other Relevant laws

2.3.1 Pakistan Environmental Protection Ordinance, 1983

Pakistan Environmental Protection Ordinance, 1983 was the first piece of legislation designed specifically for the protection of the environment. In 1984, the promulgation of this ordinance was followed by the establishment of the Federal EPA, the primary government institution dealing with environmental issues. Provincial EPAs were also established at about the same time. According to PEPO, 1983, IEE / EIA for all development projects were essentially required, but could not be undertaken in the absence of relevant regulations under that ordinance.

2.3.2 National Conservation Strategy, 1992

The Pakistan National Conservation Strategy, 1992 is the principal policy document for environmental issues in the country that was developed and approved by the Government of Pakistan. This strategy works on a ten-year planning and implementation cycle. It deals with fourteen (14) core areas such as maintaining soils in cropland, protecting watershed, conserving biodiversity, managing urban waste, preserving the cultural heritages and so on.

Project specific mitigation prescriptions cannot be expressed in the Strategy, however, the principles of environmental protection, conservation and management provided in the Strategy have to be used as guidelines during the planning and execution of Project.

2.3.3 Pakistan Penal Code, 1860

This defines the penalties for violations concerning pollution of air, water bodies and land. Protection of the environment with regards to toxic and hazardous waste is also covered by the Pakistan Penal Code (PPC), 1860. GB-EPA is mandated to monitor the transportation of hazardous materials within the prescribed limits.

2.3.4 The Explosives Act, 1884

It provides regulations for handling, transportation and use of explosives. The contractors have to abide by the regulation during quarrying and blasting for construction and for other purposes.

2.3.5 Land acquisition Act, 1894

At present, the only legislation relating to acquisition and compensation of private land for public purpose is the Land Acquisition Act (LAA) of 1894. The LAA is, however, limited to a cash compensation policy for the acquisition of land and built-up property, and damage to other assets, such as crops, trees, and infrastructure. The LAA does not consider the rehabilitation and resettlement of non-titled populations. Section 4 to 12 of Land Acquisition Act, 1894 deal with the procedure of making an award i.e. amount of compensation.

2.3.6 Regulations of Mines and Oil Fields and Mineral Development Act, 1948

This legislation provides regulatory procedures for the quarrying and mining of construction material from state-owned as well as private land.

2.3.7 Motor Vehicle Rules, 1969

Motor Vehicle Rules 1969 (MVR 1969) define powers and responsibilities of the Motor Vehicle Examiner (MVE). The establishment of MVE inspection system is one of the regulatory measures that can tackle the ambient air quality problems associated with the vehicular emissions during operation phase.

2.3.8 Cutting of Trees (Prohibition) Act, 1975

This Act prohibits cutting or chopping of trees without permission of the Forest Department, Gilgit-Baltistan.

2.3.9 Highways Safety Ordinance, 2000

This ordinance includes provisions for the licensing and registration of vehicles and construction equipment; maintenance of road vehicles; traffic control, offences, penalties and procedures; the establishment of a police force for Motorways and National Highways charged with regulating and controlling traffic on National Highways and keeping the highways clear of encroachments.

2.3.10 Labor laws

Construction and operational activities during the course of the project may affect occupational health and safety of workers. The health and safety issues of the workforce during construction/operation of project need to be ensured by the Employers in accordance with the relevant labor laws.

2.3.11 Canal and Drainage Act, 1873

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

2.3.12 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.

2.3.13 The North-West Frontier Province Wild-Life Act, 1975

The act emphasizes on the rules and regulations for the protection, preservation, conservation and management of wildlife.

2.3.14 Antiquities Act, 1975

The Antiquities Act of 1975 ensures the protection of the cultural and archeological resources of Pakistan.

The law prohibits new construction in the proximity of a protected antiquity and allows 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.

2.3.15 International Treaties & Conventions

Pakistan is a member of several international organizations such as United Nations Organization (UNO), Organization of the Islamic Conference (OIC), South Asian Association for Regional Cooperation (SAARC), and the Economic Cooperation Organization (ECO). The conventions, and obligations related to the proposed Project are:

- Convention on Biological Diversity, 1994
This convention is applicable to the projects for the conservation of biological diversity and habitat restoration during project life.
- The Rio Declaration, 1992
The declaration emphasis on the environmental protection during project life.
- Kyoto Protocol, 1992
It is applicable to the projects to reduce the emissions from project construction activities.
- The Basel Convention, 1989
This convention emphasis on the minimization of waste generation and proper management during construction as well as operation and maintenance phases.
- Convention on the International Trade of Endangered Species (CITES), 1975
This convention is applicable to the projects during construction and operation phases to safeguard the endangered species (i.e. flora and fauna).
- UNESCO Convention on the Protection of Worlds Cultural and Natural Heritage, 1975
This convention is applicable during construction phase of the project to protect and conserve the cultural and heritage sites.

2.3.16 Guidelines for Protected and Sensitive Areas

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

2.4 Environmental Administrative framework

The Federal Ministry of Environment responsible for policy making on environmental protection in Pakistan was dissolved after the promulgation of 18th Amendment in the Constitution. Subsequently, the Ministry of Climate Change has been established and authorized under the amended Rules of Business to perform the same functions/assignment to safeguard & control environmental pollution in the country and the Provincial Governments have taken over the subject of Environment. Whereas National Highway Authority (NHA) as a proponent of this Project is under obligation to undertake EIA study carried out as per the stipulations of

governing authorities and in complete conformity with national and provincial (including GB) regulations about environmental issues.

2.4.1 Environmental Protection Agencies/Agency

Pak EPA has been established at the Federal level and all other EPAs at Provincial level. However, Gilgit-Baltistan has its own Environmental Protection Agency that is headed by the Director General and it functions to safeguard the environmental quality and acts against any non-conformities that may be a threat to the environment. The organizational set-up is given below:

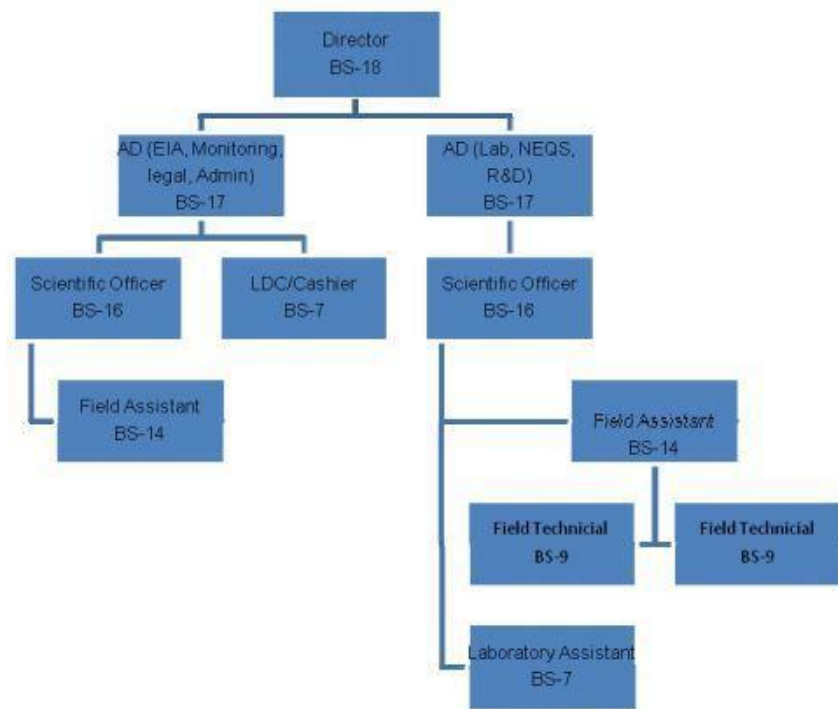


Figure 2: Organizational Framework of GB-EPA

2.4.2 Environmental Protection Council

The Gilgit-Baltistan Environmental Protection Council is the apex decision-making body of Gilgit-Baltistan. As per Gilgit-Baltistan Environmental Protection Act 2015, the council has been set up under the chairmanship of Chief Minister of Gilgit-Baltistan with Members from other relevant Departments. Functions of the Council are listed below:

1. Co-ordination and supervision of the provisions of the Act and other Laws related to the environment in the province.
2. Approval of comprehensive provincial environmental and sustainable development policies, guaranteeing their implementation within the framework of a conservation strategy and sustainable development plan approved by the Government as and when required.
3. Approval of the Gilgit-Baltistan Environmental Quality Standards.
4. Provision of guidelines for the protection and conservation of

species, habitats, and biodiversity in general, and for the conservation of renewable and non-renewable resources and new emerging environmental challenges like Climate Change and its mitigation.

5. Coordinating integration of the principles and concerns of sustainable development into socio-economic and development policies, plans and programs at the provincial, District and local levels.
6. Consideration of the annual Gilgit-Baltistan Environment Report, giving appropriate directions thereon and causing it to be laid before the Provincial Assembly.
7. Dealing with inter-provincial and federal-provincial issues, liaising and coordinating with other Provinces through appropriate inter-provincial forums regarding formulation and implementation of standards and policies relating to environmental matters with an inter-provincial impact, and
8. Provision of guidelines for bio safety and for the use of genetically modified organisms.

2.4.3 Gilgit-Baltistan Sustainable Development Fund

Gilgit-Baltistan Sustainable Development Fund has been established following the guidelines of the GB-EPA, 2015. The fund is to be used to financially aid and support projects aimed at environmental protection, conservation, rehabilitation and improvement. It is administratively headed by the Chief Secretary as the Chairperson along with members from other relevant departments.

2.4.4 Environmental Courts

Government of GB exercises the power to formulate as many Environmental Courts as it deems fit under the GB EPA, 2015. In case of more than one Environmental Courts, it is mandatory to specify the territorial limits within which their jurisdiction falls. An Environmental Court shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the Session Court to be appointed after consultation with the Chief Justice of the Chief Court and two members to be appointed by the Government, of which at least one shall be a technical member with suitable professional qualifications and experience in the environmental field as may be prescribed.

2.4.5 Forest, Wildlife and Environment Department, Gilgit-Baltistan

The Project implementation will involve clearing of vegetation and trees within the Right of Way (ROW). This might have a direct or indirect impact on the wildlife of the project area as well. Therefore, the project contractors will be responsible for acquiring a 'No-Objection Certificate' (NOC) from the Forest, Wildlife and Environment Department, Gilgit-Baltistan on the basis of the approved EIA. The application for the NOC will need to be endorsed by the NHA. Tree avenue plantation will be carried out by NHA itself or through work awarded to Forest, Wildlife and Environment

Department of Gilgit-Baltistan. NHA will also be responsible for liaising with the aforesaid department regarding the types of trees to be planted and other matters concerning plan for plantation as a measure to compensate for the loss of trees and to mitigate the damages caused to the environment during the course of the project.

2.4.6 Department of Inland Revenue, Gilgit-Baltistan

As per Land Acquisition Act (LAA) of 1894, the Department of Inland Revenue (GB) is authorized to carry out the acquisition of private land or built-up property for public purposes. For this purpose, the proponent of the Project (i.e. NHA) needs to make a request in writing to the respective District Administration to depute a Land Acquisition Collector (LAC) and other revenue staff incorporating members from other relevant departments, who will eventually be responsible for handling matters related to land acquisition and the disbursement of compensation for the respective provincial jurisdictions.

3 Description of the Project

3.1 Present Status of Project Road

Jaglot-Skardu road project provides mostly a mountainous route along the valley and crosses over two main rivers-the Gilgit River in the vicinity of Jaglot and the River Indus near Skardu. The road passes all along Indus valley except for about 4 km section near the starting point at Jaglot town. It traverses on the right bank of the Indus up to river crossing 142.35 km away from the starting point at Sapper Shaheed Bridge (North of Skardu) and thereafter runs on the left bank of the river up to end point at Skardu. The road tends to run from low grade to higher grade from start to end point respectively.

Almost all steep rocks/vertical mountains distributed along the Indus were cut for the existing road. The width of exiting road alignment varies from 3.8m-4.2m in the straight portion and 4.5m-5.0m in the curved portion whilst the width of the shoulder on the mountain side is 0.5m-1.0m and 1.0m-1.5m on the river bank side. Only one-way traffic is allowed while the vehicles running in opposite directions either stop to enable other vehicles to pass or one side wheels move on the shoulder. The existing alignment follows unacceptable steep gradient with dangerous curves where the sights distance is unfavorable, frequently resulting in severe traffic accidents. Due to repeated rainfall, slope torrents, and landslide/mudslide, the road is worn out and is in very poor condition. The pavement has failed due to inadequate thickness and poor maintenance. Major portion of the road is eroded with cracks & potholes developed at places on the surface. Moreover, the road edges in various reaches are broken and outward shoulders are damaged due to rain water & lack of side support.

3.2 Description and Scope of the Project

Considering the present dilapidated condition of the Jaglot-Skardu road, which has been continuously deteriorating unabated, it is proposed to widen the road from single carriageway to dual carriageway, upgrade it to highway standard and improve its geometry. The total length of the road is 164 km. The scope of the project including design criteria/standards are summarized in Table 4, as under:

Table 4: Scope of the Project

| Sr. No. | Description | | Remarks |
|---------|-----------------------|--------|--------------------------------|
| 1 | Total Road Length | 164 Km | |
| 2 | Type of Terrain | 30 Km | Hilly |
| | | 84 Km | Mountainous |
| | | 50 Km | Rolling/plain |
| 3 | New Culverts Proposed | 457 No | Details can be seen in Table 5 |
| 4 | New Bridges Proposed | 37 No | - |

Drawings of cross-section of hilly & plain areas are attached at **Annex-C**.

The total number of hydraulic structures i.e. bridges and culverts are shown in the Table provided below:

Table 5: Hydraulic Structures

| Sr. No. | Structures | No. |
|---------|---------------|-----|
| 1 | Bridges | 37 |
| 2 | Box Culverts | 287 |
| 3 | Pipe Culverts | 170 |

List of Culverts and Bridges along the alignment/ RD is provided at **Annex-D**.

Design Standards

The codes that should be considered and adopted for Preliminary Design of Bridge are as follows:

- For Geometric Design AASHTO
- For Material & Testing AASHTO & ASTM
- For Structures AASHTO ACI
- For Structural loads Class A or Class AA loading according to West Pakistan Code of Practice for Highway Bridges and AASHTO. For deck slab NHA abnormal load of 21 kips on a contact area of 300mm*600mm shall be used. Structural analysis and design has been carried out using SAP 2000 software.
- For Seismic Design National Building Codes (NBC) and seismic zone Map of Pakistan and AASHTO

Based on above, the geometric design/technical parameters are presented below:

Table 6: Technical Parameters of the Project Road

| Sr. No. | Description / Design Parameters | Unit | As per Alternative Bid | |
|---------|---|------|-------------------------|------------------------|
| | | | Rolling Terrain (50 Km) | Hilly Terrain (114 Km) |
| 1. | Design Speed | Km/h | 70-90 | 40-60 |
| 2. | Formation Width | m | 12.3 | 9.1 |
| 3. | Width of Travelled way (Main carriageway) | M | 7.3 | 6.1 |
| 4. | Width of Shoulders in Open fill area in Rocky areas | m | 2.5 m on Either side | 1.5 on Either side |
| 5. | Cross slope Carriageway Shoulders | % | 2 4 | 2 4 |
| 6. | Max. Gradient | % | 2.5 | 11 |

Salient features of the pavement design standards are shown as under:

Table 7: Pavement Design of Main Carriageway

| Pavement Structure for Rolling & Hilly Terrain | |
|--|-------|
| Asphaltic Wearing Coarse | 05 cm |
| Asphaltic Base Coarse | 08 cm |
| Aggregate Base Coarse | 15 cm |
| Granular Sub Base | 15 cm |
| Subgrade | 30 cm |

The quantities of various items of construction along with their sources, to be used, during execution of proposed Project are indicated in Table 8, given below:

Table 8: Items and their Quantity

| Sr. No. | Items | Quantity | Unit |
|---------|--|----------|------|
| 1. | Earth Work | 1028000 | CM |
| 2. | Sub-Base & Base | 701129 | CM |
| 3. | Surface Coarse & Pavement | 57000 | CM |
| 4. | Sub-Structures | 97281 | CM |
| 5. | Drainage & Erosion Work | 61612 | CM |
| 6. | Bridges | 68139 | CM |
| 7. | Super Structures | 1579460 | CM |
| 8. | Culverts | 5486 | No. |
| 9. | Ancillary Work | 92695 | No. |
| 10. | General Items (Vehicles used by Employees) | 10 | No. |

Table 9: Source of Items

| Sr. No. | Items | Description |
|---------|----------------------------|--|
| 1. | Source of Coarse Aggregate | Coarse Aggregate from surrounding of the project area in the range of 5 Km Radius |
| 2. | Source of Sand | Sand from River Indus and Mountain Sand available within the proximity of Project's concerned area |
| 3. | Source of Power Supply | Generators with total installed capacity of 3700KW |

List of machinery required for construction work is attached at **Annex-E**.

The requirement of water for construction activities as well as for the consumption of camps is estimated at 4,50,000 liters per day, which is proposed to be supplied through water pumps from existing water channels/ small tributaries of river Indus available in the project area.

It is estimated that 200 kg per day of solid waste and 9,000 liters per day (20% of water consumption is considered to be converted into waste) of water waste would be generated during the construction phase of the project. It may be noted that estimation of solid waste quantity is based on standard requirement of number of maximum persons available in the camps. The actual requirement cannot be accessed as the staff / labors are continued to move all along the length of the project road. Solid waste would be disposed

of at designated places and water in the septic tanks temporarily built for this purpose.

Work force of about 3,256 staff including qualified and experienced Engineers covering all disciplines of civil, mechanical, communications, mining and geo-tech engineering along-with middle and lower level technicians and operators, specialized in their fields are estimated to be mobilized for the implementation of the project.

3.3 Project Objectives

Proposed project for widening and up-gradation including improved geometry with better pavement surface would help remove the bottleneck situation on the entire length of the road particularly the impediments/operational or safety hazards posed on the alignment along the vertical mountainous terrain, thus facilitating smooth/fast traffic flow on Jaglot-Skardu road. The objectives expected to be achieved and the benefits accrued on completion of the proposed project are summarized as under:

- Saving in vehicle operating cost due to less traffic congestion, improved pavement surface and better geometry of proposed project road
- Elimination of delays in travel time due to increase in speed on the proposed project road
- Reduction of sharp curves due to widening/straightening of the proposed project road and construction of retaining walls
- To provide a safe, congestion free and high speed facility to the commuters of the project area and tourists;
- Generation of more economic and business activities in GB region and enhancing trade links between Pakistan and China
- Contributing towards the promotion of mining industry (such as precious stones/gems etc.), tourism and other infrastructure;
- Provision of more job opportunities to locals

3.4 Project Alignment

The project starts from Jaglot (RD 0+000) and ends in Skardu at (RD 165+894) with a total length of 164 km. The alignment of the Road is given below:



Figure 3: Alignment route of Project from start to end point

3.5 Project Costs

Project is estimated to cost PKR 31,136.60 Million. The estimated cost of constructing the road is estimated to be PKR31000.00 Million. The project is planned to be completed in 36 months.

The Cost breakdown for different items (Percentage) is mentioned in the Table below:

Table 10: Item wise Cost in Percentage

| Sr. No. | Items | %age of Total Cost |
|---------|---|--------------------|
| 1. | Earth Work | 36.69% |
| 2. | Sub Base & Base Coarse | 6.57% |
| 3. | Surface Corse & Pavement | 6.23% |
| 4. | Bridges | 2.09% |
| 5. | Culverts | 3.20% |
| 6. | Drainage and Erosion Works | 33.28% |
| 7. | Ancillary Works | 6.52% |
| 8. | General Items including provisional sum | 1.91% |
| 9. | Design review and update charges | 1.00% |
| 10. | Quality control/assurance and Supervisory charges and modification of design (if required during execution) | 2.53% |

3.6 Project Implementation schedule

The project Implementation schedule is presented as under.

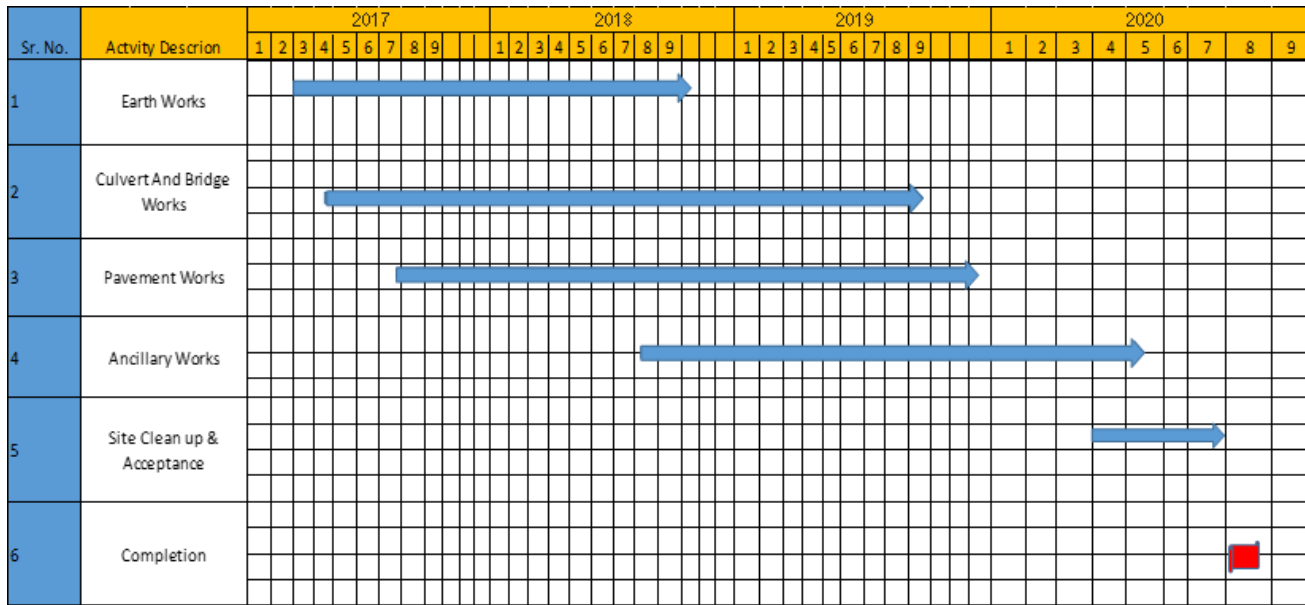


Figure 4: Implementation Schedule of the Proposed Project Road

3.7 Project Alternatives

Following alternatives of the proposed project have been taken into consideration:

Do Nothing or Without Project

In do nothing case, the bottleneck in terms of existing dilapidated pavement condition, drainage, and traffic congestion due to narrow road width and bridges would continue to impede vehicle flow/movement, causing significant delays in journey time and rise in environmental pollution. Besides, road safety would continue to be compromised due to existing sharp curves/bends, deteriorated slope protection structure /retaining walls, and occurrence of landslides etc. It is therefore planned to undertake improvement and widening of the Jaglot-Skardu road project.

Construction of New road on new alignment

Building a new road on a new alignment is not possible due to exceedingly difficult mountainous terrain and severe weather conditions prevailing in the project area. This option involves not only colossal amount of money but also an exorbitant amount of time, thus rendering it a highly unlikely alternative.

3.8 Economic Assessment

For the project to qualify as economically feasible, the EIRR must be at least 12% of Benefit Cost. Ratio must be greater than 1 and NPV must be positive. These indicators are calculated on basis of benefits which would accrue to the road users from the provision of improved road facility.

In case of Jaglot-Skardu, these indicators do not meet the feasibility criteria. However, for such projects which are of strategic nature where the link is important from defense point of view, the requirement of economic feasibility may be relaxed and value judgment of decision makers becomes more important.

Economic indicators of the project are given below:

- Benefit/Cost Ratio @12% Discount Rate = 0.022
- Net present Value @12% Discount Rate = Rs.25,181.94 Million
- Internal Rate of Return = -7.16%

3.9 Location of Camp Sites

For streamlining and better management of construction activities, the Project road is proposed to be divided into 4 subcontracting sections with length of each section at around 40 km.

Camp sites for contractor's staff and construction machinery/equipment are set up which are located adjacent to the main roads. According to the requirement, Solid waste disposal sites have been proposed by the Contractor at following camp sites. The location of camps and other details are described below:

- **Camp 1** is situated at Dhup Sarri (approximately at K8+700), which is responsible for management of Construction of road sections K0+000~A42+000; asphalt-concrete mixing station and concrete mixing station are built in the neighborhood.
- **Camp 2** is situated at Ansar (approximately at K16+900)
- **Camp 3** is located at Shungus Village (approximately at K46+700), which is responsible for management of construction of road sections & living. Quarry, asphalt-concrete mixing station, concrete mixing station, and hollow slab prefabrication yard are built in the neighborhood
- **Camp 4** is situated at Astak (approximately at K73+300) and comprises of living area and constructions plants i.e. crush plant and asphalt plant.
- **Camp 5** is located at Dambudaas Village (approximately at K96+000), which is responsible for management of construction of road sections (A42+000~K107+900). Quarry, asphalt-concrete mixing station, concrete mixing station and living area is built in the neighborhood.
- **Camp 6** is situated at Bisho (approximately at K121). Crush plant and Asphalt plant is built in the camp area.
- **Camp 7** is situated at Kachura (approximately at 137+000) and includes office living area.
- **Camp 8** is located at Gamba (approximately at K149+000), accommodating Project Manager Department, Engineer's Office, living quarters, and major auxiliary facilities. It would be responsible for management of construction of road sections K107+900~K156+476. Quarry, asphalt-concrete mixing station, and concrete mixing station are built in the neighborhood.

4 Description of Baseline Environment

4.1 General

This chapter describes the baseline conditions with respect to physical, biological and socio-economic and cultural environment prevailing at present in the project area of influence or simply termed as project area. The baseline conditions include qualitative and quantitative information which is gathered through primary and secondary data sources.

Project area is the longitudinal range of area along the entire road length of 164 km, located in the vicinity/right of way (ROW) of the proposed Jaglot-Skardu Road (i.e. 6.15 m on either side from the central line of the road).

Primary data is collected directly through field/site surveys as well as through consultative process i.e. stakeholder meetings and interviews with the persons/public residing along the road within its ROW. For the proposed project, a field survey of the Project area was conducted to collect environmental data on physical, biological and socio-economic parameters. Furthermore, interviews with local public were held and stakeholders/institutional consultations were carried out to seek their opinion regarding the implementation of the proposed Project.

As regards the qualitative environmental data pertaining to environmental quality, samples were taken from 3 locations for testing air and noise quality and from 7 locations for water quality test. Secondary data was gathered on the basis of literature review and desk studies/report, available for Gilgit-Baltistan including project area.

Data base thus established is used for the assessment/ management of potential impacts during construction and operation of the proposed Jaglot-Skardu Road Project. The EIA of the proposed Project covers a comprehensive description of the project areas, including regional resources, which are anticipated to be affected adversely or otherwise by the implementation of the Project.

4.2 Physical Environment

4.2.1 Topography

Project area is located in Northern area i.e. Gilgit-Baltistan of Pakistan. Three mountain ranges Karakoram, Hindu Kush, and Himalayas meet in the project area. The road located at Karakoram Mountains belongs to the typical mountain topography and landform. The mountains are continuous with perennial snow or glacier on high-altitude mountain peaks.

The project road traverses along the valley starting from Jaglot and terminating at Skardu. The Indus is on the right of Jaglot-Skardu Road all along before Ayub Bridge and on the left of the Road after Ayub Bridge.

Topography revealed that site terrain is hilly, rolling and prone to natural landslides and erosion. The starting point, Jaglot, near the Gilgit River is at an altitude of around 1290m and the end point, Skardu about 2230m.

The whole route tends to be low at the starting point and on higher ground at the end point. As such the road runs from the lower reaches to the upper reaches along the Indus.

Road section of 16 km length passing through the Indus valley bottom is almost rolling terrain near Skardu while steep canyons are distributed along other sections. There are flat, small-areas and stable constructional terraces at part of the villages and towns along the road only.

The mountain vegetation is extremely sparse and trees are found mostly in villages. The mountains are partially eroded due to severe weather conditions and landslides developed along the road, albeit are in a state of equilibrium and can be disturbed/ imbalanced due to rain and snow. The landslide masses can be seen along the road as shown in the following figures.

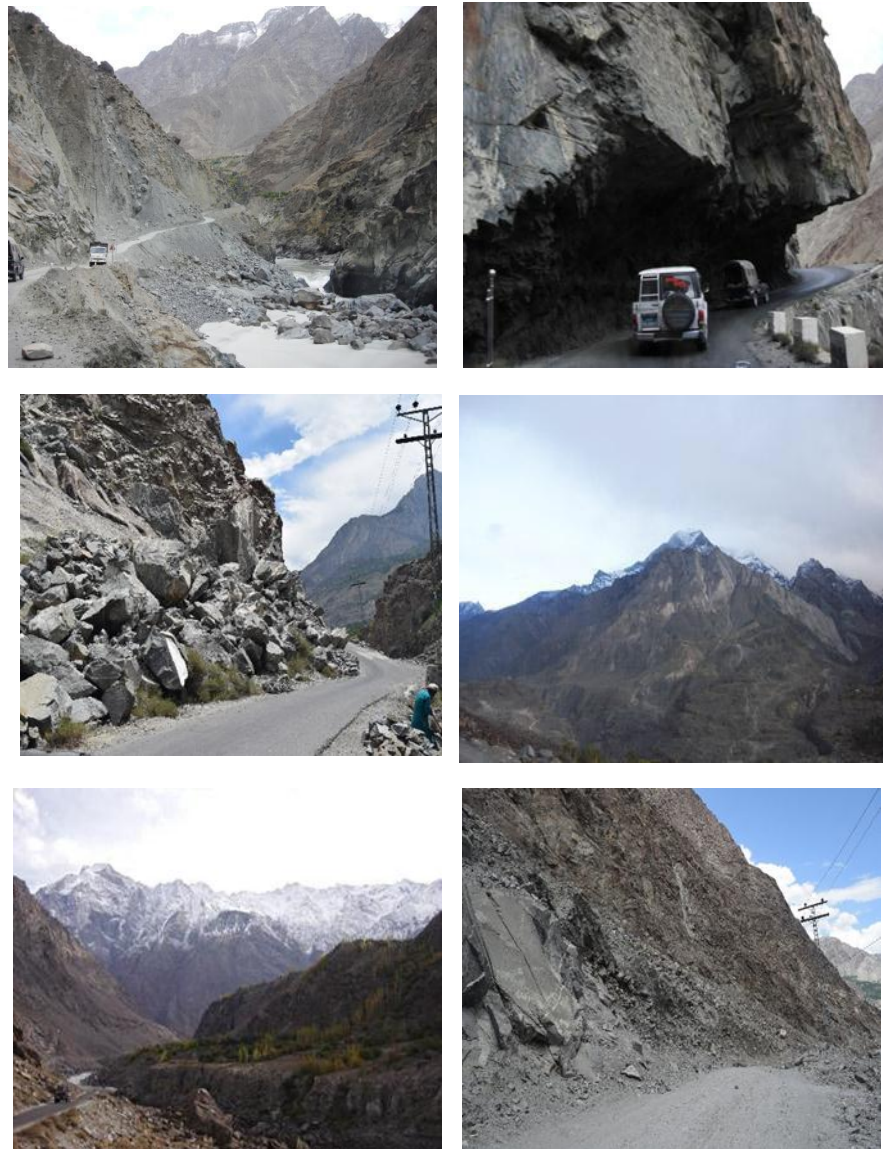


Figure 5: Topography/Landslides of the Project Area (Jaglot-Skardu Road)

4.2.2 Land Use

Land cover plays an important role in planning and management of land resources. The land cover of Gilgit-Baltistan region has been tabulated below:

Table 11: Land Cover of Gilgit-Baltistan

| | |
|-------------------------------|-----------------------------|
| Total Area | 72498 km² |
| Mountains | 94 % |
| Land under cultivation | 1 % |
| Forests | 4 % |
| Rangelands | 56 % |
| Cultivable waste | 1% |

Source: Mountain Agricultural Research Centre (MARC), Gilgit

Except for sporadic distribution of cultivated land partly appearing along road sections crossing villages, there is almost no cultivated land along the Road. Construction of the Project may require acquisition of cultivated land. Due to subsistence/small land holdings, the cultivated sources/agricultural production are scarce but are regarded as highly valuable by the local residents. Considering the scarce availability of land and demand of the locals, efforts need to be made to keep the requirement of land acquisition as minimum as possible. Figure below shows the cultivated land present along the roadside.



Figure 6: Cultivated Land along the Road

4.2.3 Crop Pattern

Though the cultivated lands are scarce in the region, the major crops grown are Wheat, Barley, Maize, Buckwheat and Turnip. Other minor cultivation includes vegetables of different sort. Average rate of cereal and fruit crops in the project area are shown in Table 12 and Table 13, respectively.

Table 12: Average Rate of Cereal Crops

| Sr. | Crop Name | Average Production/Kanal | Rate per kg | Total amount/kanal |
|-----|--------------------|--------------------------|-------------|--------------------|
| 1. | Wheat/Barley | 5 Mds | 40/kg | 8000 |
| 2. | Wheat/Barley Straw | 10 Mds | 800/Mods | 8000 |
| 3. | Maize for Grain | 8 Mds | 50/kg | 16000 |
| 4. | Maize for Fodder | 15 Mds | 800/ds | 12000 |
| 5. | Buckwheat | 90 kg/kanal | 200/kg | 18000 |

Source: Deputy Director Agriculture Department, Skardu

Table 13: Average Tate of Fruit Crops

| Sr. | Fruit Trees | Average Production/Tree | Rate per kg | Total amount/ kanal | Average Productive life of tree |
|-----|------------------|-------------------------|-------------|---------------------|---------------------------------|
| 1. | Apricot | 450 kg | 40/kg | 18000 | 100 years |
| 2. | Apple | 100 kg | 100/kg | 10000 | 70-80 years |
| 3. | Walnut | 350 kg | 200/kg | 70000 | 150 years |
| 4. | Grapes (zreshik) | 100 kg dried | 500/kg | 50000 | 50-60 years |
| 5. | Grapes (fresh) | 80 kg | 120/kg | 9600 | 50-60 years |
| 6. | Almond kaghzi | 100 kg | 500/kg | 50000 | 30-40 years |
| 7. | Almond katha | 150 kg | 300/kg | 45000 | 50-60 years |

Source: Deputy Director Agriculture Department, Skardu

4.2.4 Land use along the Project Route

The project area along the road is observed to have three main types of surroundings: residential and commercial areas (including shops and small markets), cultivated lands (including areas privately owned by inhabitants on which different fruit trees and other crops are grown), and a high mountain slope as well. Scattered houses, rooms, shops, flour mills, dry-fruit factories, small hotels, mosques and dispensaries have been found. Sparsely populated human settlements are located in the vicinity of the project area.

The land terrain of the project area is observed to be mountainous and rolling. Land acquisition is required for the project because the proposed project aims to reconstruct and widen the existing Jaglot-Skardu road with

the addition of bridges to ensure smooth traffic flow and alleviate the occurrences of deadly road accidents.

It is revealed from the survey of the area that structures including residences, shops, mosques, madarsa's and cultivated areas are likely to be affected as a consequence of the proposed project. Moreover, some small culverts or water channels constructed by the locals to derive water from the natural springs for domestic purpose would also be demolished as a result of the proposed project.

Structures and settlements such as shops, houses, mosques within the ROW project area are shown in the figures below:





Figure 7: Settlements/Structures along the Roadside

4.2.5 Forestation

Gilgit city stands as the capital of Gilgit-Baltistan region. It remains covered with snow mountains with average rainfall ranging from 120-240 mm. Vegetation of Gilgit is covered with shrub/ herbs, grasses and patches of many forests on mountainous areas.

Forests provide an important ecosystem for the protection and conservation of wildlife, biodiversity, and watershed along with protection against soil erosion. Only 9% of the land in GB is covered by the forests. Since the southern part of GB receives much more rainfall, hence it is dominated by deodar, pine, willow and poplar trees. Most of the northern part of the GB receives less or no rainfall, therefore most of the area remains without any trees. As a consequence, agricultural area of the region also faces constraints like soil erosion, land sliding issues, less water retention, silting of the streams, flooding, and scarcity of fuelwood. The most forested areas are Jutial, Karghah, Naltar, Haramosh, Bagrot, Jaglot, Danyore and Pahote. The

commonly found trees along the area of interest included *Picea smithiana*, *Pinus wallichiana*, *Juniperus excelsa*, *Betula utilis*, and *Juniperus macropoda*.

Skardu lies in the Baltistan region of Gilgit-Baltistan. Tree species commonly found in the project vicinity included *Pinus wallichiana*, *Pinus juniperus*, *Juniperus excelsa*, and *Betula utilis*. Fruit trees observed in the area consist of apple, plum, cherry, apricots, pear, walnut, peach etc. Efforts of Forest Department, Baltistan, were apparent in the form of Riverbed plantation along the roadside covering an area of 271 acres. Due to the proposed project, these tree species might get affected if not properly compensated for. Riverbed plantation is shown in the Figure below:



Figure 8: Riverbed Plantation Covering 271 Acres of Land in Baltistan

4.2.6 Wetlands

According to World Wildlife Fund (WWF), wetland is a place that is inundated by water that can be fresh water, saline water or both. Marshes, ponds, edges of lakes, oceans and rivers etc., all come under wetlands. The Himalayan, Karakorum and Hindu Kush mountain ranges consist of more than two hundred high altitude wetlands in the region of Gilgit-Baltistan and they are enacting key role in the local communities, livestock and biodiversity of Gilgit Baltistan. These wetlands include Ulter Lake, Gahkuch Marshland, Handrop Lake, Karfaq Lake, Naltar Lake, Qurumbar Lake, Rama Lake, Rush Lake Shandoor Lake, Shimshal Pamiir, Sheosar Lake and Deosai National Park which are the most important in terms of their ecology, biodiversity and eco-tourism. These wetlands are the main sources of fresh water in the region with diverse and unique flora and fauna. Therefore, their role and importance cannot be ignored while relating it with climate change and eco-tourism on the one hand and their impact on the ecosystem in that particular area on the other. According to World Wildlife Fund (WWF) Pakistan, high altitude wetlands of Gilgit-Baltistan harbor around 230 species of Birds, 54 mammals, 20 fish species, 23 herpetofauna, and several floral species.

Climate Change is one of the serious threats to water availability for alpine wetlands since increasing temperatures will increase the rate of glacier shrinkage. In short there could be an increase in flows available in the Indus system as the glaciers melt, even to the extent of increased risk of flooding which is a common phenomenon in the whole region during summers. In the longer term, because of reduced glaciers there could be less water available for alpine lakes and the Indus River and its wetlands.

Pakistan is a member of the Ramsar Convention, an international agreement on wetland protection signed in Ramsar, Iran in 1971. As of March 2013, there are nineteen Ramsar sites, covering an area of 1,343,627 hectares (3,320,170 acres) in Pakistan. However, not a single alpine wetland in the whole Gilgit Baltistan is declared as Ramsar site. This negligence and lack of commitment from GB Government might raise issues of wetland degradation in the near future.

4.2.7 Livelihood

Socio economic data of Skardu and Gilgit Districts is shown in the Table 14 & 15 respectively:

Table 14: Area and Demographic Indicators (Skardu District)

| Variable | Details |
|-----------------------------------|--------------|
| Area | 19,697 sq.km |
| Population | 214,848 |
| Sex Ratio (males per 100 females) | 87* |
| Rural Population | 87%* |
| Urban Population | 13%* |

Source: "Gilgit-Baltistan: Districts & Places – Population Statistics in Maps and Charts". citypopulation.de. Retrieved 06 August 2018. (* = 1998 Census Report)

Table 15: Area and Demographic Indicators (Gilgit District)

| Variable | Details |
|-----------------------------------|------------|
| Area | 4208 sq.km |
| Population | 145,272 |
| Sex Ratio (males per 100 females) | 115* |
| Rural Population | 60.9%* |
| Urban Population | 48.3%* |
| Literacy Ratio | 72%** |

Source: "Gilgit-Baltistan: Districts & Places – Population Statistics in Maps and Charts". citypopulation.de. Retrieved 06 August 2018. (* = 1998 Census Report; **= AKRSP, JICA study, 2010)

4.2.8 Climate

Gilgit-Baltistan areas have high mountains of Himalayas, Karakoram and Hindukush ranges with over 8000m peaks. High altitude has dominant influence on the climate of the region.

Gilgit-Baltistan areas (including the project road from Jaglot to Skardu) have

two seasons; extremely cold winter (October to March) and mild/dry summer (April to September). However, hot weather prevails occasionally during monsoon season from June to August. The average temperatures during summer and winter with precipitation (rainfall/humidity) and wind speed are presented as under:

Table 16: Average Annual Climate Data of Gilgit and Skardu (1961-2009)

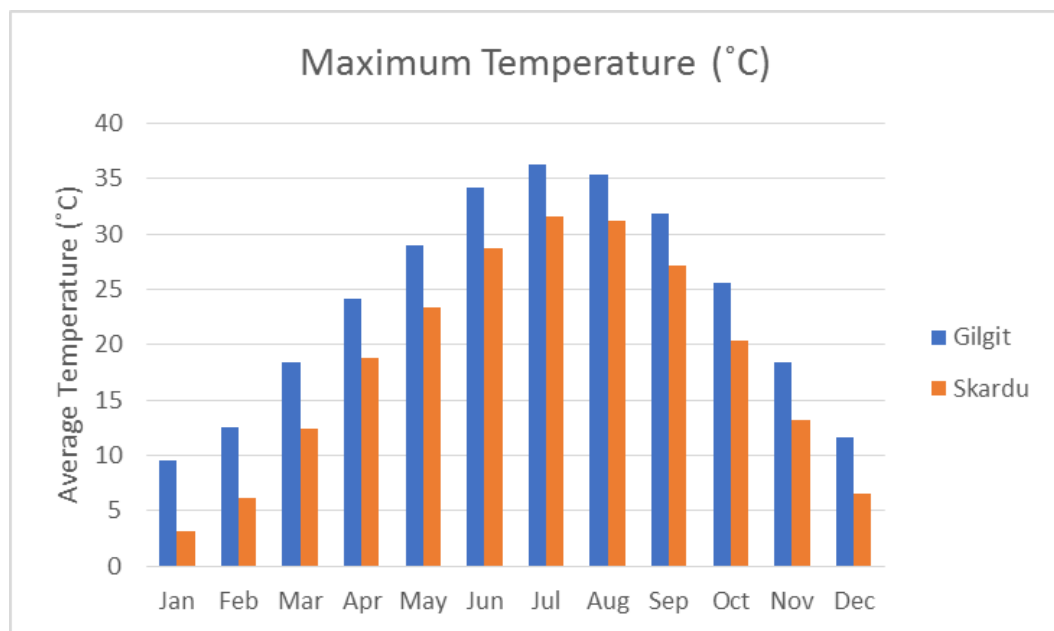
| Place | Avg. Annual Temperature (°C) | | Avg. Annual Rainfall (mm) | Avg. Annual Relative Humidity (%) | | Avg. Annual Wind Speed (Knots) | |
|---------------|------------------------------|--------|---------------------------|-----------------------------------|------------|--------------------------------|------------|
| | Highest | Lowest | | At 00 UTC* | At 12 UTC* | At 00 UTC* | At 12 UTC* |
| Gilgit | 19.4 | 6.2 | 107.8 | 59.9 | 29.6 | 0.6 | 1.6 |
| Skardu | 14.9 | 4.1 | 172.7 | 50.8 | 29.6 | 0.6 | 2.3 |

*= Co-ordinated Universal Time

Source: Pakistan Meteorological Department (PMD)

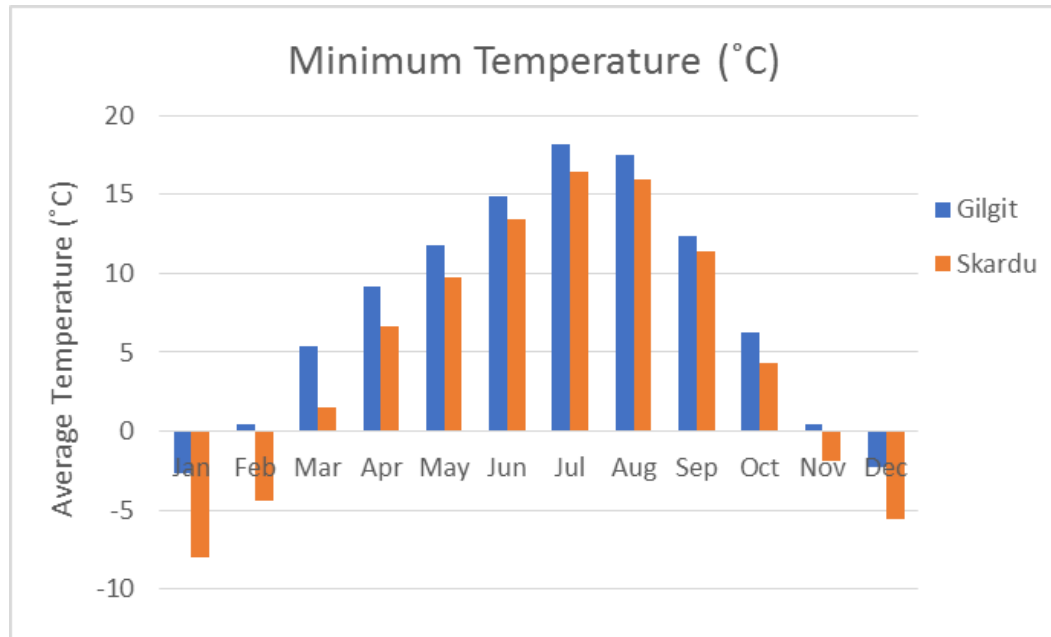
4.2.8.1 Average temperature

Temperatures are normally higher during hot season (June-August) and low in colder months (December-February) as illustrated below.



Source: Pakistan Meteorological Department (PMD)

Figure 9: Average Maximum Temperature of Gilgit and Skardu Districts



Source: Pakistan Meteorological Department (PMD)

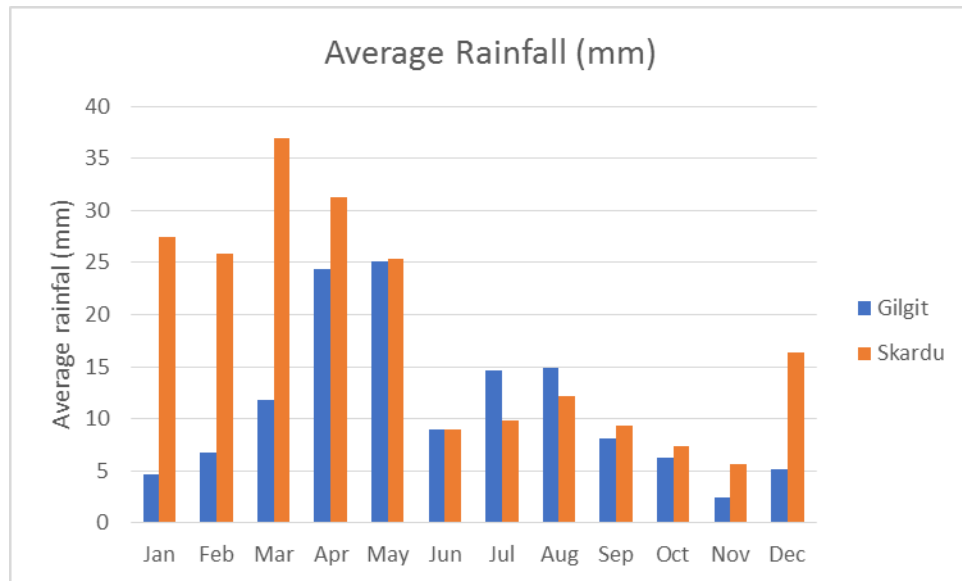
Figure 10: Average Minimum Temperature of Gilgit and Skardu Districts

Analysis of monthly temperature data for Gilgit shows that the hottest month is July with an average maximum temperature of 46.3°C. December is the coldest month of the year with an average minimum temperature of -11.1°C. The months of May-September are hot with average temperature ranging from 41.5°C to 46.3°C. While October to March are very cold with average temperature ranging from -2.5°C to -11.1°C

Analysis of monthly temperature data for Skardu shows that the hottest month is July and August with a maximum average temperature of 41°C. January is the coldest month of the year with minimum average temperature of -24.1°C. The months of June-August are hot with average temperature ranging from 40°C to 41°C, while October to April are very cold with average temperature ranging from -1.1°C to -24.1°C. The average monthly temperature data for the given range of years (1961-2009) is given in Table 16.

4.2.8.2 Average Rainfall

Highest average rainfall is usually observed during the months of March and May for Skardu and Gilgit respectively. The average monthly rainfall data for the given range of years (1961-2009) is given in Table 16, and also represented in graphical form below:



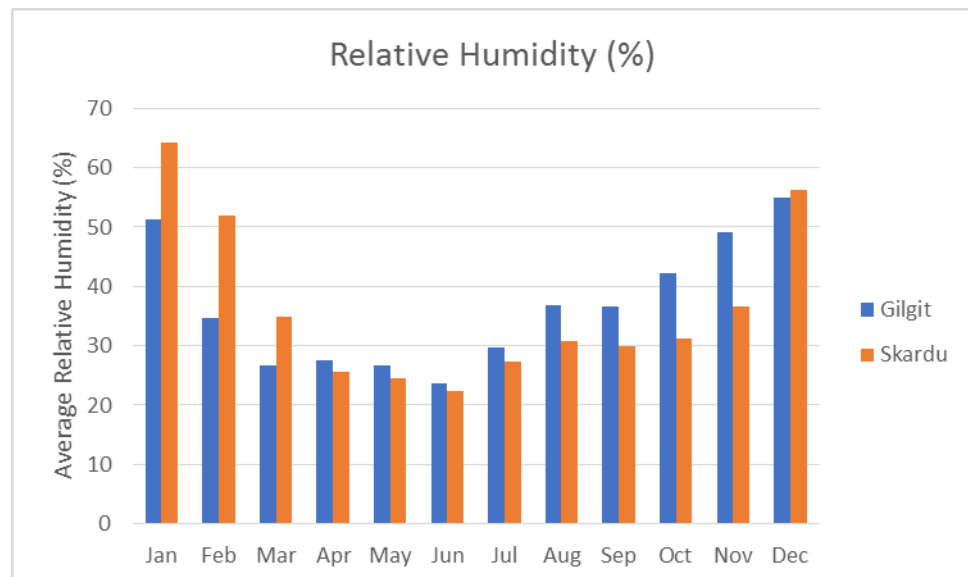
Source: Pakistan Meteorological Department (PMD)

Figure 11: Average Rainfall of Gilgit and Skardu Districts

4.2.8.3

Relative Humidity

Relative humidity reaches a maximum during colder months i.e. December, January and February whereas lowest relative humidity is observed during the month of June. In Gilgit, highest relative humidity is recorded during the month of December whereas the highest relative humidity in Skardu is recorded during the month of January. The average monthly relative humidity data for the given range of years (1961-2009) is given in Table 16, and also represented in graphical form below:

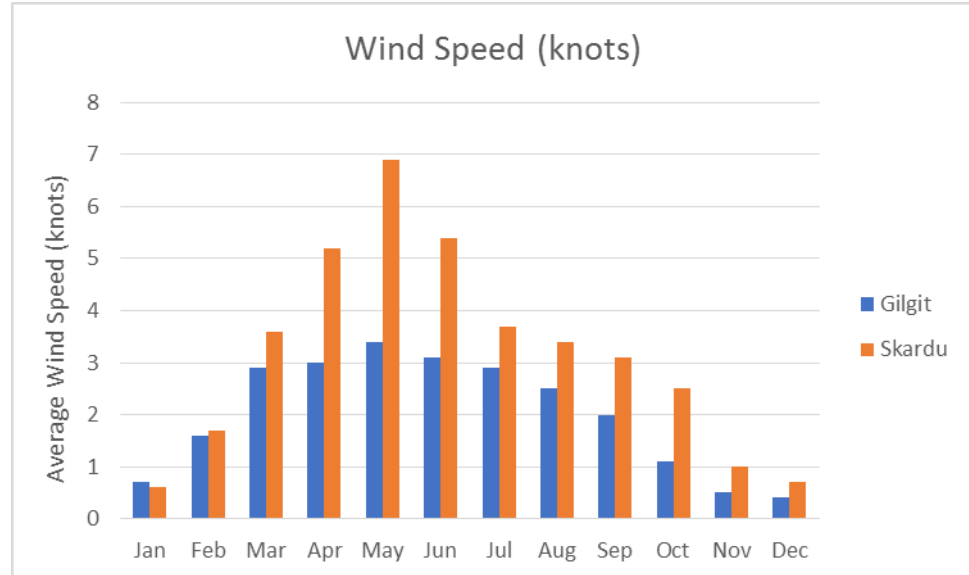


Source: Pakistan Meteorological Department (PMD)

Figure 12: Average Relative Humidity of Gilgit and Skardu Districts

4.2.9 Wind Speed

Maximum wind speed in both Skardu and Gilgit is observed during May whereas lowest wind speed is generally experienced during autumn and colder months. The average monthly wind speed data for the given range of years (1961-2009) is given in Table 17, and also illustrated below:



Source: Pakistan Meteorological Department (PMD)

Figure 13: Average Wind Speed of Gilgit and Skardu Districts

Table 17: Average Monthly Climate of 50 Years Data of Gilgit and Skardu (1961-2009)

| Gilgit | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 20-08-2018 |
|---------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------------|
| Maximum Temperature (°C) | 17.5 | 22 | 29.4 | 37.2 | 41.5 | 43.5 | 46.3 | 43.8 | 41.6 | 36 | 28 | 24.5 | 36 |
| Minimum Temperature (°C) | -10 | -8.9 | -3 | 1.1 | 3.9 | 5.1 | 10 | 9.8 | 3 | -2.5 | -8.5 | - 11.1 | 23 |
| Rainfall (mm) | 4.6 | 6.7 | 11.8 | 24.4 | 25.1 | 8.9 | 14.6 | 14.9 | 8.1 | 6.3 | 2.4 | 5.1 | 4 % |
| Relative Humidity (%) | 51.3 | 34.6 | 26.7 | 27.6 | 26.6 | 23.7 | 29.8 | 36.8 | 36.7 | 42.2 | 49.1 | 55 | 29 |
| Wind Speed (knots) | 0.7 | 1.6 | 2.9 | 3 | 3.4 | 3.1 | 2.9 | 2.5 | 2 | 1.1 | 0.5 | 0.4 | 6 km/h |
| Skardu | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 20-08-2018 |
| Maximum Temperature (°C) | 13.9 | 16.7 | 24 | 29.6 | 34.4 | 40 | 41 | 41 | 38.2 | 31.2 | 22.9 | 16.2 | 27 |
| Minimum Temperature (°C) | - 2.1 | -20 | - 1.5 | -1.1 | 0.4 | 4 | 7.5 | 7 | 2.6 | -4.2 | -9.5 | - 17.2 | 18 |
| Rainfall (mm) | 27.5 | 25.9 | 36.9 | 31.3 | 25.3 | 9 | 9.8 | 12.2 | 9.3 | 7.3 | 5.6 | 16.3 | 24 % |
| Relative Humidity (%) | 64.3 | 52 | 34.9 | 25.6 | 24.6 | 22.3 | 27.3 | 30.7 | 29.9 | 31.2 | 36.6 | 56.2 | 46 |
| Wind Speed (knots) | 0.6 | 1.7 | 3.6 | 5.2 | 6.9 | 5.4 | 3.7 | 3.4 | 3.1 | 2.5 | 1 | 0.7 | 6 km/h |

Source: Pakistan Meteorological Department (PMD)

4.2.10 Seismology

Pakistan Building Code distributes the country into 4-zones. The project site lies in seismic Zone-3. The map of seismic zones of Pakistan is given below:

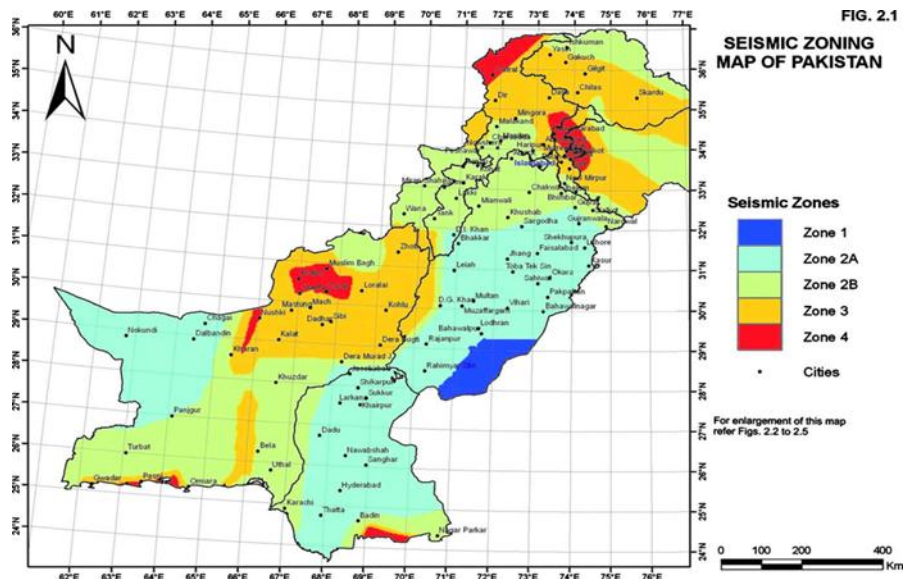


Figure 14: Seismic Zones of Pakistan

As per seismic categorization, Zone-3 is a highly severe damage zone where distant earthquake for short duration may cause severe damage to structures. As such structural designs of bridges, roads and others need to follow the applicable criteria for the zone 3 as recommended in the Building Code of Pakistan 2007. The seismic zoning map of Northern areas is illustrated as under:

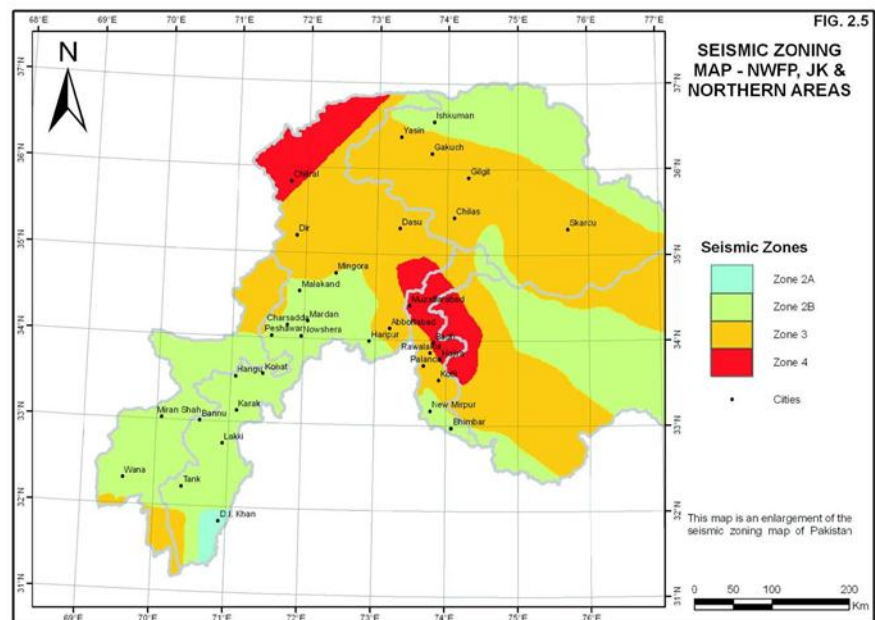


Figure 15: Seismic Zones of Northern Areas

4.2.11 Air & Noise Quality

Finite Engineering (Pvt.) Ltd. engaged the services of ESPAK (Environmental Services Pakistan), an approved laboratory by Environmental Protection Department (EPD) of Punjab, to undertake Environmental Monitoring of air & noise quality in the project area.

The main purpose of carrying out the environmental assessment is to check the adverse impacts of the project related activities on the air and noise via monitoring the ambient air quality of project area in compliance with the National Environmental Quality Standards. The date, location and parameters to check the air and noise pollution are provided in the Table 18 below:

Table 18: Environmental Monitoring Schedule

| Monitoring Schedule | | | |
|-------------------------|--|---------------|--|
| Date | Location | No. of Points | Test Description |
| 4-Aug-18 to 8-Aug-18 | Gamba Skardu (Latitude: 35.334665, Longitude: 75.534997) | 1 | <ul style="list-style-type: none"> Ambient Air Monitoring Noise Level Monitoring |
| | Shengus (Latitude: 35.733331, Longitude: 74.799157) | 1 | |
| | Dambudaas (Latitude: 35.595261, Longitude: 75.229671) | 1 | |

For finalization of monitoring location on the above-mentioned sites, following criteria has been used:

- Area where project activities would be carried out
- Present environmental conditions at the site

4.2.11.1 Ambient Air Quality

Ambient air quality monitoring is conducted at selected locations to assess the concentration of priority pollutants Nitrogen dioxide (NO₂), Sulphur dioxide (SO₂), Carbon monoxide (CO), Ozone (O₃), PM_{2.5} and PM₁₀. Selection of sampling location was based on the environmental factors including wind direction on the particular day and amount of turbulence in the air etc.

Equipment/Instrument used for checking the air quality is shown below:



Figure 16: Air Quality Monitoring Using instrument AQM65

Reference method used for the measurements are included as Table 19 followed by a description of each parameter.

Table 19: Air Quality - Methodologies

| Air Pollutant | Methodologies | Measurement Range | Sampling Duration |
|---|---|-------------------|-------------------|
| Oxides of Nitrogen | Chemiluminescence | 0-10 ppm | 24 hours |
| Sulfur Dioxide (SO ₂) | UV fluorescence (UVF) | 0-20 ppm | 24hours |
| Carbon monoxide (CO) | Non-Dispersive Infrared Absorption (NDIR) | 0 – 300 ppm | 24 hours |
| Particulate Matter PM ₁₀ , PM _{2.5} | Spectrophotometry (Nephelometer) | 0-2000 ppm | 24 hours |
| Ozone (O ₃) | Non-dispersive UV absorption | 0-0.5 ppm | 1 hour |

Oxides of Nitrogen

Oxides of Nitrogen (NO_x) were monitored using Chemiluminescent NO-NO₂ & NO_x Analyzer. The analyzer measures NO, NO₂ and NO_x using chemiluminescence (CLD) method with the help of chemical reaction between NO and O₃. Measurement range of the analyzer is 0-10 ppm. Continuous data was recorded for 24hr.

Sulphur Dioxide (SO₂)

Sulphur dioxide was monitored using UV Fluorescent SO₂ Analyzer. The

SO₂ analyzer measures SO₂ using UV fluorescence method that operates on the principle that when the SO₂ molecules contained in the sample gas are excited by ultraviolet radiation they emit a characteristic fluorescence. This fluorescence is measured and the SO₂ concentration is obtained from changes in the intensity of the fluorescence. Measurement range of the analyzer is 0-20 ppm. Continuous data was recorded for 24 hr.

Carbon Monoxide (CO)

Carbon monoxide (CO) was monitored using Non-dispersive Infrared CO Analyzer. The analyzer measures CO concentration by measuring the quantity of infrared light the sample gas absorbs as it flows through a multi-reflection chamber. Measurement range of the analyzer is 0-300 ppm. Continuous data was recorded for 24hr.

Particulate Matter (PM10 & PM2.5)

Monitoring of PM10 & PM2.5 was completed using a Nephelometer. A sharp cut cyclone fitted to the inlet physically selects a target mass fraction. The combination of Nephelometer and sharp cut cyclone ensures high accuracy and durability. PM10 & PM2.5 sampling was conducted for the period of 24 hours at identified monitoring location.

Ozone (O₃)

The O₃ analyzer module continuously measures ozone in ambient air. Air is actively sampled by pump and travels through a glass and Teflon coated inlet system to the analyzer module. The ozone analyzer module incorporates a gas sensitive semiconductor (GSS) sensor. This sensor is a tungsten oxide formulation that is particularly sensitive to ozone when incorporated at elevated temperatures.

Results

Air Quality Monitoring at Gamba Skardu

Results of environmental testing of ambient air quality monitoring are presented in Table 20 as under:

Table 20: Air Quality - Monitoring Parameters (Gamba, Skardu)

| Sr. No. | Parameters | Avg. Sampling Time | Unit | NEQS for Ambient Air | Average Concentration |
|---------|-------------------------------------|--------------------|-------------------|----------------------|-----------------------|
| 1 | Sulfur Dioxide (SO ₂) | 24 hr. | µg/m ³ | 120 | 0.91 |
| 2 | Nitrogen Dioxide (NO ₂) | 24 hr. | µg/m ³ | 80 | 5.52 |
| 3 | Nitric Oxide (NO) | 24 hr. | µg/m ³ | 40 | 1.44 |
| 4 | PM 2.5 | 24 hr. | µg/m ³ | 35 | 27.44 |
| 5 | PM 10 | 24 hr. | µg/m ³ | 150 | 90.37 |
| 6 | Carbon Monoxide (CO) | 24 hr. | mg/m ³ | 5 | 0.32 |
| 7 | Ozone (O ₃) | 24 hr. | µg/m ³ | 80 | 3.24 |

Detailed results of air quality are attached as **Annex-F**. A comparison of NEQS vs average value of air quality parameters for Gamba Skardu is illustrated in the Figure as under:

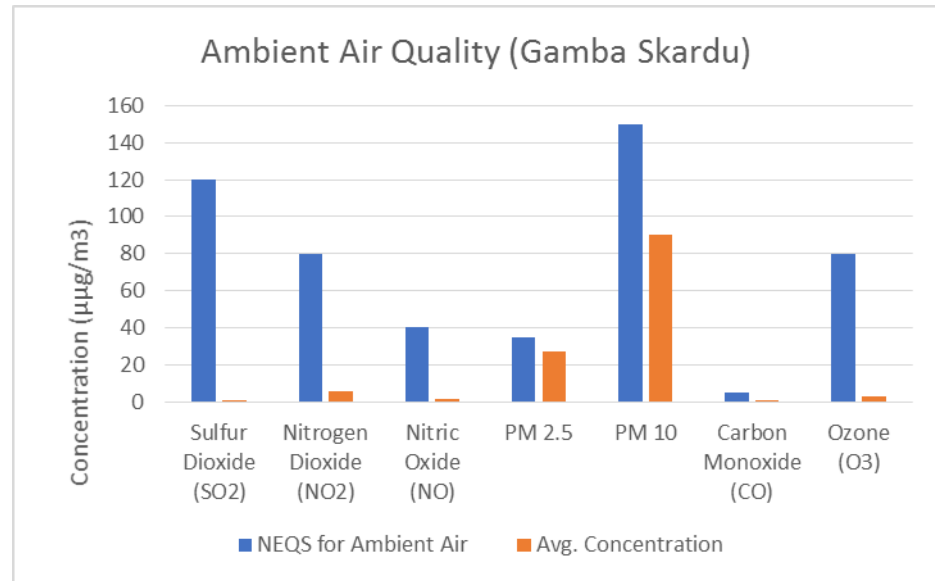


Figure 17: Results of Air Quality at Gamba Skardu

Results of the monitoring performed indicate that all parameters meet the permissible limits of National Environmental Quality Standards. The instrument used at the site for ambient air quality monitoring is shown as under:



Figure 18: Air Quality Monitoring at Gamba Skardu using AQM65

Air Quality Monitoring at Shungus

Results of environmental testing of ambient air quality monitoring are presented in Table 21 as under:

Table 21: Air Quality - Monitoring Parameters (Shungus)

| | Parameters | Avg. Sampling Time | Unit | NEQS for Ambient Air | Average Concentration |
|---|-------------------------------------|--------------------|-------------------|----------------------|-----------------------|
| 1 | Sulfur Dioxide(SO ₂) | 24 hr. | µg/m ³ | 120 | 0.80 |
| 2 | Nitrogen Dioxide (NO ₂) | 24 hr. | µg/m ³ | 80 | 6.03 |
| 3 | Nitric Oxide (NO) | 24 hr. | µg/m ³ | 40 | 1.47 |
| 4 | PM 2.5 | 24 hr. | µg/m ³ | 35 | 27.30 |
| 5 | PM 10 | 24 hr. | µg/m ³ | 150 | 81.14 |
| 6 | Carbon Monoxide (CO) | 24 hr. | mg/m ³ | 5 | 0.23 |
| 7 | Ozone (O ₃) | 24 hr. | µg/m ³ | 80 | 3.96 |

Detailed results are attached as **Annex-F**. A comparison of NEQS vs average value of air quality parameters for Shungus is illustrated in the Figure as under:

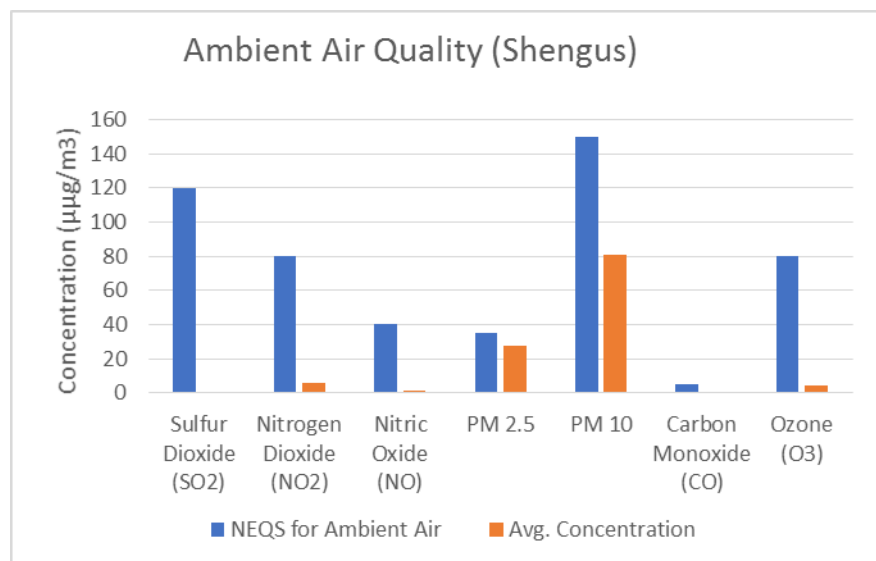


Figure 19: Results of Air Quality at Shungus

Results of the monitoring performed indicate that all parameters meet the permissible limits of National Environmental Quality Standards. The instrument used at the site for ambient air quality monitoring is shown as under:



Figure 20: Air Quality monitoring at Shungus using AQM65

Air Quality Monitoring at Dambudaas

Results of environmental testing of ambient air quality monitoring are presented in Table 22 as under:

Table 22: Air Quality - Monitoring Parameters (Dambudaas)

| Sr. No. | Parameters | Avg. Sampling Time | Unit | NEQS for Ambient Air | Average Concentration |
|---------|-------------------------------------|--------------------|-------------------|----------------------|-----------------------|
| 1 | Sulfur Dioxide (SO ₂) | 24 hr. | µg/m ³ | 120 | 0.96 |
| 2 | Nitrogen Dioxide (NO ₂) | 24 hr. | µg/m ³ | 80 | 5.85 |
| 3 | Nitric Oxide (NO) | 24 hr. | µg/m ³ | 40 | 1.44 |
| 4 | PM 2.5 | 24 hr. | µg/m ³ | 35 | 27.23 |
| 5 | PM 10 | 24 hr. | µg/m ³ | 150 | 91.53 |
| 6 | Carbon Monoxide (CO) | 24 hr. | mg/m ³ | 5 | 0.32 |
| 7 | Ozone (O ₃) | 24 hr. | µg/m ³ | 80 | 3.32 |

Detailed results are attached as **Annex-F**. A comparison of NEQS vs average value of air quality parameters for Dambudaas is illustrated in the Figure as under:

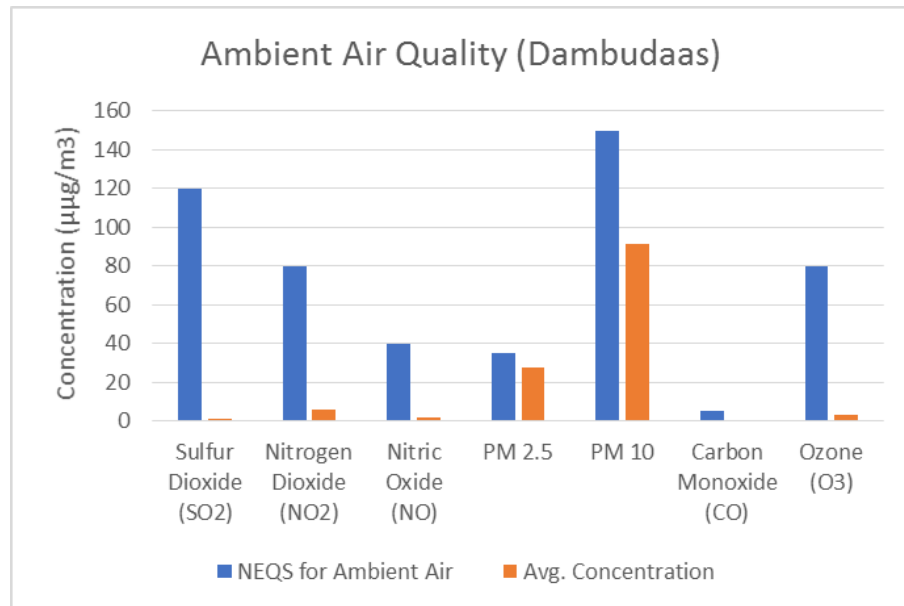


Figure 21: Results of Air Quality at Dambudaas

Results of the monitoring performed indicate that all parameters meet the permissible limits of National Environmental Quality Standards. Equipment used for Ambient Air Quality Monitoring at site is shown as under:



Figure 22: Air Quality Monitoring at Dambudaas using AQM65

4.2.11.2 Noise Level Monitoring

Noise level monitoring was conducted using Extech Sound Meter at the same locations identified for air quality as mentioned in the Table 17 above. All noise monitoring was conducted in accordance with the guidance set out in standard methods. The Meters were calibrated and checked before and after each measurement period by using sound level calibrator. The sound meter used is shown as under:



Figure 23: Noise Monitoring Day time at Project Site using Noise Meter



Figure 24: Noise Monitoring Night time at Project Site using Noise Meter

Results

Noise quality measurements for all three sampling locations at day and night time respectively are presented in Table 23 below:

Table 23: Noise Level Monitoring (Dambudaas, Gamba Skardu and Shungus)

| Sr. No | Monitoring time | Dambudaas Noise Level in dB(A) | Gamba Skardu Noise Level in dB(A) | Shungus Noise Level in dB(A) |
|-------------------|------------------|--------------------------------|-----------------------------------|------------------------------|
| 1 | 6:00 AM (Day) | 30 | 37.9 | 42.6 |
| 2 | 9:00 AM (Day) | 70.9 | 62.2 | 67 |
| 3 | 1:00 PM (Day) | 40.6 | 51.6 | 57.2 |
| 4 | 5:00 PM (Day) | 54.1 | 68.3 | 45 |
| 5 | 9:00 PM (Day) | 40.8 | 65.2 | 49 |
| 6 | 12:00 AM (Night) | 30 | 60.4 | 37 |
| NEQS (day time) | | Not More than 65 dB(A) Leq | | |
| NEQS (night time) | | Not More than 55 dB(A) Leq | | |

The graphical illustration of a comparison between the averages measured at each site viz-a-viz the NEQs for noise are presented as under:

Noise Level Monitoring at Dambudaas

For Dambudaas, all the measured noise values lied well within the permissible limits (NEQS). The only time where the noise level exceeded the NEQS was in the morning at 9 AM.

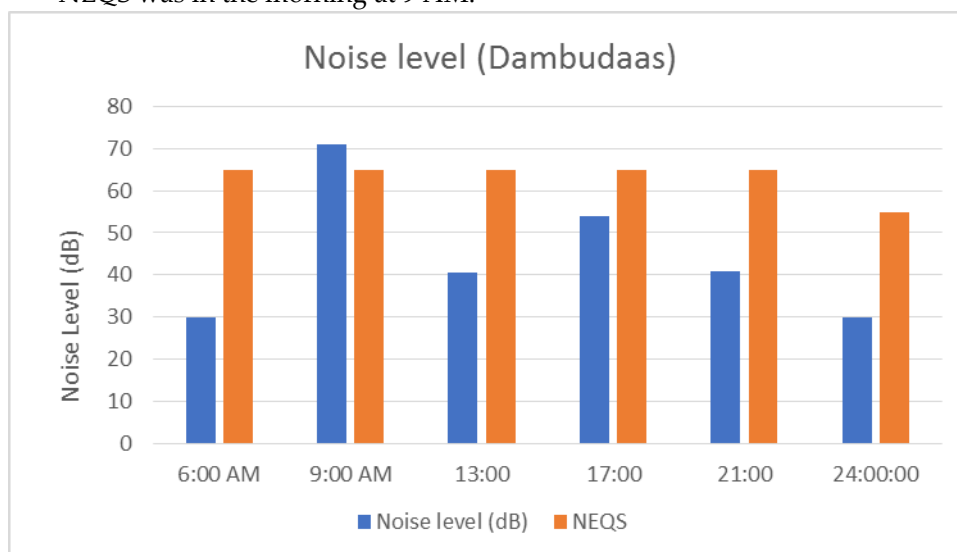


Figure 25: Results of Noise level at Dambudaas

Noise Level Monitoring at Shungus

From the results of monitoring performed at Shungus, it became evident that noise pollution is not an environmental issue for Shungus. The only time at which the Noise level exceeded the NEQS was in the morning.

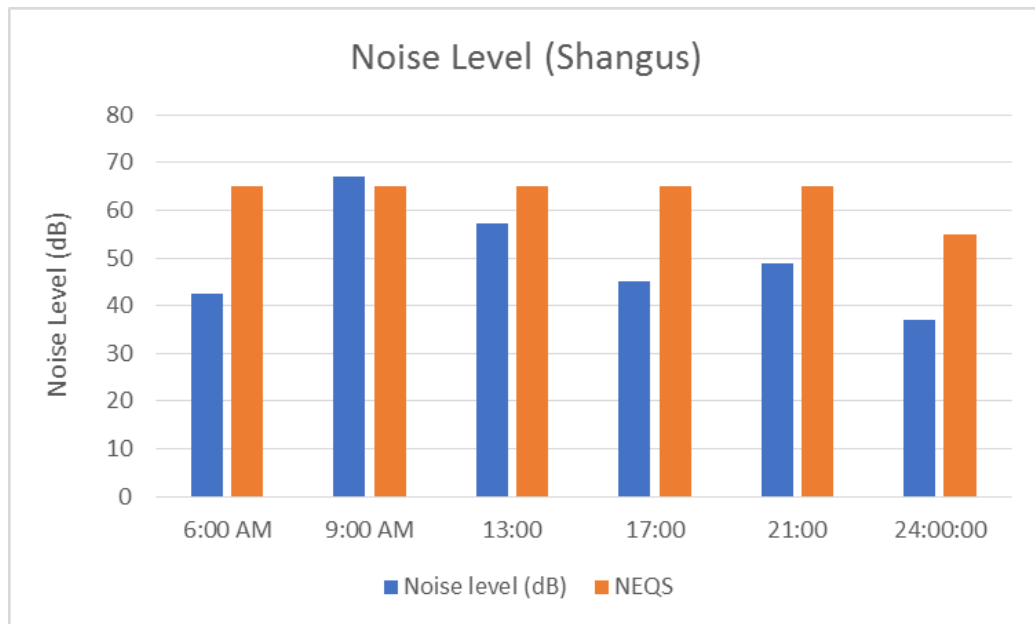


Figure 26: Results of Noise level at Shangus

Noise Level Monitoring at Gamba Skardu

The results of monitoring performed at Gamba Skardu revealed that noise levels were well within the permissible limits as defined by the NEQS. Only during the evening and night time, it was observed that the noise levels exceeded the NEQS.

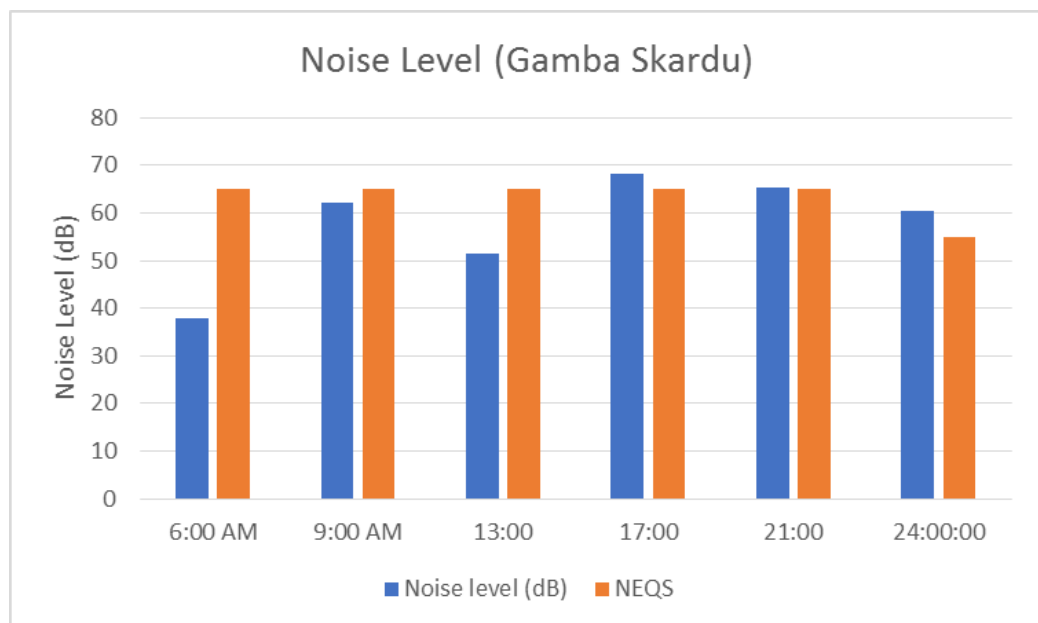


Figure 27: Results of Noise level at Gamba Skardu

4.2.12 Surface Water & Ground Water

4.2.12.1 Surface Water

Sources of surface water include springs, streams and River Indus. Water from the mentioned sources is used for various purposes including drinking and domestic/agricultural purposes. Water was sampled from four sites in the project area namely Astak, Dambudaas, Tungush and Hoto. Details are enlisted in Table 24 below:

Table 24: Water Sampling Sites

| Serial # | Location | Water Sample Collected |
|----------|-----------|--|
| 1 | Astak | Tap water & Surface water coming from a stream |
| 2 | Dambudaas | Channel water coming from a spring & Tap water |
| 3 | Kachura | Tap water & Surface Water |
| 4 | Bagcha | Tap water & Surface Water |
| 5 | Shungus | Tap water & Surface Water |
| 6 | Juglot | Tap water |
| 7 | Heramosh | Tap water |

4.2.12.2 Water Quality

To check the water quality, Pakistan Council of Research in Water Resources (PCRWR) was engaged. Samples for testing the water quality taken from 4 locations in the project vicinity are presented in the figures below:





Figure 28: Water Sample Collection from Various Sources

4.2.12.3 Groundwater

Survey of the project area revealed that groundwater was available near the Skardu region only. However, this information was true only according to the locals and was not confirmed by the respective department.

Testing & Results:

Samples for water quality of tap water (TW) and surface water (SW) have been collected from 7 different locations and submitted for physical, bacteriological and chemical testing to GB-EPA laboratory. The results are summarized in Table 25 & 26 as under:

Table 25: Physical and Bacteriological Water Quality Results

| S# | Sampling Point | Analysis Parameters | | | | | | | | |
|---|------------------|----------------------------|---------------------|-----------|------------------------|-------------------------|-------|-----------|----------|-----------|
| | | Bacteriological Parameters | Physical Parameters | | | | | | | |
| | | E. Coli | pH | Turbidity | Total Dissolved Solids | Electrical Conductivity | Temp. | Color | Odor | Taste |
| 1 | S#1 Kachoor TW | 0 col/ 100 ml | 7.8 | <5 NTU | 258 ppm | 369 μ s | 200° | colorless | odorless | tasteless |
| 2 | S#2 Kachoor SW | 0 col/ 100 ml | 7.8 | <5 NTU | 310 ppm | 491 μ s | 200° | colorless | odorless | tasteless |
| 3 | S#3 Bagcha SW | 0 col/ 100 ml | 7.9 | <5 NTU | 380 ppm | 570 μ s | 200° | colorless | odorless | tasteless |
| 4 | S#4 Bagcha TW | 0 col/ 100 ml | 7.8 | <5 NTU | 331 ppm | 498 μ s | 200° | colorless | odorless | tasteless |
| Findings: Results show that the tested water samples are within the limits of National Standards for Drinking Water Quality of Pakistan | | | | | | | | | | |
| 5 | S#5 Dambudas TW | 0 col/ 100 ml | 8 | <5 NTU | 65 ppm | 115 μ s | 200° | colorless | odorless | tasteless |
| 6 | S#6 Dambudas SW | 0 col/ 100 ml | 7.8 | <5 NTU | 170 ppm | 223 μ s | 200° | colorless | odorless | tasteless |
| 7 | S#7 Astak TW | 0 col/ 100 ml | 7.2 | <30 NTU | 280 ppm | 370 μ s | 200° | colorless | odorless | tasteless |
| 8 | S#8 Astak SW | 0 col/ 100 ml | 6.8 | <80 NTU | 341 ppm | 465 μ s | 200° | colorless | odorless | tasteless |
| Findings: Results show that the turbidity of Astak TW and Astak SW is high which is against the National Standards for Drinking Water Quality of Pakistan. | | | | | | | | | | |
| 9 | S#9 Shungus TW | 0 col/ 100 ml | 7.1 | <5 NTU | 284 ppm | 388 μ s | 200° | colorless | odorless | tasteless |
| 10 | S#10 Shungus SW | 0 col/ 100 ml | 7.3 | <5 NTU | 270 ppm | 305 μ s | 200° | colorless | odorless | tasteless |
| 11 | S#11 Juglot TW | 0 col/ 100 ml | 8.1 | <5 NTU | 205 ppm | 370 μ s | 200° | colorless | odorless | tasteless |
| 12 | S#12 Heramosh TW | 0 col/ 100 ml | 8.2 | <5 NTU | 345 ppm | 572 μ s | 200° | colorless | odorless | tasteless |
| Findings: Results show that the tested water samples are within the limits of National Standards for Drinking Water Quality of Pakistan. | | | | | | | | | | |

Table 26: Chemical Water Quality Results

| S# | Sampling Point | Analysis Parameters | | | | | | | | | |
|---|------------------|---------------------|----|------|------|------|----|------|----|-----|-----|
| | | As | Hg | Cu | Al | Fe | Mn | Cr6 | Zn | Ni | B |
| 1 | S#1 Kachooru TW | ND | ND | ND | ND | 0.02 | ND | 0.04 | ND | 0.1 | 0.1 |
| 2 | S#2 Kachooru SW | ND | ND | ND | 0.01 | 0.03 | ND | 0.05 | ND | 0.1 | 0.2 |
| 3 | S#3 Bagcha SW | 0.01 | ND | ND | 0.01 | 0.04 | ND | ND | ND | 0.2 | ND |
| 4 | S#4 Bagcha TW | ND | ND | ND | ND | 0.01 | ND | ND | ND | 0.1 | ND |
| Findings: Results show that the concentration of Nickle is against National Standards for Drinking Water Quality of Pakistan. | | | | | | | | | | | |
| 5 | S#5 Dambudas TW | ND | ND | ND | ND | ND | ND | 0.02 | ND | 0.1 | 0.2 |
| 6 | S#6 Dambudas SW | ND | ND | ND | ND | ND | ND | 0.06 | ND | 0.2 | 0.3 |
| 7 | S#7 Astak TW | ND | ND | ND | 0.01 | 0.02 | ND | 0.07 | ND | 0.1 | ND |
| 8 | S#8 Astak SW | ND | ND | ND | 0.02 | 0.03 | ND | 0.1 | ND | 0.1 | ND |
| Findings: Results shows that the concentration of Nickle and Chromium6 is against National Standards for Drinking Water Quality of Pakistan. | | | | | | | | | | | |
| 9 | S#9 Shungus TW | ND | ND | 0.6 | ND | ND | ND | 0.01 | ND | ND | ND |
| 10 | S#10 Shungus SW | ND | ND | 1.54 | ND | ND | ND | 0.02 | ND | ND | ND |
| 11 | S#11 Juglot TW | ND | ND | ND | ND | ND | ND | ND | ND | 0.1 | ND |
| 12 | S#12 Heramosh TW | ND | ND | ND | 0.2 | 0.03 | ND | ND | ND | 0.1 | ND |
| Findings: Results shows that the concentration of Nickle is against National Standards for Drinking Water Quality of Pakistan. | | | | | | | | | | | |

Details of water quality results are attached at **Annex-G** while details of sampling points are provided at **Annex-H**.

Testing & Results:

Conclusions for the water quality tests of TW and SW at 7 locations are presented below in Table 27.

Table 27: Conclusions of Water Testing

| Locations | Results |
|------------------|---|
| Kachoor TW & SW | Water is fit for drinking |
| Bagcha TW & SW | Water is fit for drinking |
| Dambudas TW & SW | Water is fit for drinking |
| Astak TW & SW | Water is not fit for drinking because of the high turbidity levels. |
| Shungus TW & SW | Water is fit for drinking |
| Juglot TW | Water is fit for drinking |
| Heramosh TW | Water is fit for drinking |

4.3 Biological Environment

The proposed Jaglot-Skardu Road Project is situated in two Districts of Gilgit-Baltistan region; District Gilgit and District Skardu. The project area with its vicinity, comprising of Rocky Mountains and valleys along the river Indus, is rich in biodiversity which is adapted to the extreme variations in climate (-2°C to 35°C) and geographical conditions. Biological environment prevailing in the vicinity of the project road consists of Flora and Fauna. The Flora includes vegetation and flowers that are found in human settlements/agricultural fields along the river banks/shops and mountain cliffs. The Fauna comprises of the wildlife habitat, endangered/rare species, livestock etc. The details are described as under:

4.3.1 Flora

Vegetation appeared in different areas mentioned above is bundles together as wood trees, fruit trees, shrubs/scrubs, herbs, grasses etc. The alpine scrubs are found in small ravines and in the upper tops of the higher mountains (Himalaya, Hindu Kush and Karakoram ranges). Mostly trees grown near the project area include timber, firewood and fruit trees. As the natural forests are scarce, the local residents have planted Poplar trees which are utilized as timber and firewood. In addition to the crops, high alpine plants and weeds (wild flower and plants) are found near agricultural fields, along the roadside, stream/river banks and mountain tops.

There are so many varieties of roses, lilies, and pansies in Gilgit and Skardu. Most of the fruit trees are found in the residential areas owned by people. Apples, apricots, peaches, plums mulberry, walnuts and grapes are fully ripe from June to October and almonds from October to March. Apart from the fruit trees, many other tree species are also commonly found in the Gilgit-Skardu regions including deodar, pine, poplar, and willow. These floral species are an important habitat for the wildlife of the area and also

play a crucial role in landscaping and scenic beauty to the place.

The project area has a variety of trees, along the road (both sides) consisting of the following major species as given below in Table 28, 29 & 30.

Table 28: List of Prominent Fruit Trees Identified in Skardu and Gilgit District

| Sr. # | English Name | Scientific Name |
|-------|--------------|---|
| 1 | Apple | <i>Malus domestica/ Malus sylvestris/ Malus communis/ Pyrus malus</i> |
| 2 | Peach | <i>Prunus persica</i> |
| 3 | Pear | <i>Pyrus communis</i> |
| 4 | Almond | <i>Prunus dulcis</i> |
| 5 | Plum | <i>Prunus domestica</i> |
| 6 | Apricot | <i>Prunus armeniaca</i> |
| 7 | Grapes | <i>Vitis vinifera</i> |

Table 29: List of Wood Trees Identified in Skardu and Gilgit District

| Sr. # | English Name | Scientific Name |
|-------|------------------------------|---|
| 1 | Pine | <i>Pinus gerardiana/ Pinus pinea etc.</i> |
| 2 | Poplar | <i>Populus alba</i> |
| 3 | Deodar | <i>Cedrus deodara</i> |
| 4 | Willow | <i>Salix alba/ Salix babylonica</i> |
| 5 | Red Cedar | <i>Cedrella toona</i> |
| 6 | Seeta | <i>Artemesia scoparia</i> |
| 7 | Indian/Himalayan Juniper | <i>Juniperus macropoda</i> |
| 8 | Himalayan White Pine | <i>Pinus wallichiana</i> |
| 9 | Indian/West Himalayan Spruce | <i>Picea smithiana</i> |
| 10 | Turkestan Juniper | <i>Juniperus excelsa</i> |
| 11 | Himalayan Birch | <i>Betula utilis</i> |

Table 30: List of Shrubs, Herbs and Medicinal Plants Identified in Gilgit and Skardu District

| Sr. # | English Name | Scientific Name |
|-------------------------|-----------------|-----------------------------|
| Shrubs | | |
| 1 | Pencil cedar | <i>Juniperus communis</i> |
| 2 | Sea buckthorn | <i>Hippophaerhmnoides</i> |
| 3 | Berberry | <i>Berberislycium</i> |
| 4 | Tamarix | <i>Tamarixgallica</i> |
| 5 | Wild rose | <i>Rosa webbiana</i> |
| 6 | Goose berry | <i>Rebisalpestris</i> |
| Herbs | | |
| 1 | Trifolium | <i>Trifoliumrepens</i> |
| 2 | Dandelion | <i>Taraxacumofficinale</i> |
| 3 | Wild thyme | <i>Thymus serphyllum</i> |
| 4 | Berginia | <i>Berginiastracheyi</i> |
| 5 | Mullein | <i>Verbescumthapsus</i> |
| 6 | Wild strawberry | <i>Fragariavesca</i> |
| 7 | Ephedra | <i>Ephedra intermedia</i> |
| 8 | Cumin seed | <i>Cumiumcyminum</i> |
| 9 | Coriander | <i>Coriandrumsativum</i> |
| Medicinal Plants | | |
| 1 | Worm seed | <i>Artemisia aritime</i> |
| 2 | Stinging nettle | <i>Urticadioica</i> |
| 3 | Capper | <i>Capparisspinosa</i> |
| 4 | Safflower | <i>Carthamustinctorious</i> |
| 5 | Wild rue | <i>Peganumharmala</i> |
| 6 | Sea buckthorn | <i>Hippophaerhamnoides</i> |
| 7 | Curled sock | <i>Rumexhastatus</i> |
| 8 | Puncture wine | <i>Triblusteristris</i> |
| 9 | Thorn apple | <i>Datura stramonium</i> |
| 10 | Horse mint | <i>Menthasylvestris</i> |
| 11 | Chicory | <i>Cichoriumintybus</i> |

Source: WWF Gilgit Baltistan

A variety of fruit trees, wood trees, shrubs, herbs etc. prevalent in the project area are shown in the figures below.



Figure 29: Trees along the Jaglot-Skardu Road

4.3.1.1 Endangered Species of Flora

No endangered or vulnerable species of flora have been reported in the project area. However, it was reported that the species of *Haplophyllum juss* (a medicinal plant for fever treatment with vernacular/ English name as Plant of Mosquito) which was common in the past is now rare in Gilgit-Baltistan area. As a result of the improvement, widening and upgradation of the existing Jaglot-Skardu Road, a lot of species might get affected i.e. their number might reduce. So, more plantation of all kinds of trees including proper management/maintenance would be required in the project area.

4.3.2 Fauna

According to Wildlife Conservation Society, Pakistan, Gilgit-Baltistan is also an important stronghold for a range of spectacular and threatened wildlife species, most notably the endangered snow leopard (*Panthera uncia*), flare-horned Markhor (*Capra falconeri falconeri*), and woolly flying Squirrel (*Eupetaurus cinereus*). It is also an important stronghold for the Ladakh Urial,

Marco Polo sheep, musk deer, Asiatic black and Himalayan brown Bears, Himalayan lynx, leopard cat, otters, various threatened pheasants and a host of other wildlife species.

The wildlife of Skardu (Baltistan) consists of Markhor, Ibex, and Snow Leopard, including a variety of birds, namely Chakors, Partridges and Ducks. Limited shooting and hunting are allowed to protect the species by issuing permits by the local administration. The Himalayan Ibex, Himalayan Brown Bear, Red Fox, Golden Marmot, Grey Wolf, the Ladakh Urial, Tibetan blue Bears, wild horses, the Snow Leopard, and more than 124 local and migratory birds are living there. Birds include the Golden Eagle, Lammergeyer, Griffon Vulture, Laggard Falcon, Peregrine Falcon, Kestrel, Sparrow hawk and Snow cock. More than a hundred bird species have been reported around the city. These species include migratory birds for which GB region provides migratory routes as well as resident for nesting & breeding. The altitudinal migratory birds descend from higher altitudes during the winter months. Typical bird species found here include Snow Partridge (*Lerwa*), Chukar (*Alectoris chukar*), Common Quail (*Coturnix*), Common Hoopoe (*Upupa epops*), Common Swift (*Apus*), Rock Pigeon (*Columba livia*) and Common Kestrel (*Falco tinnunculus*).

4.3.2.1 Endangered Species of Fauna

No Endangered or Critically Endangered bird has been reported in the Gilgit City. The only bird included in the IUCN Red List is the European Roller (*Coracias garrulous*), which is listed as Near Threatened. Endangered animals include Musk Deer, Snow Leopard, Himalayan Ibex, Markhor, Woolly flying squirrel and Brown bear.

4.3.3 Protected Areas

A protected area is an area of land dedicated to the protection and maintenance of biological diversity of natural and associated cultural resources managed through legal or other effective means. Under Pakistan's current provincial and territorial legislation, three categories of protected areas have been established: Wildlife Sanctuaries, National Parks, and Game Reserves, but no such land exists in the near vicinity of project area. Deosai National Park declared as protected area is situated 50 km away from Skardu in the South that can be reached via kacha road.

4.4 Socio- Economic Environment

This provides baseline description regarding socio-economic and cultural environment of the project area. It includes information regarding population distribution, households, socio-economic status and livelihood activities, state of education and health facilities. Assessment of socio – economic condition of the project area, forming an important part of the base line environment, has been made on the basis of data collected from secondary source (desk review of available reports, documents etc.) and primary source (field survey).

A field survey was carried out to collect Socio-economic and cultural data

through questionnaire and focused group interviews with residents, shopkeepers, and village heads, land owners, pedestrians, farmers & laborers, school teachers/employees in the project area.

Most people living in the villages surrounding the project area are residents/locals, farmers, businessman, running their own shops/khokha/ laborers (skilled, semi-skilled and unskilled workers). Shalwar Kameez is the common dress for males and Shalwar Kameez with Chaddar for females. Shina is the common language spoken in the project area.

4.4.1 Demography

According to the 1998 census, the Gilgit population at the time was 0.88 million, projected rate of population growth in year 2013 is 1.301 million. The annual growth rate is 2.56%. The average household size is 8. According to the Planning and Development Department, Government of Gilgit-Baltistan, "Gilgit-Baltistan at a Glance, 2013" the literacy rate is 60% in 2013. Population information of the region is given below in the Table 31.

Table 31: Demographic Indicators of Gilgit-Baltistan

| Indicators | Value | Indicators | Value |
|--------------------------------------|---------|--|--------|
| Total Population | 214,848 | Population of Tehsil Guttary | 11,966 |
| Population of Tehsil Rundu | 34,375 | Population of Tehsil Municipal committee | 28,023 |
| Population of Tehsil Skardu | 55,215 | Urban Population | 13% |
| Population of Tehsil Shigar | 45,322 | Rural Population | 87% |
| Population of Tehsil Kharmang | 42,059 | Sex ratio (number of males over 100 females) at birth | 87 |

Source: Hyogo Framework for Action (HFA) District Report – Skardu 2014)

4.4.2 Education

According to the Report of Alif Ailaan Pakistan District Education Rankings 2015, Skardu is ranked 14 out of 148 Districts in terms of education. For facilities and infrastructure, the District is ranked 89 out of 148.

The people of Jaglot are tribal in nature and majority is Muslims. The population of Jaglot, including the suburbs, is approximately 45,000 in 3200 houses, with an education rate of 52%. The educational institutions and enrollment of students in GB are given below in Table 32.

Table 32: Education Status of Gilgit-Baltistan (2015)

| | Government | | Private | |
|----------|--------------|-----------|--------------|-----------|
| District | Institutions | Enrolment | Institutions | Enrolment |
| Gilgit | 345 | 43188 | 160 | 21070 |
| Skardu | 505 | 44588 | 116 | 18575 |

As a result of the survey conducted in the project area, 10 schools were found that were likely to be affected by the Proposed Project. Details are given below in Table 33.

Table 33: Government Schools Existing Along Both Sides of Jaglot-Skardu Road in District Skardu

| S. No. | Name of School, Village, Union Council | Direction of Roadside from Gilgit to Skardu | Approximate effected area | Enrolment | | | Likely effect on |
|--------------------------------|--|---|---------------------------|-----------|-------|-------|------------------------------|
| | | | | Boys | Girls | Total | |
| 1 | Girls Primary School, Baghardo Thang, Tormik | Right | 84 rft (running ft) | 59 | 92 | 151 | Boundary wall/building |
| 2 | Boys Primary School, Charee, Tormik | Left | 64 rft | 9 | 15 | 24 | Boundary wall |
| 3 | Girls Primary School, Charee, Tormik | Right | 300 sq. feet | 17 | 38 | 55 | Area including Boundary wall |
| 4 | Boys Middle School, Charee, Tormik | Right | 150 rft | 26 | 36 | 62 | Boundary wall |
| 5 | Boys Primary School, Tungus, Tormik | Right | 200 sq. feet | 25 | 19 | 44 | Area including Boundary wall |
| 6 | Boys Middle School, Taraq Thang, Ganji | Left | 1050 sq. feet | 90 | 84 | 174 | Area including Boundary wall |
| 7 | Boys High School, Talu, Ganji | Right | 200 sq. feet | 170 | 82 | 252 | Area including Boundary wall |
| 8 | Boys Primary School, Shungus, Stak | Right | 35 rft | 48 | 48 | 96 | Boundary wall |
| 9 | Boys Middle School, Hoto, Chunda | Right | 220 sq. feet | 142 | 125 | 267 | Area including Boundary wall |
| Gross Total of Students | | | | 586 | 539 | 1125 | |

Source: Deputy Director Education, Skardu

4.4.3 Literacy Rate

According to AKRSP JICA study, in 2009, literacy rate of Gilgit District was 72% (Male: 83%, Female: 61%). The 61% rate for female literacy seems highly encouraging in an area mainly governed by male domination and traditional mind-set towards female education. The literacy rate, for both men and women, in Gilgit is far better than the rest of the Districts of Gilgit-Baltistan. This is mainly because Gilgit, being the capital of Gilgit-Baltistan, offers wide-ranging education facilities and opportunities and the students from all others Districts come to the educational institutions here, particularly for higher education. The progression of literacy rate in the region with the passing of years is shown below in Table 34.

Table 34: Literacy Rate in Gilgit-Baltistan

| Year | Male | Female | Both |
|------|------|--------|------|
| 1981 | 24% | 3% | 15% |
| 1998 | 53% | 22% | 33% |
| 2008 | 57% | 27% | 43% |

Source: <http://mygilgit.com/gilgit-baltistan/education.php>

Article, *Pakistan Emergency Situational Analysis – Gilgit-Baltistan* by Al-Hasan systems Pvt. Ltd.

4.4.4 Religion

The population of Gilgit and Baltistan region is Muslim and is denominationally most diverse in the country. Among Muslims the region of Skardu is Shia-majority area while the region of Jaglot and the adjoining areas to Jaglot are considered as Sunni-Majority areas. Areas of Diamir and Astore Districts also have Sunni majorities. Ghanche District has a Noorbakhshi population, and Ghizar has an Ismaili majority. The populations in Hunza and Nagar Districts are composed of a mix of all of these sects. In 1948, the Shias and Ismailis constituted about 85% of the population. However, with the passage of time and the migration of people from other provinces and Federally Administered Tribal Areas to this region, especially to Skardu, has diluted the Shia and Ismaili majority areas to a great extent

4.4.5 Languages

Gilgit and Skardu is a multi-lingual area. More than six different languages are spoken in the region. Shina is the largest language spoken in the Districts of GB. Other languages include Balti, Burushaski, Khowar, Wakhi and Domaki. Shina is a Dardic language which is Indo Arian language. Balti language is spoken in Skardu, Shigar, Kharmang and Ghanche in Baltistan division. However, Urdu being National Language is spoken and is used in all the areas of the region. English language is used for education purposes and Arabic language serves the religious purposes of the people.

4.4.6 Health Facilities

There are 5 civil hospitals, 4 BHUs, 24 Dispensaries and 1 District Headquarters Hospital in Gilgit. The average distance of vicinity from health facility is 3.74 km, whereas the maximum distance is 20 km. The following Table gives details of health facilities that are available in the region.

Table 35: Healthcare Facilities Available in Gilgit-Baltistan Region

| Type of Health Facility | Gilgit-Baltistan | Gilgit |
|-------------------------------|------------------|--------|
| Combines Military Hospitals | 02 | 1 |
| District Headquarter Hospital | 05 | 1 |
| Civil Hospital | 21 | 4 |
| Rural Health Centers | 02 | 2 |
| Basic Health Units | 17 | 4 |
| Dispensaries | 118 | 30 |
| First Aid Posts | 133 | 26 |
| MNCH Centers | 91 | 7 |
| TB Leprosy Centers | 20 | 2 |

4.4.7 Land Acquisition:

Land Requirement has been estimated on following basis:

- Length of Road: 164 km
- Total Row Proposed: 24 m
- ROW Already Available: 9 m
- Balance Required: 15 m
- Land Required : 2,460, 000 m²

Utilities:

Following utilities exist along the Jaglot-Skardu Road:

Electric Poles and Lines: More than 90% of the electric poles are existing within the ROW so early planning and measures are required in order to replace these poles.

Water Channels (Privately Constructed): Water channels were made by the local people to facilitate their daily activities.

5 Public Consultation and Stakeholder Meeting

5.1 General

In this section generally, opinions of the people that may be affected by the project are described. Environmental Impact Assessment (EIA) of development projects is considered incomplete without involvement of potentially affected and interested public. Generally, the stakeholders include both, the group of people affected by the Project during its implementation and the organizations i.e. government departments or private entities concerned with socio-economic & environmental impact assessment of the Project. Field social survey is conducted to take the views of the project affected people through interviews/ consultation in the project area.

The objective of social survey conducted at the project location is to share information with stakeholder regarding the proposed project of improvement, widening & upgradation of Jaglot – Skardu Road and its socio-economic impact on the surrounding area. This is the way to provide an opportunity to the public of that area to share their valuable suggestions in the project design and implementation.

The other objective of the survey was to collect the socio-economic profile of the residents, share with them the impacts of the proposed project, and create awareness among them about the importance of proposed project and seeking their suggestions through interviews based on a questionnaire.

During the survey, effort was made to take maximum number of interviews as possible to gather wide range of information/ fair opinion of the majority of local affected people. The information was collected with respect to following:

- Loss of land/ agriculture land
- Loss of Structure (i.e. houses, schools, shops etc.)
- Loss of agriculture production/crops etc.
- Loss of trees and fruit trees
- Effect on livelihood
- Public facilities
- Opinions of local and affected people regarding project

5.2 Main Stakeholders

During the field survey, the different stakeholders identified included shopkeepers, local residents, hotel managers, farmers, teachers and masjid imams. All the respondents from the public as well as stakeholders/Government departments have different types of risks/dangers exposed to the construction of the proposed project road. The consultations with different categories are shown in Table 36 below:

Table 36: Consultations with Affected People/ Stakeholders

| Sr. No. | Category of PAP/ Stakeholders |
|---------|-------------------------------|
| 1 | Hotel Managers |
| 2 | Farmers |
| 3 | Shopkeepers |
| 4 | Teachers and Masjid Imams |
| 5 | Local Residents |
| 6 | Government Departments |

5.3 Issues Identified by Stakeholders

Generally, a number of issues were brought out by the stakeholders defined above. The broad issues expressed by each category of stakeholders are summarized in the Table 37, as under:

Table 37: Issues and Problems of Stakeholders

| Sr. No | Stakeholders | Issues/ Problems |
|--------|------------------------|---|
| 1 | Hotel Manager | Sewerage, Water Supply, Pollution, Dust and Noise |
| 2 | Farmers | Sewerage, Water Supply, Land compensation, Dust |
| 3 | Shopkeepers | Sewerage, Water Supply, Telephone facility, Compensation |
| 4 | Residents | Electricity, Sewerage, Water Supply, Telephone facility, Road safety awareness, |
| 5 | Imam Masjid | Sewerage, Water Supply, Traffic Congestion, movement of people |
| 6 | Government Departments | Detailed views/observations made during the stakeholder meetings are stated in section 1.4. |

Detailed particulars of PAP interviewed during the survey and the issues/apprehensions expressed by them are reported in Table 38, below:

Table 38: Survey Results

| Respondent's Profile | | | | | Major Concern Raised/ View |
|---|-------------|--------------------------|------------------------|----------------|---|
| Name | Family Size | Dwelling Type & Location | | Occupation | |
| | | Type | Location | | |
| Fidda Hussain s/o Hassan Muhammad | 10 | Shop | Astana Chungi | Shop keeper | The respondent was of the view that construction of road is necessary for travelling from Skardu to Gilgit. However, road must be equipped with other facilities like proper drainage system, as the traffic is being faced with severe problem of water accumulation during winter/ snow season. Pedestrian and animal crossing should also be provided along with proper signs affixed on the road. |
| Ali Muhammad s/o Ali Naqi | 14 | Shop | Gale bus stand, Ghamba | Shop keeper | Along with the construction of road other facilities like water supply to local people must be ensured. |
| M. Hassan s/o Ghluam Nabi | 14 | Shop | Gale bus stand, Ghamba | Shop keeper | In addition to water supply, health facilities to local people must be ensured. |
| Arshad Hussain s/o Ghluam Muhammad | 14 | Shop | Gale bus stand, Ghamba | Shop keeper | The road should be constructed with provision of improved/ additional facilities i.e. sewerage, water supply, electricity schools and hospitals and road safety signs. |
| Asif Ali s/o M. Jafar Ali | 14 | Shop | Gale bus stand, Ghamba | Shop keeper | The respondent was in favor of road and had a view that Jaglot – Skardu road would save time and reduce the prices of the commodities. However, other facilities like water supply must also be provided to local people. |
| Zahid Hussain s/o Imtiaz Hussain | 26 | Shop | Sadiqabad, Ghamba | Shop keeper | Government must provide prompt compensation in case of damage to property. |
| Qambar Ali s/o Haji Raheem | 12 | House | Hotto | Local resident | The road should be constructed but new road should be equipped with modern facilities like cat eyes, speed breakers and side barriers. Road safety must be ensured because people, on newly constructed road, drive with high speed which can cause accidents. Along with road, culverts must be provided and drainage of water must be ensured. |

| | | | | | |
|---|----|-------|-------|----------------|--|
| Sher Muhammad s/o Haji Raza Ali | 10 | House | Hotto | Local resident | The respondent had a view that besides provision of road safety, trauma centers need to be set up along road side must be ensured to provide first aid or treatment to the people injured during accidents. Along with road culverts must be provided and drainage of water must be ensured. |
| Haji Mehmood s/o Saifullah Muhmmad | 12 | House | Hotto | Local resident | Along with road culverts must be provided and drainage of water must be ensured. |
| Haji Ahsen s/o Haji Hassan | 11 | Shop | Hotto | Shop keeper | Road safety signs especially at sharp bends along with pedestrian/animal crossings need to be provided for the safe driving and avoiding accidents. |
| Muhammad Sadiq s/o Haji Ali | 13 | Shop | Hotto | Shop keeper | New road must be equipped with modern facilities like cat eyes, speed breakers and side barriers. |
| Ali Hussain s/o Rehmat Ullah | 15 | Shop | Hotto | Shop keeper | Apart from the facilities, it is also important to launch campaign among the people about road safety, traffic signs and safe driving techniques. |
| Akbar Ali s/o Muhammad Asghar | 12 | Farm | Hotto | Farmer | Land erosion because of the river must be controlled. Road safety signs must be provided alongside the road to stop vehicle drivers from over speeding. Proper warning signs for reducing speed at sharp bends/curves in mountain terrain needs to be installed which could be seen far away from the curve. |
| Haji Muhammad s/o Haji Hussain | 14 | Farm | Hotto | Farmer | Authorities must refrain from establishing a new ROW for the road. They must use the old road alignment. Also they should stop land erosion by adopting proper techniques because of river cutting. |
| Sajid Ali s/o Muhammad Ali | 25 | Farm | Hotto | Farmer | Along with new road facilities like water drainage, hospitals and educations centers must be established. The proposed improvement of road must be carried out on existing alignment to avoid damage to the property or keep the loss minimum level. |

| | | | | | |
|--|----|-------|--------------|----------------|--|
| Rehmat Ali s/o Wasil Khan | 18 | Shop | Kachura | Tailor | A proper system for drainage and water supply must be ensured along with the construction of road. Everyone adversely affected from the proposed construction must get due compensation from the government of Pakistan/GB without any delay and authorities must ensure that businesses of local people must not be affected during the construction of the road from Jaglot to Skardu. |
| Shareef s/o Saeed Khan | 12 | Farm | Shukar Ababd | Farmer | Road would only benefit people if their houses, lands and trees are not disturbed at all. |
| Farman Ali s/o Muhammad Kazim | 15 | Farm | Shukar Ababd | Farmer | The respondent was totally against the construction of road. He had a point of view that road construction is a total loss for community. Government promised but never provided any compensation before to the people affected due to earlier bridge projects and this time also the government would do the same. |
| Asghar Ali s/o Muhammad Muraad | 18 | Farm | Shukar Ababd | Farmer | Residential buildings, shops, agricultural lands and trees must not be damaged during construction of the road. There should not be any loss of property, agricultural output/fields and trees. |
| Abadul Raheem s/o Abdullah | 11 | House | Shukar Ababd | Local resident | The Government should pay attention to provide health, education and drinking water facilities first rather than constructing the road. |
| Fidda Muammad s/o Hussain Ali | 8 | Shop | Soordas | Shop keeper | Road project would be very beneficial. However, the local may lose their livelihood due to damage caused to their trees/fruit trees and property due to construction of the road. Authorities must pay compensation even before starting the construction. |
| Muhammad Nazir s/o Abdul Jalil | 5 | House | Soordas | Local resident | Road project would be very beneficial but along with the construction of the road, authorities must make efforts to educate/train people about the traffic and safety rules to avoid accidents. |
| Muhamamd Ameen s/o Haji Mirza Hussain | 7 | House | Serri | Local resident | The respondent was completely in favor of the road and had a view that road network is a lifeline for any country therefore this project must be completed at any cost. |

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|--|----|-------|----------|----------------|---|
| Mutahir Hussain s/o Haji Suleman | 22 | Farm | Serri | Farmer | Many issues will resolve but some issues that may arise include the destruction of water channels, houses, shops and agricultural lands in the vicinity of the project area. Therefore, proper measures must be taken to secure the property of the local people. |
| Manzoor Hussain s/o Rasool Muhammad | 11 | House | Serri | Local resident | Proper measures must be taken to protect existing water channels, houses, shops, agricultural land/crop and trees including the fruit trees. |
| Muhammad Ishaq s/o Sher Muhammad | 12 | Farm | Garbidas | Farmer | Livelihood of the people in Garbidas is totally dependent on crops and fruits. If new road destroys agricultural lands and fruit trees then a handsome amount in the form of compensation must be paid so that a new business can be started by the PAP to secure their livelihood. |
| Babar Ali s/o Fida Ali | 7 | House | Garbidas | Local resident | Along with the new road, new hospitals and education centers must be established. Road safety campaigns must be launched so to avoid frequent accidents. |
| Muhammad Essa s/o Hussain | 7 | Shop | Tungush | Shop keeper | The project must not be constructed unless and until authorities pay to PAP the adequate compensation for the loss of their property, lands, crops, and fruit/wood trees. |
| Muhammad Hassan s/o Hussain | 13 | Shop | Tungush | Shop keeper | PAP need payment/compensation due to loss/damage of their property. So, the authorities should pay first before the execution of the project. |
| Ahmad Hussain s/o Sultan Ali | 10 | House | Tungush | Local resident | Blasting must be stopped or must be done in a way where no damage can be inflicted to property and life of PAP. The warning notice needs to be issued to the public before blasting. Property must not be demolished during the construction of road. Contractor must follow the existing ROW for the road and must not include houses and water channels in the new ROW. |
| Ali Chou s/o Hassan | 22 | Hotel | Baghicha | Hotel Manager | The respondent was in favor of road construction but had a view that compensation must be paid according to present value of land and property and compensation for fruit trees must be between Rs 40,000 to Rs 100,000. |

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|---|----|----------------|-----------|--|---|
| Liaqat Ali s/o Ali Chou | 11 | Farm | Baghicha | Farmer | The respondent was in favor of road construction but had a view that compensation must be paid according to present value of land and property and trees/ fruit trees. The compensation of agricultural land and fruit trees are more than the ordinary land /wood trees. |
| Ahmad Khan s/o Ali Chou | 32 | Hotel | Baghicha | Hotel Owner | The respondent was in favor of road construction but had a view that compensation must be provided according to present value of land and property. The trees compensation must be made based on the age and output of the fruit trees. |
| Ismaeil s/o Abdullah | 16 | Farm | Baghicha | Farmer | The respondent was in favor of the road and had a view that road network is a lifeline for any country therefore this project must be completed at any cost. |
| Shujat Nasir Hussain s/o Ibrahim | 14 | Farm | Baghicha | Farmer | The respondent was in favor of the road and had a view that road network is a lifeline for any country therefore this project must be completed at any cost. |
| Ghulam Haider s/o Ghulam Ali | 36 | Shop | Dambo Das | Shop Keeper | Compensation must be according to the present price of the property. In Dambudaas one shop of about 3 marla area costs 14 lac but government pays only 2 lac price which is very less. Road construction is no doubt very important for our area but livelihood earning and income is more important than a road. |
| Sher Ali s/o Ghulam Ali | 36 | Shop and House | Dambo Das | Local resident and business owner | Road, hospitals, water supply and school structures are needed in the community. Also government must provide us with the compensation for our property that will come within the ROW. |
| Asim s/o Ali Muhammad | 9 | Shop and House | Dambo Das | Local resident, business owner & Imam masjid | Road, hospitals, water supply and school structures are needed in the community. Also government must provide us with the compensation for our property that will come within the ROW. Mosques must be reconstructed if gets damaged during the process of road construction. |

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|---|----|-------|------------|----------------|---|
| Mirza Muhammad s/o Ali Muhammad | 12 | Farm | Dambo Das | Farmer | Trees and animals are not safe because of the blasting. If any of the property of anyone in the area comes within the ROW then compensation according to the land revenue must be made to the stakeholder. |
| Tariq Husain s/o Hazrat Khan | 22 | Shop | Mehdi Abad | Shop Keeper | School staff is not available in our area. Hospitals facilities do not exist. In case of any emergency people can't reach to the nearest hospital in time because of very poor road condition. It is hoped that a new road when completed would help solve these problems. |
| Ahmad s/o Hassan | 10 | Shop | Tarikho | Shop keeper | Water supply, schools, hospitals and drainage are the major issues. Construction of road is important for the local people which may bring development and prosperity in the area. |
| Zulfiqar Ali s/o Ghulam Muhammad | 34 | Shop | Tarikho | Shop keeper | Respondent was of the view that construction of the project road should be followed by building/providing other facilities e.g. schools, hospitals, drinking water, cottage industries/employment etc. |
| Muhammad Bashir s/o Muhammad Ali | 9 | Shop | Tarikho | Shop keeper | The respondent expressed his apprehension about the compensation, which in many earlier cases is either delayed considerably or not paid so far. |
| Mubarik s/o Muhammad Ali | 13 | House | Tarikho | Local resident | Drinking water, education, health and transport are the basic necessities for life. If the construction of the road can provide all of these to the people then there is no issue in the construction of this road but if this deprives people from their lands and provides no benefit then this road must remain the same as it is in its present condition. He also added that if government is about to take their lands for road then their demand for adequate and prompt compensation must be met before the start of construction activities. |
| Haji Ghulam Abas s/o Ali Muhamad | 6 | Shop | Astak | Shop keeper | Jaglot-Skardu Road provides the linkage between Skardu and other cities of the country. Hence, it is important that Jaglot-Skardu road links the area with other via KKH. |

| | | | | | |
|---|----|-------|----------|---------------------------|---|
| Muhammad Raza s/o Haji Ali | 12 | Shop | Astak | Shop keeper | The road on completion would facilitate fast movement of people and goods in the area. |
| Amir Hayat s/o Khichou | 12 | House | Chamachu | Local resident | Hospital and school staff is missing. Road should at least make it easy for us to reach to the other destinations for utilizing these facilities. In addition to this, the construction of road may create river/land erosion and this may cause flooding of the area. This aspect should be looked into carefully and practical solution provided to tackle the problem. |
| Nasir Hussain s/o Nasir Hussain | 10 | House | Chamachu | Local resident | Hospital and school staff is missing. Road should at least make it easy for us to reach to the other destinations for utilizing these facilities. |
| Muhammad Sharif s/o Ghulam Akbar | 40 | Hotel | Shangus | Chairman & Business owner | Dust pollution due to Shangus crush plant is causing breathing problems especially for children. No medical aid is being provided to the people affected by the dust. Dust allergy is very common during monsoon among the people because of the crush plant. Fruits, especially cherry are badly affected by the dust. Other than this issue problems related to drinking water, sewerage system and education are very common in this area. |
| Muhammad Riaz s/o Dolat Shah | 15 | Hotel | Shangus | Hotel manager | <p>Following are the problems being faced by the locals.</p> <ul style="list-style-type: none"> ▪ Drinking water is not easily available ▪ Education institutes are working without staff ▪ Hospitals and dispensaries are non-existent in the area ▪ Drainage system has not been provided <p>Working of crush plants causing severe respiratory diseases must be removed from the populated areas. Furthermore, its construction near the populated areas should be stopped/banned in future during the construction of the road.</p> |

The photographs taken during the field survey/interviews with the PAP at different locations are exhibited as under:



Figure 30: Interviews with Public/Project Affected People at Mehdiabad



Figure 31: Interviews with PAP at Chamachu



Figure 32: Interviews with PAP at Astak



Figure 33: Interviews with PAP at Shungus



Figure 34: Interviews with PAP at Gamba



Figure 35: Interviews with PAP at Baghicha



Figure 36: Interview with PAP at Dambudaas

5.4 Stakeholder Meetings

The objective of the meeting with main stakeholder was to discuss and seek their opinion pertaining to environmental impacts in terms of damages and loss of property, land, structures, agricultural output, crops and livelihood as well as Government property/land, trees induced by the proposed project for improvement, widening & upgradation of Jaglot – Skardu Road.

Stakeholder meetings were arranged on 23rd July, 2018 with the help of District Commissioner Skardu. In the meetings, important information was shared regarding environmental and safety provisions in the project design and to protect the surrounding communities and safeguard the interest of PAP from the expected impacts of improvement and widening of the road construction.

Consultative Meetings held with the officials of various departments of Skardu in DC office are summarized in the following Table:

Table 39: Meeting with Stakeholder (PEPA)

| Sr. No | Date | Department | Name of official | Designation | Observation/ Comments |
|--------|---------------|--------------------------|------------------|----------------------------|--|
| 1 | July 23, 2018 | Forest Department Skardu | Mr. Sher Ali | Range Forest Officer (RFO) | <ul style="list-style-type: none"> Trees are the major contributors towards the beauty of the land as well as control of environmental pollution in Skardu. The fruit trees along the roadside mostly add to the landscape but are also important source of income/livelihood in the area. Therefore we must try to avoid cutting of these trees during the construction of road. There are numerous benefits to the people of Skardu region attached with the construction of road. Forest department of Skardu has divided the region into different Range Forest Officers (RFOs) and each RFO has the responsibility to administer his/her area. Value of Wood trees cut are measured with respect to its diameter while all the other trees in terms of their weight. There is no reserve forest in the District Skardu. However, an artificially made riverbed forest has been planted in Kachura near Skardu to protect the land from erosion of River Indus. Forest department has the following procedure to determine the cost of a tree: <ul style="list-style-type: none"> Cost of cutting down a tree Make pieces of the wooden log Weigh each of those pieces Determine the cost of the tree based on its weight. Revenue department of District Skardu has already fixed the prices of the trees according to the rules and regulations. Revenue department determines the cost on the basis of following categories of trees: <ul style="list-style-type: none"> Large size trees classified as Kallan Medium size trees as Miyana Small size trees Forest department is completely in favor of the construction of Jaglot to Skardu road. However, the contractor/consultant must give top priority to |

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|---|---------------|-------------------------------|--------------------|----------------------------|---|
| | | | | | <p>issue relating to tree removal/cutting along Jaglot-Skardu road to save the serene environment of Skardu region.</p> <ul style="list-style-type: none"> ▪ In this regard, the contractor/consultant should ensure to keep better co-ordination with the Forest Department and provision of timely information to them much before it is required to for cut down any tree so that the forest department official may take necessary steps to save that single tree or trees. ▪ It has been observed that in some areas tree have been cut down without giving any notice to forest department of Skardu which must be stopped in the future. |
| 2 | July 23, 2018 | Agriculture Department Skardu | Mr. Zahid Ali Khan | Deputy Director (DD) | <ul style="list-style-type: none"> ▪ Construction of road between Skardu and Jaglot will bring many opportunities on the development and employment to the people of region. ▪ Economy of the region would be improved, especially the crop import and export from and to the other regions of Pakistan would likely be increased. ▪ More goods between the two cities; Gilgit and Skardu, would be moved at a faster speed to the desired destination in less time. ▪ If any agricultural land gets disturbed by the construction of road then the owner of that land must be paid compensation in accordance with the criteria laid down by the Revenue & Land Department of Skardu and that too would be made immediately without any delay. |
| 3 | July 23, 2018 | Wildlife Department Skardu | Mr. Inayat Ali | Range Forest Officer (RFO) | <ul style="list-style-type: none"> ▪ Brown Bear, Snow Leopard and Markhor (National Animal of Pakistan) are the wild life animals that are commonly found in the vicinity of the Jaglot – Skardu road. ▪ Wildlife Department of Skardu has declared a region near Baghicha as Community Control Hunting (CCH) area where hunting of Markhor is banned/prohibited. After the declaration of CCH the number of Markhors in the region has started increasing. ▪ Mushknaba deer (Musk Deer) commonly known as <i>Qastoori Hiran</i> is among the endangered species and wildlife department is taking measures to prevent its killing in the region. |

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|---|---------------|-----------------------------------|---------------------|--------------------------|--|
| 4 | July 23, 2018 | Building & Road Department Skardu | Mr. Taj Muhammad | Executive Engineer (XEN) | <ul style="list-style-type: none"> Construction cost of building in Skardu differs with the type of construction e.g. RCC structures are costly than the structures that simply are made of blocks, new structures differ in their construction cost than the old ones. Construction cost in Skardu varies approximately from PKR 600 to PKR 3000 per square feet. Usually the old structures cost PKR 1500 per square foot and new structures cost PKR 3000 per square foot approximately. Sewerage system of the Skardu city is in the control of PWD department and needs to be improved. Many NGOs are working on the water supply systems in the villages along the road line. PWD after the construction of educational institutes hand them over to the education department and if any of the educational institute or school is expected to be damaged due to the construction of the road, the matter would directly be dealt by the Education Department of Skardu. |
| 5 | July 23, 2018 | Water & Power Department Skardu | Mr. Muhammad Qadeer | Executive Engineer (XEN) | <ul style="list-style-type: none"> Currently Skardu has 2 megawatt (MW) electricity to supply to the whole Skardu District. 7-8 hours of load shedding is observed inside Skardu city. Department of Water & Power is being faced many issues due to Jaglot-Skardu road construction. Among these issues, the most common is the damage/dismantling of electric poles along the roadside caused by the construction. These affected poles need to be relocated on urgent basis to avoid any uninterrupted power supply wherever space is available in the area/ across the River. In this connection, close coordination with the Department and provision of timely information regarding construction activities must be ensured, enabling the Department to take preventive measures beforehand and to avoid the electricity break down in the area. Electric poles are the government assets and these assets must be saved by the contractor at any cost. Electric supply is the need of the hour and the contractor has to take the |

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| | | | | | <p>responsibility to ensure that the electric supply to the people must not be disturbed during the construction phase.</p> <ul style="list-style-type: none"> ▪ If any of the electric pole gets damaged or needs to be relocated then an amount must be paid by the governing authority to the department of Water & Power Skardu on urgent basis. ▪ Compensation amount must include the cost of rehabilitation as well. |
| 6 | July 23, 2018 | Rep. of GB-EPA / Disaster Management Department Skardu | Mr. Shehzad Baig | Assistant Director (AD) | <p>AD NDMA informed the stakeholder meeting that GB-EPA, time and again, conveyed their comments to the District Administration as well as in the meeting with FWO. He delivered a letter to GB-EPA containing their comments on JSR project, a copy of which is attached as Annex-I. Almost all the observations made by GB-EPA have been covered in the Chapter 6 (Anticipated Environmental Impacts & Mitigation Measures) of the Report. However, the points are summarized as under:</p> <ul style="list-style-type: none"> ▪ Heavy machinery deployed for the construction of the road in the area, has reduced the bearing capacity of the Saper Shaheed Bridge. The bridge was able to bear more load in the past. However, now it could only take 16 tons of load which causes slow movement of goods. Alternative for the SS Bridge must be constructed on the priority basis. ▪ River Indus is causing soil erosion near the road alignment for which remedial measures must be taken on priority basis. ▪ For the operation of Hotu Crush Plant, excavation is carried out near the residential area, which lies in the vicinity of Shigri Kallan Nullah. The rain flood common in GB region in Nullah may cause soil erosion/mud sliding, resulting in settlement or destruction of nearby building. The contractor should direct the concerned staff to stop further excavation and retaining wall should be constructed on high priority basis to avoid soil erosion. |
| 7 | July 23, 2018 | Social Welfare Organization Skardu | Mr. Muhammad Bashir | Head | <ul style="list-style-type: none"> ▪ Road network is a life line to any region. ▪ In the region of Skardu NGOs are working for the welfare of communities on small and large basis. ▪ Construction of road can only be beneficial to the people if a campaign is launched to create awareness regarding road usage and safety among the people in the area. |
| 8 | July 23, 2018 | Mines & Mineral Department Skardu | Mr. Mohammad Ishaq | Representative | <ul style="list-style-type: none"> ▪ Stones like Termaline, Topaz, Carmine and Quartz are found in the mountains along with the road side. |

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| 9 | July 23, 2018 | Livestock Department Skardu | Dr. Fida Hussain | Deputy Director (DD) | <ul style="list-style-type: none"> ▪ Livestock such as horses, cows, bulls, yaks, sheep, donkey and goats are among the most commonly found animals in the region. ▪ Food for the livestock is dependent on the grass/green fields, herbs and shrubs which grow only on the rainwater and springs. Contractors need to ensure protection of these areas. ▪ Natural springs can possibly be affected by the waste material of roads, if not properly dumped. ▪ Movement of livestock along road may become a cause of accidents especially in winter when the animals (i.e. sheep, lambs, cows) descend from the mountain tops covered with snow in winter. Therefore there is a need to put speed breakers and road signs. Alternatively, pedestrian/animal crossings may be provided (if possible) along the road. ▪ Smoke emission because of fast moving vehicles will become a cause of breathing issues for animals. Hence, awareness campaign for maintaining vehicles in good condition must be initiated. |
| 10 | July 23, 2018 | Industrial Department Skardu | Mr. Ghulam Muhammad | Administration In-charge | <ul style="list-style-type: none"> ▪ Industry of Skardu will be among the top benefited departments with the construction of Jaglot – Skardu road. ▪ Industrial department has been working for the last 5years on the training of men and women to gain the skills in the field of: <ul style="list-style-type: none"> ○ Stitching ○ Mobile repairing ○ Plumbing ○ Building electrical works ▪ 400 to 500 people have been engaged in this program. ▪ Most commonly found industry in Skardu is: <ul style="list-style-type: none"> ○ Flour mill ○ Dry fruit industry ○ Marble fable ▪ The only issue with the road construction is the disturbance of water supply to these factories because many water channels would be disturbed or damaged during construction activities. This issue needs proper care and attention of the contractor. |

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|----|---------------|---------------------------|---------------------|----------------|---|
| 11 | July 23, 2018 | Revenue Department Skardu | Mr. Muhammad Hassan | Distt. Qanongo | <ul style="list-style-type: none"> ▪ Whole area of Skardu is divided into parts for the survey of the estimated land damages because of the construction the road. Areas of Ghamba, Hoto, Kachura, and SS Bridge are under one team and the whole Rondu division is under the responsibility of the second team. ▪ Each Survey team comprises of officials from the following departments: <ul style="list-style-type: none"> ○ Forest Department, Skardu ○ PWD, Skardu ○ Water & Power, Skardu ○ Frontier Works Organization (FWO), Contractor ○ National Highway Authority (NHA), Client ▪ Notified rate of land is dependent on the type and place of the land. ▪ Revenue Department has specified different rates for different trees: <ul style="list-style-type: none"> ○ Fruit Trees: <ul style="list-style-type: none"> ▪ PKR 400 for small plants ▪ PKR 4000 for small size trees ▪ PKR 5000 for medium size trees ▪ PKR 5500 for Large size trees ○ Wood Trees: <ul style="list-style-type: none"> ▪ PKR 300 for small plants ▪ PKR 3000 for small size trees ▪ PKR 3500 for medium size trees ▪ PKR 4000 for Large size trees ▪ Cost for an agricultural field is dependent on the type of the crop that grows on that specific land. ▪ According to the notification of 2015 the rate of land was: <ul style="list-style-type: none"> ○ PKR 0.4 million/kanal for agricultural land ○ PKR 0.3 million/kanal for barren land ▪ In the past Revenue Department has provided the compensation to the effected people and exchange of land has never been observed here. ▪ Revenue Department of Skardu is following Land Acquisition Act 1894. ▪ Cost of land is also dependent on the union wise distribution of the area as well; land price in Hoto is PKR 0.25 million per kanal while in Ghamba is PKR |
|----|---------------|---------------------------|---------------------|----------------|---|

| | | | | | |
|----|---------------|-----------------------------|----------------------------|----------------------|---|
| | | | | | <p>0.6 Million per kanal.</p> <ul style="list-style-type: none"> Land occupied by educational institutes is the property of education department of Skardu and it would be dealt according to the policies of the education department of Skardu. A committee comprising of members of various departments is constituted by the Deputy Commissioner Skardu to acquire land process for Gilgit Skardu road. The committee will ensure the measurement of land, structures, trees and water channels to be affected due to construction of Gilgit-Skardu Road. A list of the Committee members is attached as Annex-J. |
| 12 | July 23, 2018 | Education Department Skardu | Mr. Ghulam Mohammad Nasiri | Deputy Director (DD) | <ul style="list-style-type: none"> Education department of Skardu has never faced an issue which involves the shifting of schools because of road construction therefore the education department would assess the situation and prepare certain policies to deal with such a situation. Site/land for the construction of schools is provided by the District government. If any of the school structure gets damaged or needs to be relocated then it would become difficult for the education department to adjust the increasing number of students in schools. Education department would contact District government for further actions. |

Pictures of meetings with the concerned Departments are given below.



Figure 37: Meetings with the Concerned Departments

5.5 Grievance Redressal

This section describes mechanism to receive and facilitate the resolution of issues & grievances raised by the project affected people (PAP). The mechanism would allow PAP to appeal against adverse impacts/decisions or project activity which may be emanated from process of Land acquisition or compensation of other assets.

PAP would be fully informed of the project activities by the Contractor or his representative engineer executing the construction work. The main objective is to streamline the procedures for addressing complaints and socials problems, disputes (verbally or in writing) during project implementation or at the time of

compensation.

This mechanism thus is of significant importance as it facilitates the procedures thereby allowing PAP to safeguard their interest by preventing/ reducing risks/ damage to their properties and other livelihood sources which are likely to be adversely affected by project activities. In dealing with the disputes or concerns of the affected communities, the procedure followed would make the project authorities accountable to the affected people, enabling them to comprehend and resolve the issue/problems at local level in a transparent manner without hampering the project implementation process.

In order to provide an accessible mechanism to PAP for addressing their complaints and disputes, Grievance Redressal Committee (GRC) is proposed to be constituted in the project area. The GRC would comprise the following members:

- | | | |
|---------------------------------------|---|--------------------|
| ▪ Project Director (EALS), NHA | : | Chairman/ Convener |
| ▪ Environmental Engineer (AER) | : | Member |
| ▪ Environmental Engineer (Contractor) | : | Member |
| ▪ Representative of PAP | : | Member |

The PAP/ local community would register their complaints formally at the field level in PD office. The PD would forward the complaint to Environmental Engineer of the consultant/contractor, who would review the complaints and resolve the grievance as per provision of EMMP within a week. If the issue remains unresolved within the specified period, it may be referred to GRC for final decision. Alternatively, the PAP may approach the GRC directly for the resolution of their issue. The GRC may decide the disputed matter in a month's time. The decision of GRC must be in accordance with the provisions made and procedures laid down in the EMMP.

In case the Grievance Redressal System does not satisfy the PAP/ local community, they may take up the matter with higher authorities or relevant government department for its resolution. At this stage, if relief/ remedy are not provided for resolution of PAP's concerns, then they may submit their complaint to GB-EPA. The Grievance Redressal Mechanism is shown in the flow chart below:

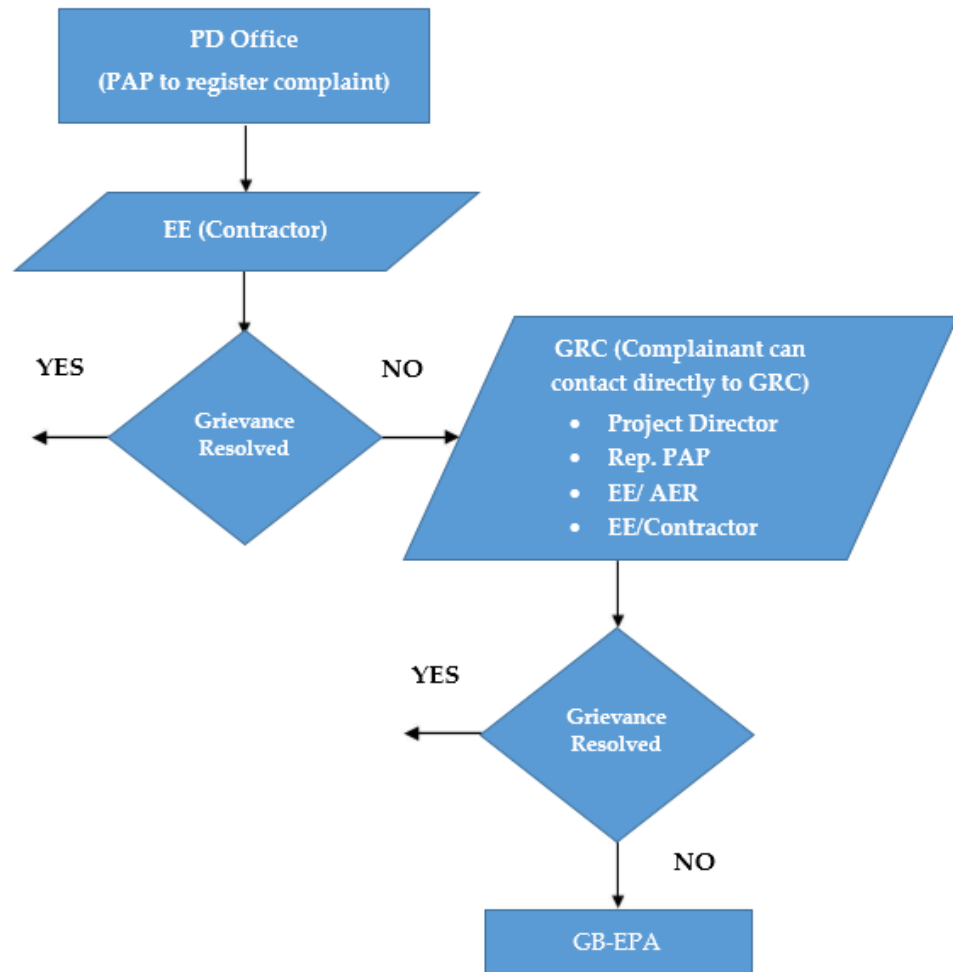


Figure 38: Flow Chart of Proposed Redressal Mechanism

6 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 General

This section presents potential impacts to be made on the baseline conditions of physical, biological and socio-economic environments in the project area of influence (PAI) during design, pre-construction, construction and operational phases of the proposed project. Based on the field survey/secondary source data, departmental consultations/ meetings, and relevant design/hydrology study, the impact analysis is carried out to assess the anticipated effects along with mitigation measures preventing/reducing the damages caused due to implementation of the project.

6.2 Description of Project Area of Influence (PAI)

Prior to identifying impact analysis of the proposed, it is considered imperative to define the PAI. The area under influence by the project activities, which have been used to identify environmental baseline information, impacts assessment and mitigation measures described briefly as under:

- PAI mainly refers to Right of Way (ROW) along the project alignment/ route where direct impacts are anticipated due to construction of the road and other structures. For this project, ROW of varying width w.r.t land use (9 m in hilly terrain and 12.3 m in other areas) is taken to construct road of 164 km long joining Jaglot to Skardu.

6.3 Environmental Impact Matrix

This matrix involves the screening of impacts on environment due to project activities in the preliminary stage for impact assessment. The proposed project would affect different types of environment in the region. The affected environment, either positive or negative in nature, is prepared in matrix form during construction and operation phases and is enlisted in Table 40 & 41 respectively with the description of impact activities, as under:

- **Negligible/ No Impact:** The impact which is insignificant or has negligible influence on natural and socio-economic environment.
- **Low Adverse Impact:** The impact which has a slight/little influence on the natural and socio-economic environment
- **Medium Adverse Impact:** The impact which is significant and can be eliminated or mitigated after applying the appropriate measures.
- **High Adverse Impact:** The impact which is greatly damaging and can be partially but not fully mitigated by applying the measures.

Table 40: Impact Assessment Matrix for Construction Phase

| Sr. No. | | Physical Environment | | | | | | Biological Environment | | | Socioeconomic Environment | | | | | | | |
|---------|---|----------------------|----------------------------|-----------|-------------|------------------------|----------------------|------------------------|------------|-----------------|-------------------------------------|--------------------------------|------------|------------------------|--------------------------|-------------------|-------------------------------------|--------------------|
| | | Topography | Soil Erosion/Contamination | Landscape | Air quality | Hydrology and Drainage | Ground Water Quality | Habitat Change | Vegetation | Animal Movement | Health & Safety for Public & Worker | Disruption of Public Utilities | Employment | Population Disturbance | Cultural/Religion Values | Noise & Vibration | Local Economics/Benefits to country | Traffic Management |
| 1. | Construction camps, workshops etc. | O | LA | O | LA | O | LA | O | O | LA | LA | O | LB | LA | O | LA | LB | O |
| 2. | Excavation operations | LA | LA | LA | MA | LA | O | LA | LA | LA | LA | LA | MB | LA | O | MA | LB | LA |
| 3. | Transportation of construction Material | O | LA | O | LA | LA | O | O | O | LA | LA | O | LB | LA | O | MA | LB | LA |
| 4. | Use of construction materials etc. | O | LA | O | LA | O | LA | O | O | O | LA | O | O | O | O | LA | LB | LA |
| 5. | Earthwork/concrete work operations | LA | LA | LA | LA | O | LA | LA | O | LA | LA | LA | MB | LA | LA | MA | MB | LA |
| 6. | Operation of Concrete Batch Plant | O | LA | LA | HA | O | O | O | O | O | LA | O | MB | O | O | MA | MB | O |
| 7. | Disposal of Waste water | O | MA | LA | MA | LA | LA | O | O | O | LA | O | MB | LA | O | MA | LB | O |
| 8. | Solid Waste Management | O | LA | LA | LA | LA | LA | O | O | O | LA | O | LB | O | O | O | O | O |
| 9. | Storage of oil/diesel | O | LA | O | LA | O | LA | O | O | O | LA | LA | LB | LA | O | O | O | O |

| | | | | |
|---------|------|----------------|------|----------------|
| Legend: | O = | No Impact | LA = | Low Adverse |
| | MA = | Medium Adverse | HA = | High Adverse |
| | LB = | Low Benefit | MB = | Medium Benefit |
| | HB = | High Benefit | | |

Table 41: Impact Assessment Matrix for Operational Phase

| Sr. No. | | Physical Environment | | | | | | Biological Environment | | | Socioeconomic Environment | | | | | | | |
|---------|---|----------------------|----------------------------|-----------|-------------|------------------------|----------------------|------------------------|------------|-----------------|-------------------------------------|--------------------------------|------------|------------------------|--------------------------|-------------------|-------------------------------------|--------------------|
| | | Topography | Soil Erosion/Contamination | Landscape | Air quality | Hydrology and Drainage | Ground Water Quality | Habitat Change | Vegetation | Animal Movement | Health & Safety for Public & Worker | Disruption of Public Utilities | Employment | Population Disturbance | Cultural/Religion Values | Noise & Vibration | Local Economics/Benefits to country | Traffic Management |
| 1. | Construction camps, workshops etc. | O | O | O | O | O | O | O | O | O | O | O | O | LA | O | O | LB | O |
| 2. | Excavation operations | LA/O | O | O | O | O | O | O | LA | O | O | O | O | LA | O | O | LB | LA |
| 3. | Transportation of construction Material | O | O | O | LA | O | O | O | O | O | LA | O | O | LA | O | LA | LB | LA |
| 4. | Use of construction materials etc. | O | LA | O | LA | O | O | O | O | O | LA | O | O | O | O | LA | LB | LA |
| 5. | Earthwork/concrete work operations | LA/O | O | O | O | O | O | O | O | O | LA | O | O | LA | O | LA | MB | LA |
| 6. | Operation of Concrete Batch Plant | O | O | O | LA | O | O | O | O | O | O | O | O | O | O | O | MB | O |
| 7. | Disposal of Waste water | O | LA | O | O | LA | O | O | O | O | O | O | O | LA | O | O | LB | O |
| 8. | Solid Waste Management | O | O | O | O | LA | O | O | O | O | LA | O | O | O | O | O | O | O |
| 9. | Storage of oil/diesel | O | O | O | O | O | O | O | O | O | LA | O | O | LA | O | O | O | O |

| | | | | |
|---------|------|----------------|------|----------------|
| Legend: | O = | No Impact | LA = | Low Adverse |
| | MA = | Medium Adverse | HA = | High Adverse |
| | LB = | Low Benefit | MB = | Medium Benefit |
| | HB = | High Benefit | | |

6.4 Impact Assessment in Pre-Construction/Design Stage

Impacts predicted during Pre-construction/Design Stage and the suggested mitigation measures are described here.

6.4.1 Topography

- The topography in the project area would change but only to some extent due to the construction of project related structures such as embankments, bridges, culverts, retaining walls etc.
- Visual changes to the topography would be of permanent but slightly adverse in nature and need no mitigation measures except that the project design must consider aesthetic concerns.

6.4.2 Land Acquisition

- Land acquisition for the improvement/widening of Jaglot-Skardu road is one of the major projects and the related impacts would cause disturbance for the local residents of the areas which may also include damages to their property/structures.
- The project area includes scattered population with most of the fertile land alongside the road and land acquisition would cause loss of livelihood/earnings (in terms of loss of trees/fruit trees) and thus may create socio-economic problems for the local communities.
- As per data received from FWO encroachment in terms of effected number of houses, shops, school buildings, trees, mosques etc. are found within the proposed ROW of the Jaglot-Skardu road. An area of land measuring 46.29 acres from RD 00+000 to RD 144+552 is estimated to be acquired. The details are as under:

Table 42: Land Acquisition for Improvement/Widening of J-S Road

| RD | Land | Area (Acres) | | *25% Un-foreseen | Trees | *25% Un-foreseen | Details |
|--------------------|------------------------|--------------|-------------------|------------------|-------|------------------|--|
| 00+000 to 144+552 | Private Land | Structures | Agricultural Land | 37.13 | 2163 | 2704 | Private Land includes shops, houses, small buildings, trees, mosques, etc. |
| | | 7.9 | 21.8 | | | | |
| 113+410 to 144+552 | Civil Land | 2.06 | | 2.58 | 2810 | 3512 | Civil Land includes boundary wall, road, civil buildings etc. |
| 133+400 to 144+000 | Un-designed Civil Land | 5.26 | | 6.58 | 0 | 0 | Un-designed land includes bridges, and unconstructed structures. |
| 42+000 to 144+552 | | 37.02 | | 46.29 | 4973 | 6216 | |

***Note:** Provision of 25% extra land is made due to the fact that the project involves widening of Jaglot – Skardu Road by cutting steep mountains through blasting. Since the project lies in the steep mountainous terrain, the widening operation will not result in homogeneous land recovery. In order to carryout smooth implementation of the project, unforeseen land acquisition of 25% is added along the project based on actual site requirement.

6.4.2.1 Mitigations

- Careful alignment and route selection in the project design to minimize the impacts by avoiding the land/residences of local people.
- Project affected people to be displaced needs adequate compensation & resettlement.
- Resettlement at new sites (if any), may bring improvement in quality of life of PAP, which may be considered to be a positive impact of the project.
- Adequate Compensation based on revenue record or market value for agriculture land and structures including shops, mosques etc.

6.4.3 Loss of Trees

A highly negative impact of permanent nature is to be caused by proposed project is the loss of trees within the ROW of the road alignment. Around 6319 trees including fruit trees and non-fruit trees are estimated to be cut or removed within the ROW of the proposed project road. The details are given as under:

Table 43: Total Trees within the ROW of the Project

| RD | Fruit Trees | Non-Fruit Trees | Sub Total | 25% Unforeseen |
|--------------------|-------------|-----------------|-----------|----------------|
| 00+000 to 42+000 | 665 | 210 | 875 | 1094 |
| 42+000 to 111+141 | 0 | 0 | 0 | 0 |
| 113+410 to 144+552 | 552 | 3628 | 4180 | 5225 |

The size and type of trees to be cut can be determined at the project execution stage.

6.4.3.1 Mitigations

- Ten saplings in lieu of loss of a tree of each type should be planted in Project Area.
- Adequate compensation for the loss of trees including fruit trees based on value to be determined by Revenue/Forest Department

should be paid to the land owner.

6.4.4 Other Settlements

As per data compiled by FWO, the other settlements include structures, shops, mosques, etc. found to be encroached within the ROW are summarized as under:

Table 44: Structures & People Affected by Project (RD 00+000 to RD 164+000)

| Structures | Number |
|--|--------|
| Houses | 325 |
| Estimated effected population (@ 10 persons per household) | 3250 |
| Shops | 171 |
| Estimated effected people (@ 2 persons per shop) | 342 |
| Mosques | 18 |
| Schools | 2 |
| Graveyards | 3 |
| Electric Poles | 656 |
| Telephone Poles | 39 |
| Others | 18 |

Details of structures/ land along-with RD is provided in the land utility folder and attached herewith at **Annex-K**.

List of settlements along the ROW is also provided at **Annex-L**.

6.4.4.1 Mitigations

- Efforts need to be made as much as possible to avoid the damages to the structures and other settlements etc. However, in case it is essentially required to remove the settlements, adequate compensation based on market value or the value estimated by the Revenue/ Building Department of Gilgit Baltistan, may be made to the affected people.

6.4.5 Changes in Land Value

- One of the positive impacts induced by the project is that the value of land and property is likely to be increased, especially in the villages where little or no infrastructure exists.
- Land owner would have a chance to sell their lands on higher rates and thus able to open new businesses for earning livelihood.

6.4.5.1 Mitigations

- Adequate compensation is provided to make up for the loss of agricultural crops of various types to Project Affected Persons (PAP).
- The worth of various crop types should be determined in consultation with revenue department on market price

6.4.6 Religious/Cultural Resources

- In the vicinity of project area there lies mosques, a shrine and a monument. By upgradation of Jaglot-Skardu Road it is anticipated that these religious and physical cultural resource may be affected.

6.4.6.1 Mitigations

- In design of road, road alignment must be adjusted keeping in view the location of religious and physical cultural resources.
- If unavoidable, a suitable alternate site must be allocated to the affected mosques, shrines and monuments.

6.4.7 Ecology

The proposed project would be constructed on an area which involves vegetation, river bed forest and water bodies. All of these would be adversely affected due to the construction of road and project, causing negative impact on the ecology of the region such as: the cutting of trees within of ROW of the road is a highly adverse impact to environment.

- As a result of land acquisition and land clearing loss of vegetation would occur.
- Solid waste that would generate as a result of construction is a potential threat to the blockage of water channels.

6.4.7.1 Mitigations

- The efficient technical design measures must be used to avoid or minimize removal of trees and flora.
- The alignment of project and its activities must be designed to minimize the effect on local fauna and biologically sensitive areas.

6.4.8 Social Disturbance

Due to the proposed land acquisition/agricultural fields, settlement of residents would be an issue, which would be causing inconvenience and disturbance to PAP. This impact is permanent and moderate adverse in

nature.

6.4.8.1 Mitigations

- Project alignment needs to be selected so as to avoid/minimize the relocation/disturbance to the local people.
- The provision of alternate routes must be planned to carry out daily activities of the locals. A survey has been conducted in the light of public consultation to get local's opinion on the project alignment and its activities. It would help in implementing accurate mitigation measures to facilitate locals with their livelihood.

6.4.9 Public Utilities

Due to the proposed project, public utilities affected may create disruption of public services and economics. This impact is however temporary and moderate adverse in nature. However, majority of locals rely on private water channels for water consumption which would be affected. The other public utilities including electric poles are inside the ROW and would be dismantled or damaged resulting in power shut down in the area.

6.4.9.1 Mitigations

- Water channels should be avoided/saved while preparing the alignment/design.
- The project alignment and boundary must incorporate technical design measures for public utilities.
- The public utilities need to be relocated before the commencement of work.
- It is worthwhile to mention that WAPDA in Public Consultation meeting informed that all existing electric poles along the road are proposed to be shifted across the River Indus.

6.4.10 Surface/ Ground Water Resources

The project has an extensive network of drainage channels/ Nullahs falling in to the Rivers Indus. Most of the water used by the local public is coming from Nullahs and springs. People have made their own water channels to guide water to their agricultural lands and to their residences. Construction of the proposed project would affect these water channels and water sources. As the proposed alignment is running along the rivers, 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.

6.4.10.1 Mitigations

- Proper design of bridges on Nullahs to accommodate design flows.
- 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
- Provision of sufficient sizes of drains to take design flows.
- Provision of box culverts to control flood damages and provision of safety of embankments in the road design.

6.5 Impact Assessment during Construction stage

Implementation of proposed project would involve the following construction activities:

- Construction Camps / Camp Sites
- Movement & Operation of construction machinery.
- Flora
- Fauna
- Construction yards
- Traffic management
- Waste
- Blasting
- Excavation
- Air Quality
- Ground / Surface water
- Noise
- Employment
- Health & Safety

The potential impacts during project implementation have been described as under:

6.5.1 Construction Camps / Camp Sites

- Construction of site camps would result in loss of vegetation and assets on selected land and dissatisfaction of rehabilitation measures. It would be a temporary low adverse impact.
- Noise level increase at a single location and associated disturbance to wildlife and human receptors.
- Temporary visual intrusion would occur.
- Waste generation/ chemical or oil slippage affecting water contamination quality.

6.5.1.1 Mitigations

- Efforts should be made at the design phase to minimize the cutting and removal of the existing trees and plants.
- Contractor must provide a rehabilitation & removal plan after completion of project.
- Waste management plan must be formulated and implemented.

Locations of construction Camps and Plants along with the layout maps showing solid and liquid waste disposal sites are provided at **Annex-M and Annex-N** respectively.

6.5.2 Movement & Operation of Construction Machinery

Construction Vehicles carrying plant machinery & materials are expected to generate substantial heavy traffic volume on Road. The operation of heavy traffic volume may induce adverse but temporary impacts and cause traffic issues in the project area devised as under:

6.5.2.1 Highly Adverse Impact

- Traffic congestion & delays may occur, hampering the movement of local vehicles and people and thus may cause inconvenience to daily life activities.
- There may be major safety risks/challenges including accidents on the project site. The impacts & accidents involving human/animal life (injuries/deaths) are highly adverse in nature.
- Heavy construction traffic especially carrying rock material may cause damage to existing public utilities especially to the electric poles. Damaging affect is considered to be highly adverse in nature.
- The vehicle operation in project area would result in loss of vegetation/trees, shrub/scrub forest etc. which is a highly adverse impact.

6.5.2.2 Moderately Adverse Impact

Moderately adverse environmental pollution/degradation of following types may occur due to heavy traffic movement and the operation of construction machinery in the project area:

- Dust pollution & smoke emission damaging the air quality.
- Noise Pollution causing inconvenience and disturbance to local people.
- Loss of trees, shrubs, vegetation etc. as a result of constructing road using extended ROW for widening of the Jaglot-Skardu road.

6.5.2.3 Positive Impact

- Construction machinery operators and vehicle drivers would be hired from the local communities which would provide

livelihood to many families.

6.5.2.4 Mitigations

- To avoid traffic jams and delays, traffic management plan must be formulated during design phase needs to be implemented during construction.
- Signage/sign posts labeled with Urdu/local language needs to be displayed throughout the project site and advertised in all the localities to avoid/control the traffic safety issues and accidents in the project area.
- Provision of pedestrian/animal crossings alongside road needs to be made to avoid accidents.
- Axle load limit should be strictly followed by the construction vehicles to control damage to existing structures. Violation in this regard should be penalized in accordance to fine stipulated in the regulations.
- Environmental degradation due to dust or other air pollutants need to be controlled/mitigated by sprinkling water on the road section used by construction vehicles.
- As a rule, the construction vehicle operation needs to be conducted in day time.
- Low noise making construction machinery/vehicles as well as noise proof sheer block at densely populated site in the project area need to be used to mitigate/control noise pollution and avoid disturbance to the local population.
- Plantation of saplings (1 cut tree to be replaced with 10 trees) along with grass and other vegetation should be undertaken to recover the loss in the project area. Similarly, the loss of agricultural crops within the construction route/ROW needs to be properly compensated.
- Movement of construction vehicle & equipment needs to be halted or minimized to the extent possibly during wet weather conditions/ snow to control/avoid damage to top soil and surface water contamination with the slurry/mud as well as accidents.

6.5.3 Flora

- Trees are the most important member of an ecosystem which improves environment in variety of ways. About 6319 trees belonging to different species and different age groups will be cut during the construction of Jaglot-Skardu Road.
- Installment of Camp sites and camp yards involves removal of trees and vegetation.
- Widening of road would require extra area for road construction, thereby

damaging more trees on the sides of the existing road.

- 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.
- During the construction activities, the contractor's workers may damage the vegetation including trees.

6.5.3.1 Mitigations

- An awareness campaign targeted on the neighborhood farmers shall be run to popularize the planting of trees.
- The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes. They will use the paths and tracks for movement and will not be allowed to trespass through farmlands.
- Construction vehicles, equipment and machinery will remain confined within their designated areas of movement.
- Camp sites and asphalt plants would be established on waste/barren land rather than on forested or agriculturally productive land.

6.5.4 Fauna

- Due to the implementation of the proposed Road Project, the free movement of fauna would be disturbed.
- Reptiles like snakes and lizards, living in the holes or underground shall either get killed or move to the adjacent areas.
- Another impact on the fauna of the project area would be the probable dislocation of the birds/animals from their nests and burrows.
- Trees provide resting and nesting places to the animals and birds, so the cutting of the trees would have negative affect on fauna.
- 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.

6.5.4.1 Mitigations

- Plantation of large number of trees along the proposed road project to regain the ecological habitat.
- New and good condition machinery with minimum noise should be utilized in construction.
- Contractor must ensure that there should be no hunting and trapping of animal would be carried out during construction.
- Borrow pits must be fenced properly so that no animal would fall

into them.

6.5.5 Construction yards

Construction yards/camps need to be constructed at the site away from residential areas to store equipment, machinery/ vehicles & their parking, batch mixing, fabrication etc. Map showing the location of construction camps established on the project site is attached. The potential significant environmental impacts of both moderately negative & positive in nature expected to be induced during these activities are identified as follows:

- Clearing of sites for construction yards/camps would entail loss of land, trees, landscape/vegetation, crops & other habitats
- Movement of construction material/machinery, vehicles/equipment etc. including power generation & crush, concrete and asphaltic plant operation would create air and noise pollution
- Development of residential facilities for workers may cause local drainage/ sewage/ sanitation (if any in the project area), & oil spillage problems and pose threat to surface water quality and resulting in health issues
- Improper storage of waste material as a result of batch mixing, prefabrication, shuttering may also induce health, water supply, hygienic problems including spread of contagious diseases.

6.5.5.1 Mitigations

- Mitigation measures for loss of land, trees, vegetation, and agricultural production are the same as mentioned above during preconstruction stage. However, a plan determining the establishment of number of construction camps in project area to assess their need should be prepared to make adequate compensation for the environmental losses (as indicated above).
- The plan needs to include removal & rehabilitation of site upon completion by reinstating temporary facilities (if any) to pre-existing/original conditions particularly at places in project area.
- Plan should also envisage proposals for landscaping in areas of high vegetation value which warrant site-specific landscape restoration measures.
- Deterioration of air & noise quality due to operation of construction plants, movement of construction machinery, equipment, material storage etc. can be controlled if handled carefully by the contractor. The dust in air can be reduced/ mitigated by perpetually sprinkling water in & around the camp sites and also with the use of anti-dust instruments.
- Emissions from power generators and construction machinery

are important point sources at the construction sites. Proper maintenance and repair of power generation plant needs to be carried out to minimize the hazardous emissions.

- The burning of solid waste in the open or the camps as well should be strictly banned.
- Allowing for the existing drainage/sewerage facilities, if any, new system needs to be properly designed to avoid contamination of surface/drinking water and thus avoid health hazards & safety issues.
- Proper waste disposal facilities including treatment need to be provided near/at the site camps to protect the local dwellers and other habitat from health risks including threats of epidemic diseases.

6.5.6 Traffic Management

- During the construction phase of the project, improper traffic management may cause inconvenience to the people passing through the project area. This impact is temporary and moderate adverse in nature.
- Movement of kettle on the road would be risk factor in causing road side accidents.
- No alternative route is available except the JSR. Hence, the traffic to/ from Jaglot has to be stopped during construction hours for a minimum period of time (15 minutes approximately).

6.5.6.1 Mitigations

- Proper traffic management plan has been formulated (**Annex-O**) and announced before the construction work to avoid traffic jams/public inconvenience and accidents.
- Security personnel on both directions are deployed to ensure safety both for humans and vehicles.
- Appropriate measures are being taken such as use of whistles, cones etc. for proper coordination to avoid traffic jams for long hours as well as accidents.
- To avoid any severe damage/ accident during night time, construction work is only done during day time.
- Pedestrian/animal crossing with labor proper sign in local language may be provided/ installed.

6.5.7 Waste

Different kind of waste would be generated during construction activities. Moreover, construction waste would also be generated during construction phase. The waste if not collected and disposed of properly would affect the aesthetics of area. It would lead to generation of odor, attracting disease

vectors and contamination to water bodies.

6.5.7.1 Mitigations

Proper waste management plan shall be designed including provision of waste collection vehicles/equipment, defining collection frequencies, allocating personnel and defining safe disposal options/sites.

6.5.8 Blasting

- Blasting may be required for the generation of construction material.
- Blasting may be required where the alignment is passing through the hills. Blasting would generate short-term impacts such as noise and vibration, and long-term potential impacts on land stability.

6.5.8.1 Mitigations

- To minimize the short term impacts, control blasting should take place at predetermined times notified to communities and local residents.
- To minimize the long term impacts, geological and soil conditions should be carefully assessed to avoid blasting in sensitive locations.

6.5.9 Excavation & Embankment construction

- For the clearance of ROW excavation is required which would result in the change of edaphic characteristics of soil. Loss of fertile top soil may affect adversely on the agriculture of the project area.
- Excavation near the residential area may result in settlement of houses.
- Machinery engaged in excavation would cause noise and air pollution.
- Excavation may result in the formation of ditches resulting in water accumulation during rains and floods.
- Change in landscape/Topography as a result of constructing embankment/ retaining walls.

6.5.9.1 Mitigations

- Burrow pits would not be located on agricultural land unless unavoidable.
- Contractor needs approval before excavation.
- Removed top soil needs to be stored and used for filling/ rehabilitation process elsewhere with the approval of local authorities.
- Use of water sprinklers or other anti-dust devices would help in minimizing the dust/air pollution.
- To avoid water accumulation excavated areas must be treated so

to provide a water removal mechanism.

- Mitigation measures for adverse impact of embankments on landscaping & retaining walls to avoid erosion.

6.5.10 Air Quality

Air quality would be affected by 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 sources of air pollution during the construction phase would be:

- Transport of construction material and other construction activities on site that generate dust pollution and ambient air quality.
- Quarry areas that generate dust during crushing & air pollutants.
- Asphalt plants that generate toxic emissions which contain un-burnt Carbon particles, Sulfur compounds and dust from batch preparation.
- Respiratory diseases in a locality due to dust of crush plants.

The above mentioned impacts are however high adverse in nature but limited to project construction phase only.

6.5.10.1 Mitigations

- Regular water sprinkling on the Site should be carried out to suppress excessive dust emission.
- Concrete mixing plants, Asphalt plant and crush plants should be installed away from the local communities.
- Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases.

6.5.11 Ground / Surface water

- Surface water might get contaminated due to the disposal of construction waste generated during the construction activity. This contamination of water may not only disturb the aquatic life (especially in the lakes of the area) but this would also cause health issue for the local people.
- The slippage of various materials/chemicals like fuel, lubricant and other oil products, which are used during the construction phase, may contaminate water, if they are not handled properly.
- During construction phase the sanitary waste generated from the labor's camps has a potential to contaminate water as well. This impact is temporary and minor negative in nature.

6.5.11.1 Mitigations

- Construction yards and the storage yards for construction machinery must be located away from the water bodies &

populated areas.

- Water usage for construction purposes must be in such a way that water availability and supply to nearby communities remains unaffected.
- Regular water quality monitoring must be ensured.
- Waste must be collected, stored and dumped to allocated sites.
- Contractor to ensure that construction debris or waste must not find its way to water channels or resources.

6.5.12 Noise

- Noise is a by-product of human activity, and area of exposure increases as function of mobility and construction activities.
- On a project site main source of noise pollution is the heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers asphalt plants and other equipment.
- Noise generation is likely to affect/damage the noise receptors especially in the area of 10 – 50 m from the construction site.

6.5.12.1 Mitigations

- Heavy machinery hammers and drills should not be used during the night without prior approval of the Client.
- All the work equipment must be provided with a silencer to control the noise emission.
- If applicable make use of low noise machinery for construction activities must be ensured.
- Batching plants crush plants and asphalt mixing plants must be installed away from the populated areas.
- Worker should be provided with ear plugs and other safety equipment.

6.5.13 Employment

Proposed project is 164 km in length, connecting Jaglot to Skardu and involves extensive construction works. This would create a large number of job vacancies for the laborers and semi-skilled local people and allow them to enhance their skills and capacities. This is a moderate positive impact.

6.5.14 Health & Safety

- The construction activities and vehicular movement at construction sites may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment.
- Chances of water contamination because of construction activities.
- The Labor works with different transmittable diseases may cause spread

out of those diseases in the local residents.

- The borrow pit areas located near the residential areas may cause accident for the people moving near to those areas and dust emission by the operation of crush plants can be a cause of breathing problems for locals.
- Health risks and workers safety problems may result at the workplace if the working conditions provide unsafe and/or unfavorable working environment due to storage, handling and transport of hazardous construction material.

6.5.14.1 Mitigations

- Efforts must be made to create awareness of road safety among the drivers operating heavy machinery and the local people using road for travelling.
- Borrow areas should be fenced and banned for the movement of locals and crush plants must be provided with anti-dust equipment to control dust emission.
- Setting up speed limits in close consultation with the local traffic management staff.
- Timely public notification on planned construction works.
- Providing basic medical training to specified work staff and basic medical service and supplies to workers.
- Source of water should be selected carefully so that it may not disturb public water availability.
- Batching plants must be installed away from the populated areas.
- Discharge of any waste to the upstream of the public water supply must be restricted and water quality must be monitored on regular basis.

6.6 Impact Assessment during Operation & Maintenance Stage

Anticipated impacts assessed during operation and maintenance of the proposed Jaglot-Skardu Road project along with their mitigation measures are identified as under:

- Road traffic flow on road would emit air pollutant & dust in the air resulting in deterioration of air quality along the road, which is expected to increase with the increase of road traffic. This being high adverse impact, has Global Warming potential due to generation of more Greenhouse gas emission
- Traffic volume would also result in degradation of noise quality along the road. The noise level would be higher with the increase in traffic flow. The worsening noise quality especially at day time has potentially high negative impact and therefore can be a cause of concern for the migratory birds.

- 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 would move.
- Project is not likely to entail significant adverse impact on flora during its O&M stage. It is anticipated that growth of saplings, planted in lieu of the trees to be removed in the proposed project, may be adversely affected due to lack of maintenance.
- The Project activities would 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 medium adverse but permanent in nature.
- No major adverse impact on surface and drinking water is anticipated during the operational phase. However, occasional oil spills due to any road accident may be risky to the traffic flow/pedestrians.
- More landslides/ flood during rains and snow would hinder the movement of traffic on road. Landslide has the capability of blocking whole road for days.

6.6.1 Mitigation Measures

- Roadside green areas need to be developed through vegetation & plantation which should be properly looked after & maintained in terms of their water requirement & nutrients during operation stage. This would have positive impacts in terms of improved air quality by reducing greenhouse gas emissions/hazardous air pollutants and better landscaping
- Plantation of new trees and their proper maintenance in the long run would serve as a noise barrier to the surroundings and thus help mitigating the higher noise level.
- Improved landscaping in the areas where possible along the road would have significant impact on roadside bird habitats including migratory birds and to other animals as well.
- Proper maintenance of newly planted saplings in place of trees cut in the project area would also have positive impact on flora & fauna.
- An awareness campaign needs to be launched to get the population/ farmers in the project area to familiarize with the benefits of tree plantation.
- Provision of animal/ livestock crossings, sign boards and speed limits after appropriate distances to facilitate their movement.
- Emergency plan should be prepared and made readily available to meet accidents involving oil spills.

- Equipment /Machinery for the removal of the debris must be present in the vicinity of the areas prone to land slide. Emergency contact number of the concern authorities must be advertised so that in any emergency situation the affected people may contact at that number for seeking help.

7 ENVIRONMENT MANAGEMENT AND MONITORING PLAN (EMMP)

7.1 General

This section demonstrates the work plan for managing and monitoring identified social and environmental impacts on the proposed project during construction and operation phase. The work plan aim towards the formulation of EMMP on the basis of Environmental Impacts. EMMP is prepared by fulfilling the requirements of Pak EPA. The scope of EMMP is to;

- Provide the impacts associated with construction and operational phase along with the mitigation measures.
- Prepare monitoring plan for all the possible impacts on environment due to Jaglot-Skardu Road project
- Measures to mitigate the potential impacts.
- Exhibit the responsibilities of major stakeholders involved in project which are Project Proponent, Contractor, and Design & Supervision Consultant (In this project DSC is defined as CPM-Finite JV) and other contractual staff.
- Suggesting construction and project activities which are favorable for sustainable environment.
- Outlining the key standards, references, activities and their frequencies to ensure smooth transition of project activities and operation

7.2 Institutional Responsibilities

Following functionaries would be involved in the implementation of EMP:

- EALS (NHA)
- Environmental Engineer (EE)/ Officer of Design & Supervision Consultant (In this project, DSC is defined as CPM- Finite JV)
- Environmental Engineer/Officer of Construction Contractor (CC) The duties/responsibilities of the functionaries are discussed below (organogram provided in Figure 40):

7.2.1 Responsibilities of NHA

NHA (EALS) would be responsible for the environmental management and supervisory affairs during the construction phase of the proposed Project. Director Environment (EALS) would designate the Deputy Director Environment who would 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 implementation of the environmental process
- Preparing training materials and implementing programs;
- Maintaining interfaces with the other lined departments/ stakeholders; and
- Reporting to the GB-EPA on status of EMP implementation.

7.2.2 Responsibilities of Design & Supervision Consultant

Environmental Engineer/specialist of DSC would oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP as mentioned in the contract documents. The Environmental Engineer/Specialist would also provide assistance to the Contractor's Staff to implement EMP. Package wise Site Specific Environmental Management Plan (SSEMP) would be prepared by the contractor under the supervision of EE of DSC. The SSEMP would be approved by the EALS (NHA). EE of DSC would provide guidance to the contractor's EE for implementing each of the activity as given in EMP. EE of DSC would be responsible for record keeping providing instruction through the "Resident Engineer (RE)" for corrective actions and would ensure the compliance of various statutory and legislative requirements. EE would maintain the close coordination with the contractor and EALS for successful implementation with environmental safeguard measures. However, overall responsibilities of EE of DSC 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 are no contractor's activities, active construction work sites, completed areas of work sites as well as ancillary sites such as borrow 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; and preparing and submitting monthly and quarterly environmental progress/compliance reports to the EALS.

7.2.3 Responsibilities of Contractor

Site Environmental Engineer of contractor would carry out the implementation of the mitigation measures at construction site. Contractor would 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 would prepare SSEMP, monitoring plan, traffic control/diversion plan, and asphalt and batching plant area plans and would submit all the plans to the EE of DSC.
- EE of contractor would be responsible for the implementation of EMP and to take effective measures against corrective actions plan;
- EE would prepare the compliance reports as per schedule and would submit it to the DSC;
- Provision of proper Personal Protective Equipment (PPEs) to the workers that includes breathing equipment in overalls in dust and blasting areas, face shields for flying particles, helmets, goggles, footwear in areas where expose to falling, rolling and piercing objects, hearing protection like ear buds and ear muffs in noisy areas and train them for their proper use; and
- EE would conduct the environmental and health & safety trainings to the workers /labor.

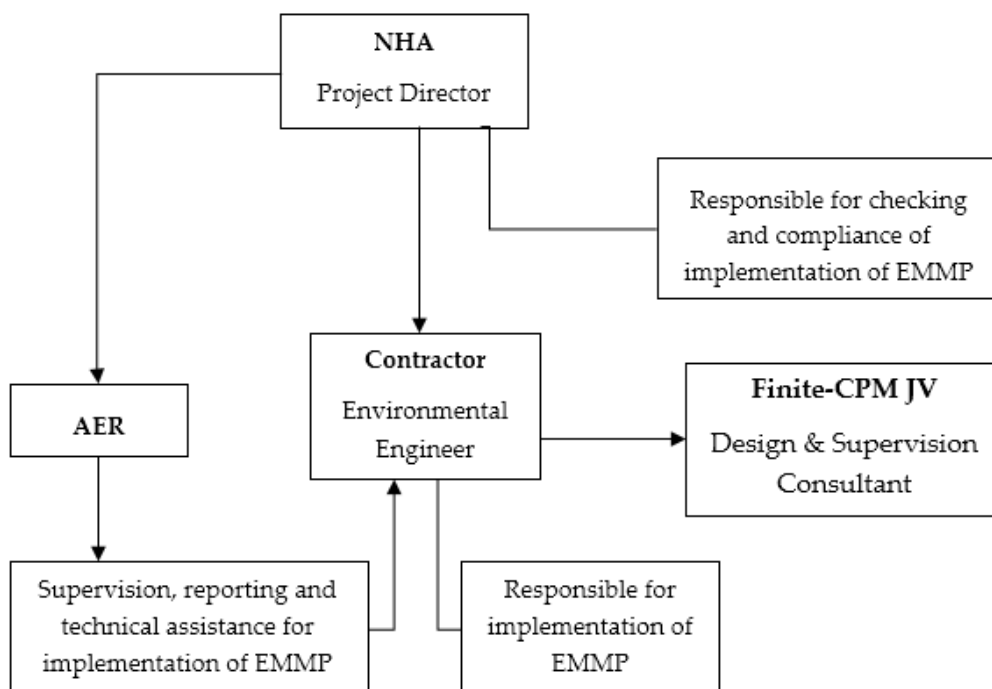


Figure 39: Organizational Set-Up for Implementation of EMMP

7.3 Non-Compliance of the EMMP

The implementation of the proposed SSEMP involves inputs from various functionaries as discussed earlier. The contractor would be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which would be part of the contract documents. The provision of the environmental mitigation cost would be made in the total cost of project, for which contractor would 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) would 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 would be given 48 hours to rectify the problem and to restore the environment. If restoration is done satisfactorily during this period, no further actions would be taken. If it is not done during this period, NHA (EALS) would 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 would be a financial penalty up to 1% of the contract value in addition to the cost for restoration activities.

7.4 Description of Environment Management and Monitoring Plan

Every project envisages certain impacts to the environment which must be controlled to have a safer and sustainable environment. Jaglot-Skardu Road Project would affect the physical, socio-economic, biological, air, noise, water and waste disposal of region. The study has been performed to control and monitor the impacts in every possible manner. It results in preparing an EMMP plan to monitor impacts identified during design, construction and operational stages in chapter 6; as highlighted in Tables 45, 46, and 47 respectively.

Table 45: Environmental Management and Monitoring Plan (Design/Preconstruction Stage)

| Environmental Management Plan (Design/Preconstruction stage) | | | | |
|--|---------------------------------|---|---|---|
| Sr. No. | Aspect | Project Impact | Mitigation Measures | Responsibility |
| 1 | Topography & Landscaping | Visual changes to Topography/landscape, Soil erosion | Adequate aesthetic feature close to original perceptions of landscaping need to be incorporated in the project design to ensure minimum visual changes, degradation of topography/soil erosion | CC, DSC |
| 2 | Land acquisition and clearing | Loss of land, structure, crops, trees and resettlement | The road alignment is so designed to avoid and minimize acquisition of agricultural, residential and commercial land as well as cutting/removal of trees. Resettlement of Project Affected People (PAP) if required should be undertaken in consultation with relevant authorities/displaced persons. However, adequate compensation based on Revenue Department's estimate or market price needs to be paid for loss of land, structure or shops & crops | GB Land Department, CC, DSC |
| 3 | Resettlement issues | Relocation of household, commercial buildings | The road is designed in such a manner that resettlement and tree removal should be avoided. | CC, DSC, NHA |
| 4 | Social Disturbance | Impediments in Exit/Entry and movement for the residents and loss of commercial activities. | The road design should provide alternate pathways to the extent possible to allow the movement of the locals unhindered and ensure their privacy. | CC, DSC |
| 5 | Safety Concerns | Traffic hazard in the construction and operation stages | Traffic management plan/ safety measures, if any, may be prepared in this stage to ensure protection in construction/operation stage. | CC & local Traffic Police Authority |
| 6 | Physical and Cultural resources | Difficulty for people to visit public places; mosques, shrines, schools and graveyards. | Involve technical design features to avoid any interference with public places and provide some alternate walk ways and pedestrian/animal crossings to the locals to get to these places. | CC, DSC |
| 7 | Ecology | Loss of vegetation, tree/shrubs & destruction of natural water channels | Effective technical design for the protection of natural water channels and springs must be prepared and road alignment must be designed to preserve vegetation /shrubs to the extent possible. | CC, DSC |
| 8 | Flora (Vegetation) | Cutting of trees falling within the ROW | Alignment needs to be properly designed in such a manner that minimum trees should be cut /removed. Ten saplings need to be planted in place of removal of each tree. | CC, NHA under oversight of forest department, GB. |

Table 46: Environmental Management and Monitoring Plan (Construction Stage)

| Environmental Management Plan (Construction Stage) | | | | |
|---|--------------------------------------|---|--|------------------|
| S. No | Aspect | Project Impact and Removal of Structures/ houses | Mitigation Measures | Responsibility |
| 1 | Land acquisition and resettlement | Acquisition of private land may result in change in topography & creating economic and social issue unease among the residents of Project area | Compensation cost to be paid to the PAP/land owner by providing sufficient budget in project cost. The affected persons need to be resettled if required, as per agreement with the contractor. | NHA, Contractor |
| 2 | Site clearing, leveling/tree cutting | Loss of vegetation, soil erosion & instability of the soil and surface water pollution | <ul style="list-style-type: none"> Assure minimum disturbance to native flora during construction especially where the asphalt, batching and crushing plants would be installed. Install temporary erosion control features. Use machinery for clearing without damaging avoidable plants and trees. | CC, DSC, NHA/AER |
| 3 | Material extraction and excavation | <ul style="list-style-type: none"> Change in landscape may occur by quarry and borrow areas Air pollution Formation of ditches and water accumulation. Flooding & damaging residential area near Nullah. Damage to top soil in agricultural fields. | <ul style="list-style-type: none"> Select environmentally sound source for material extraction and restore the whole area after excavation. Control blasting must be done at predetermined site. Excavation (especially in Nullah near Hoto) needs to be stopped to prevent the potential threat of flood to nearby residential area. Use water sprinklers or other anti-dust devices to avoid dust emission & air pollutants. Refill the excavated areas with the other materials so that the issue of ditches and water accumulation can be avoided. Construction of retaining walls to avoid flooding of residential area near Nullah. Inform farmers/cultivators in advance for crop/tree cutting. Proper disposal of top soil material in consultation with local authorities for filling the area where required. Proper signs and staff deployment for traffic management on the road during movement of construction machinery. | CC, DSC, NHA/AER |

| | | | | |
|---|---|---|---|---|
| 4 | Use of heavy machinery for construction | <ul style="list-style-type: none"> Existing soil structure may get damaged Noise pollution | <ul style="list-style-type: none"> Water sprinkling before movement of heavy machinery. Less use of heavy machinery. Regular maintenance of the construction machines. Noise control instruments must be installed on the machines. Well maintained and QC passed equipment must be used for the construction works. | DSC, NHA/AER, CC, Local Traffic Police Authority. |
| 5 | Vehicular movement | <ul style="list-style-type: none"> Hindrance in the movement of local transport. Time delays. Traffic safety concerns. | <ul style="list-style-type: none"> Effective traffic management plan must be enforced with the help of local traffic police. Use of properly designed sign boards. Local traffic control police staff must be present at all times for the smooth handling and controlling of traffic flow during construction. CC staff must also be trained about controlling and guiding the traffic flow. Create awareness among the locals residing alongside/near the road to take precautionary measures during movement of heavy machinery/equipment | DSC, NHA/AER, CC & Local traffic police |
| 4 | Air Quality | Dust emission from construction machinery and crush plants as well as vehicular traffic and air pollutants emission from asphaltic plants | <ul style="list-style-type: none"> Dust control should be conducted by equipping asphalt, hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions. Water should be sprinkled regularly across road tracks at the construction site. It should be ensured that haul trucks carrying asphalt concrete mix and/or aggregate fill materials are kept covered with tarpaulin to help contain construction material being transported between sites. The NEQS and Pak EPA standards should be enforced by undertaking air/water/noise quality tests where ever applicable to gaseous emissions generated due to construction vehicles, equipment and machinery. Construction workers should be properly equipped with dust masks. Establishing Concrete plants away from residential and green areas. | CC, DSC, Police department and NHA/AER |
| 5 | Noise | Noise Pollution due to increased vehicular mobility and construction activities | <ul style="list-style-type: none"> Low noise making machinery/plants equipped with suitable in-built damping techniques and appropriate muffling devices need to be utilized along with noise proof sheer block at densely populated sites in project area. | CC, DSC, Police Department and NHA/AER |

| | | | | |
|---|--|--|---|--------------------|
| | | | <ul style="list-style-type: none"> Noisy works should be confined to normal working hours in day time. The construction workers should be equipped with suitable hearing protection like ear muffs. Concrete mixing should be located away from residential areas. | |
| 6 | Flora (Vegetation) & Fauna | Cutting of road trees fruit trees, crop and other vegetation due to Project related construction activities | <ul style="list-style-type: none"> Plantation of indigenous siblings/species of trees along with grass/vegetation needs to be undertaken. Compensation cost to be paid to land owner for the cut down wooden trees/ fruit trees, crop etc. Construction traffic needs to be organized at day time only to avoid obstruction to the movement of animals/ birds as well as to the nesting/breeding of migratory birds. | NHA/AER |
| 7 | Disposal of Construction waste disposal material (wastewater, oil, chemical, solid waste etc.) | <ul style="list-style-type: none"> Contamination of soil and surface water sources Unhygienic conditions resulting in health hazards | <ul style="list-style-type: none"> Wastewater effluent from contractor's workshop/ camp sites and equipment of washing yards needs to be passed through gravel/sand beds to remove oil/grease contaminants before discharging into natural streams/ water channels. Training of the work force in the storage and handling of materials and chemicals that can potentially cause soil contamination. Solid waste generated during construction and in camp sites needs to be properly treated and safely disposed of at demarcated waste disposal sites. Avoid blockage of water channels/ during disposal of solid waste/ waste water. | CC & DSC, NHA/AER |
| 8 | Running Crush plants and Asphalt plants | <ul style="list-style-type: none"> Dust emission causing health problems. Effect on the bio-physical environment. | <ul style="list-style-type: none"> Install crush plants away from the public areas. Make use of water sprinklers and anti-dust equipment. Mixers and other equipment use in asphalt plants must be sealed and must be according to the existing standards. Provide masks to project personnel's/ staff working in plants. | CC & DSC, NHA/AER |
| 9 | Surface water and Natural water channels | Contaminated by the drainage/sewage & disposal of construction waste to be caused by construction/labor camps | <ul style="list-style-type: none"> The surface water reserves and natural water channels need to be adequately protected from any source of contamination such as the construction, sanitation and oily spillage that may degrade its potable quality. | CC, DSC, & NHA/AER |

| | | | | |
|----|---|---|--|---|
| | | | <ul style="list-style-type: none"> The solid waste should be disposed of at designated landfill sites to maintain/sustain the water quality for domestic requirements and avoid blockage of natural stream and water channels. | |
| 10 | Public Utilities | Relocation of certain utilities in such as electric poles in ROW | <ul style="list-style-type: none"> Close coordination with the concerned departments (i.e. PWD of Gilgit-Baltistan) to evade inconvenience to the residents of the project area. Electric poles removed would be re-located/ re-installed at suitable sites along the river banks/ mountain side to avoid land slide, soil erosion. If so, proper retaining structures to strengthen the site need to be constructed | CC, DSC, Police Department, NHA/AER |
| 11 | Risk of infectious diseases/health and safety hazards | <ul style="list-style-type: none"> Spread of infectious diseases by construction workers Unhygienic conditions/health hazards to be caused during asphaltic concrete pavement work Accidents to workers at the construction site | <ul style="list-style-type: none"> The contractor should be well informed about the risk of infectious diseases such as HIV/AIDS and hepatitis. Workers should be trained in construction & safety procedures and all workers should be equipped with hard boots, helmets, gloves and protective masks. Persons other than workers involved in operation of asphaltic plant should not be allowed to enter in such premises Proper training of the contractor's staff for handling / providing the emergency & first aid during an un-towards incidents. | Training Professional for environmental management and monitoring hired by CC, DSC, and NHA |

Table 47: Environmental Management and Monitoring Plan (Operation Stage)

| Environmental Management Plan (Operation stage) | | | | |
|---|----------------------------|--|---|--|
| S. No | Aspect | Project Impact | Mitigation Measures | Responsibility |
| 1 | Vehicular movement | <ul style="list-style-type: none"> Possibility of road accidents | <ul style="list-style-type: none"> Enforcement of speed limits. Installation of road signs and enforcement of penalties to the violators. Provision of designated pedestrian/ animal cramping if possible | Local Traffic police, O&M staff of Contractor/NHA |
| 2 | Road Maintenance | <ul style="list-style-type: none"> Use of heavy machinery. Oil spillage may occur which may result in severe accidents. Land Slide/ road. | <ul style="list-style-type: none"> Road administration project must be formed. Emergency response team must be organized for any accident, road blockage due to land/ road slide. To avoid oil spilling, a departmental coordination must be ensured. Avoid using heavy machinery. | District governments of Gilgit & Skardu, Maintenance Contractor & NHA maintenance |
| 3 | Flora (Vegetation) & Fauna | <ul style="list-style-type: none"> Newly installed saplings can be damaged. Accidents may occur because of the moving animals on the road. | <ul style="list-style-type: none"> Saplings installed in place of cut trees must be protected and maintained throughout all the construction and maintenance phases of the project. Awareness campaigns to educate people must be organized by the Contractor District Administration governments local NGO's. Road safety signs must be properly maintained. Speed limits must be ensured. High speed vehicles must be monitored to avoid accidents on roads especially near crowded communities. | District governments of Gilgit & Skardu, Forest/Agricultural departments Maintenance Contractor & NGO's, NHA |
| 2 | Noise | Noise increase due to increase in traffic volume | <ul style="list-style-type: none"> Setting up of a system to monitor noise level in the project area in accordance with NEQS. Or noise testing at least three times a year. Provision of adequate noise barriers such as hedges and indigenous tree species. The height of boundary walls of sensitive receptors such as schools, college and any hospital can be raised along the project corridor. | NHA, Maintenance Contractor |

| | | | | |
|---|---|--|--|---|
| 3 | Air Quality | Air Pollution caused by increased traffic levels. | Setting up a system to monitor air quality in the Project Area in accordance with NEQS. Or quality testing must be carried out three times a year. Help identifying special measures for the owners and occupants of the affected premises to grow hedges and vegetation to reduce air pollution. | NHA, local Councilors, Maintenance contractor |
| 4 | Surface water and Natural water resources | As a result improvement of widening of road, movement of people through this area would increase which results in the construction of new hotels and commercial businesses. This movement of people can pollute the natural water sources of the area by throwing garbage and other waste products in the way of natural water channels. | The locals and commuters shall be well informed of risks involved in throwing garbage into water bodies. Sign boards shall be used to warn people against waste disposal in water along with launching awareness campaigns by different NGO's on the issue. | Maintenance contractor, NHA and Tourism departments with help of NGO's |

7.5 Environmental Management and Monitoring Plan

A framework for Environmental Management and Monitoring Plan (EMMP) is prepared for all the potential environmental impacts induced due to implementation of various project activities. The EMMP is formulated for impacts in three stages of project implementation i.e. during pre-construction, construction and operational stages. The methodology followed for preparing the EMMP consists of the following guidelines:

- Suggesting mitigation/protection measures for identified impacts for the project activity/ environmental component,
- Recommending mitigation and compensation measures for the potential impacts identified,
- Evolving a mechanism for monitoring the proposed mitigation measures,
- Estimating cost required for implementation of mitigation and monitoring measures, and
- Identifying responsibilities of various agencies involved in the project for implementation and monitoring of mitigation measures.

7.6 Environmental Monitoring Plan & Mitigation Cost

Monitoring of environmental impacts and mitigation measures during construction and operation stages form an essential part of the EMMP. The objectives are:

- Monitor changes in the environment during various stages of the project execution with respect to baseline conditions; and
- Manage environmental issues arising from construction works through compliance of mitigation measures.
- Develop a monitoring mechanism to assess the performance of mitigation measures proposed for potential impacts.

Environmental monitoring plan thus formulated along with mitigation cost, is presented as under:

Table 48: EMMP Cost of Jaglot-Skardu Road (Divided into 4 Sections for Construction Purpose)

| Sr. No. | Particulars | Basis | Responsibility | Cost (Rs.) |
|------------------|---|---|----------------|--------------------|
| 1 | Four (4) dedicated Environmental Engineer/specialist | 4 person for 48 months @Rs100,000 (4*48*100000) | CC | 19,200,000 |
| 2 | Provision of Personal Protective Equipment (PPE) i.e. Safety & Health Equipment For Workers | Provision for 600 employees : dust masks, safety, shoes, gloves, plugs, safety helmets and safety jackets (Hi Vis) and provision of dust bins, warning tap, safety cones, safety sign boards and water sprinkling | CC | 19,000,000 |
| 3 | Environmental Monitoring Cost | | | |
| | Dust Pollution | Sprinkling water@Rs10000/section twice/day/year(4*10000*4*365) | CC | 58,400,000 |
| | Air quality | 12samples@ 50000/sample for 4 years construction & one year operation | CC | 600,000 |
| | Noise level | Procurement of 4 noise meters @ 50000 each for construction/operation of project (4years) | CC | 100,000 |
| | Water quality | Surface water, ground water, Turbidity (12 samples for 4 years @ 35000 per sample) | CC | 420,000 |
| 4 | Soil contamination | Arrangements for careful collection and disposal of solid wastes, oils, lubricants etc.(L.S) | CC | 16,000,000 |
| Sub Total | | | | 113,720,000 |

Plantation

About 6319 plants, vegetation etc. consisting of wood & fruit trees, herbs shrubs, weeds etc. falling within ROW of the proposed Jaglot-Skardu road would likely to be removed during construction. It is proposed to plant saplings of similar type as per following criteria in the median of the road after its improvement.

- One tree removed, equivalent to Plantation of 10 saplings alongside the road and its surroundings
- Cost of 63190 (estimated) plants@ Rs. 100 per plant including 1500 maintenance cost for 3 years = **Rs 101,104,000**

Environmental Training Plan/cost

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 and
 - 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.

- How the activities of staff/labors, the materials/products they use/create, can damage the environment.
- The contractor's staff and labors should be aware of basic sanitation and health care process, how to handle these issues, how to avoid malaria & other contagious diseases, basic & site specific hazards and
- How to use person protection equipment, safety devices, firefighting tools, and first aid kit and make arrangements for evacuation during emergency/fire.

The environmental training cost is provided in lump sum at **Rs. 1,000,000. Cost**

Summary

Overall cost relating to Mitigation & Monitoring including plantation and training is summarized as under:

| | |
|--------------------------------|------------------------|
| Environmental Monitoring Cost: | Rs. 113,720,000 |
| Plantation of trees: | Rs. 101,104,000 |
| Environmental Training: | Rs. 1,000,000 |
| Total: | Rs. 215,824,000 |
| Contingencies @ 5%: | Rs. 10,791,200 |
| Grand Total: | Rs. 226,615,200 |

Say **Rs. 226.5 million**

Note: EMMP Cost excludes the Compensation cost on account of loss/damage to property, house/shops, other structures trees, fruit trees, crops etc. during construction of the project

7.7 Implementation of EMMP

Following personnel/staff would be involved in the implementation of EMMP:

- Project Director or Representative from NHA to oversee the EMMP implementation
- Environmental Engineer from Supervision Consultant
- Site Environmental Engineer of the Contractor

Contractor would be liable under the contract to implement the suggested mitigation measures in the EMMP. The EMMP is required to be included as a clause in the contract documents.

Organizational setup for implementation of EMMP is presented in Figure 40, below:

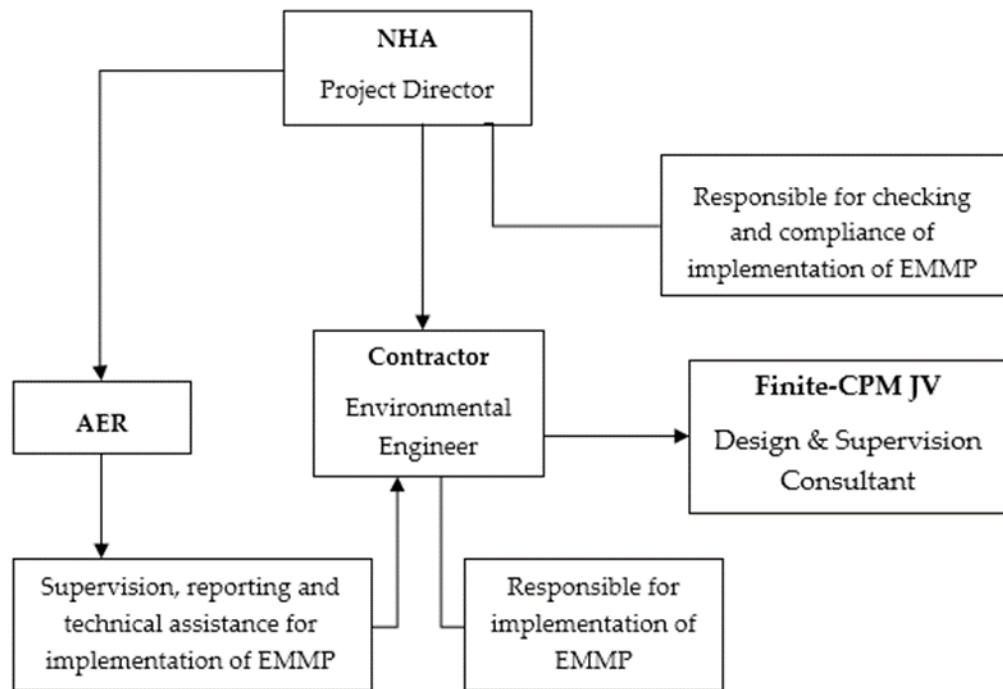


Figure 40: Organizational Chart for Implementation of EMMP

Reporting Mechanism

Progress reporting related to environmental activities would be the responsibility of the Environmental Engineer of CC. Environmental Engineer would also be responsible for submitting a monthly EMMP compliance report for the project to the GB-EPA.

Non-Compliance of the EMMP

Contractor would be mainly responsible for ensuring implementation of the mitigation measures proposed in the EMMP, which should form part of the contract documents. The provision of the environmental mitigation cost needs to be made in the total cost of project. However, if the contractor fails to comply with the implementation of EMMP and submission of the monthly compliance reports, action deems necessary under the agreement would be taken against him accordingly.

8 Conclusion and Recommendations

8.1 Conclusion

Environmental Impact Assessment (EIA) study was conducted for the proposed project for upgradation, widening and improvement of existing Jaglot- Skardu Road. In the process of EIA preparation standard procedures were followed which included field surveys, verification and assessment of anticipated impacts together with their mitigation measures. NHA and other concerned departments/officials of District Skardu were also contacted for consultations and collection of data. The EIA study of the proposed project reveals that there are no highly significant adverse impacts on natural, physical and socio-economic environments associated with the implementation of project along the entire route of 164 km long Jaglot- Skardu road. The major impacts are concluded as under:

- The project route alignment does not fall within any environmentally-sensitive, protected area, or biological corridor of the country.
- Road alignment of 30 km falls in hilly region & 84 km falls in mountainous region within the very hard mountainous terrain. At places the widening of road can only be possible through considerable rock cutting or constructing tunnel through the mountains to avoid sharp bends or raising embankment on river side.
- Approximately 3500 people are likely to be affected including their houses, shops, school walls, and other structures that are found within existing ROW/road width which would be damaged/dismantled or adversely affected.
- Potential Impacts on water quality, air pollution and disturbance to households due to noise, dust & air pollutants emanating from vehicle/machineries movements and asphaltic plant are mostly associated with construction activities and would adversely affect the environment. The impacts are temporary in nature and can be managed and mitigated.
- Around 6319 trees/plants including fruit trees, herbs/shrubs etc. are likely to be removed from within the existing road width in the project area.
- Local residents affected due to earlier projects complained that they have yet to be paid compensation for damage inflicted to their property as well as loss of their livelihood. It was pointed out with concern that this time too they would face the same problem (i.e. non-payment of compensation or delayed payment).
- Social issues such as safety of workers and general public, security and social problems including disturbance to local residents, risk of communicable diseases are of temporary nature and can be controlled.
- Local dwellers living in the project area of influence have expressed their concern regarding disturbance to their movement and intrusion to their

privacy especially that of women which needs to be properly addressed and taken care of during project execution.

- An EMMP has been provided which clearly outline impacts and mitigation measures and defined monitoring responsibilities to monitor the activities on the part of environmental engineers/specialists from CC in close coordination/supervision of PD/EALS (NHA)/AER.
- In overall conclusion, the proposed project is considered environment friendly and would least affect adversely the existing social and ecosystem of project areas.

8.2 Recommendations

Construction of the proposed road should proceed once the potential environmental and social impacts associated with it, are reduced/controlled through the implementation of appropriate mitigation measures suggested in the EIA Study including EMMP for the project.

This opinion is based on the nature and extent of the proposed project, the local level of disturbance predicted because of the construction and operation of the proposed project, the findings of this EIA and the understanding of the level of significance of potential impacts.

Major recommendations are summarized as under:

- Prompt compensation should be paid to PAP. Moreover, the payment in earlier cases should be expedited on top priority basis, so that their confidence could be restored in concerned authorities.
- Temporary labor camps should be developed to the nearby location and should be facilitated with proper drainage facilities.
- Soil contamination, water contamination, air pollution and high noise levels should be controlled with the use of good engineering practices/techniques as well as the machinery/plant equipped with the controlling devices using different laboratory tests for water, air and noise quality during construction and operation of the project.
- Contractor should develop plan such as traffic management, arrange pedestrian/animal crossings, solid waste management, and material management etc. before starting the construction activities.
- Contractor should adopt some suitable timing for the construction activities so as to cause the least disturbance to the local community particularly women considering their movement during peak hours.
- EMMP is required to implement in letter and spirit the measures suggested to avoid damage to local dwellers near the project site.
- Adequate provision in the project/budget should be made for the amount to be incurred on EMMP/EMP.

- Training should be provided to professional staff at site for promoting a better understanding and knowledge/awareness regarding environmental quality standards as well as for the use of devices to carry out the air, noise and water quality tests during the construction and operation of the project.

ANNEX-A

References

- NHA & FWO Contract Document for Improvement, Upgradation and Widening of Jaglot – Skardu Road (164km) on Supplier/ buyer Credit Basis (EPC/ Turnkey) – June, **2017**
- NHA: PC-1 for Improvement, Widening and Upgradation of Jaglot-Skardu Road Project – **2015-16**
- Gilgit Baltistan Environmental Protection Act – **2015**
- USAID: Pakistan Emergency Situational Analysis – A Profile of District Gilgit - November, **2012**
- Pakistan Environmental Protection Agency Review of IEE/ EIA Regulations, - **2000**
- Pakistan Environmental Protection Act - **1997**

ANNEX-B

Survey Questionnaire

| | |
|------------|--|
| Serial No. | |
| Date: | |

Name of Surveyor : _____

Name of Respondent : _____

CNIC of Respondent : _____

Contact No. of Respondent : _____

Survey Area : _____

Address : _____

Father's Name : _____

Age : _____

Education : _____

Respondent's status in family

| | | |
|------------------------|--------------------|--------------------|
| a. Head of household | b. Housewife | c. Retired Elderly |
| d. A child of the Head | e. Others(specify) | |

Family Members (a. Total_____persons, b. Adult men_____persons)

Total Earning Members _

Q.1. Type of Dwelling

| | | |
|---------------------|------------------------|-------------|
| a. Concrete (Pacca) | b. Bricks (Semi Pacca) | c. Tin-shed |
| d. Special Material | e. Others(specify) | |

Q.2. Name of Tehsil, Village, Union Council

Q.3. Languages spoken in the Village

| | | | |
|---|---------------------|------------------|----------|
| Q.4. Accessibility from main road to village | | | |
| a. Kacha Track | b. Un metalled Road | c. Metalled Road | d. Other |

Q.5. Distance from tarred road to Village: _____ km

Q.6. Approximate population of the village: _____

Q.7. Total number of houses: _____

Q.8. Educational facilities available in the village

| Sr. No. | Facilities | Yes | No | Govt. | Private | Boys | Girls | Co-Education |
|---------|---------------------|-----|----|-------|---------|------|-------|--------------|
| 1. | Primary School | | | | | | | |
| 2. | Middle School | | | | | | | |
| 3. | High School | | | | | | | |
| 4. | College | | | | | | | |
| 5. | Vocational Training | | | | | | | |
| 6. | Deeni Madrassa | | | | | | | |
| 7. | Others (Specify) | | | | | | | |

Q.9. Institutional Facilities available in the village

| Sr. No. | Facilities | Yes | No | Govt. | Private | Name |
|---------|-------------------|-----|----|-------|---------|------|
| 1. | Hospitals | | | | | |
| 2. | Dispensary | | | | | |
| 3. | Basic Health Unit | | | | | |
| 4. | Post office | | | | | |
| 5. | Mosque | | | | | |
| 6. | Banks | | | | | |
| 7. | Others | | | | | |

Q.10. Means of Transport available in the village

| Local | Intercity |
|-------------------|-------------------|
| Public Transport | Public Transport |
| Private Transport | Private Transport |
| Pedestrian | Pedestrian |
| Others | Others |

Q.11. Civic Facilities available in the village

| Sr. No. | Facilities | Yes | No | Remarks |
|---------|--------------------------------|-----|----|---------|
| 1. | Line Drainage System | | | |
| 2. | Street Lights | | | |
| 3. | Grocery Shops | | | |
| 4. | Recreational/ Games Facilities | | | |

| | | | | |
|-----|---------------------|--|--|--|
| 5. | Medical Store | | | |
| 6. | Graveyards | | | |
| 7. | Electricity | | | |
| 8. | Telephone | | | |
| 9. | Public water Supply | | | |
| 10. | Others | | | |

Q. 12. Source of water in the village

| | | | | |
|-------------|---------|--------|--------|--------|
| Storage Pit | Channel | Spring | Nullah | Others |
|-------------|---------|--------|--------|--------|

Q.13. Details of Affected Property

Type of affected property

| | | |
|---------|--------------|---------------------|
| a. Land | b. Structure | c. Land & Structure |
|---------|--------------|---------------------|

Offset from the Outer Edge of Existing ROW:

Located at (RS/LS):

Q.14. In case of affected land provide following details:

| Type of Land | Total Land Owned (Kanals) (within and outside this village) | Detail of Property |
|---------------------|--|--------------------|
| 1. Agriculture | | |
| 2. Commercial | | |
| 3. Residential | | |
| 4. Grazing Land | | |
| 5. Forest Land | | |
| 6. Waste Land | | |
| 7. Others (specify) | | |

Q.15. If structures specify category of the structure:

| | | | | |
|------------|-------------|------|--------|------------------|
| Commercial | Residential | Dera | School | Others (specify) |
|------------|-------------|------|--------|------------------|

Year of construction: _____

Q.16. Detail of affected Trees/Crops:

| Sr. No. | Description e.g. Crop Type | Privately Owned | | | Government | |
|---------|----------------------------------|-----------------|-------------|-------------|------------|-------------|
| | | No. | Value (Rs.) | Age (Years) | No. | Age (Years) |
| | | | | | | |

Q.17. Nature of water supply:

| | | |
|---------|-------------------------|-----------------|
| Public | Mode of supply of water | a. Self-carried |
| Private | | b. Tapped |
| | | c. By Channel |
| | | d. By Tanker |

Q.18. Common diseases in village

| | | |
|------------------|--------------|--------------|
| a. Common Cold | b. Diarrhea | c. Typhoid |
| d. Stomach Worms | e. TB | f. Malaria |
| g. Goiter | h. Dysentery | i. Hepatitis |
| j. Others | | |

Q.19. What are the units of measurements for agricultural land?

| | | |
|-----------|----------|--------------|
| a. Marlas | b. Acres | c. Sq. feet |
| d. Kanals | e. Jarib | f. Sq. Haath |
| g. Others | | |

Q.20. What is the system of irrigation in the area?

| | | | |
|----------|---------------|---------|-----------|
| a. Canal | b. Tube Wells | c. Rain | d. Others |
|----------|---------------|---------|-----------|

Q.21. What is the average land ownership in your village/area?

| |
|--|
| |
|--|

Q.22. How much land do you own?

| |
|--|
| |
|--|

Q.23. What are the major crops in your area?

| | | |
|----------|-----------|--------------|
| a. Wheat | b. Rice | c. Sugarcane |
| d. Maize | e. Cotton | f. Others |

Q.24. What is average yield of crop in your area?

| |
|--|
| |
|--|

Q.25. What are the units of measurements of agricultural produce?

| | | |
|-------|--------|-----------|
| a. Kg | b. Haa | c. Maunds |
|-------|--------|-----------|

| | |
|---------|-----------|
| d. Sinn | e. Others |
|---------|-----------|

Q.26. Who is the influential in your village?

| | |
|---------------------|----------------------|
| Head of the Tribe | Councilors |
| Religious Scholars | Head of the Families |
| Government Servants | Numberdar |
| Others | |

Q.27. What types of trees are in your area?

| | |
|-------------------|--|
| Fruit Trees | |
| Forest/Wood Trees | |

Q.28. What kind of animals are in your village?

Q.29. What types of Birds/migrated Birds are in your village?

Q.30. Are there any endangered or rare species in this area?

Q.31. What kind of industry exist in your village?

Q.32. What is the rate of crop in this village and surrounding areas?

Q.33. What is the rate of land per Kanal?

Q.34. Are there any waste disposal facilities?

Q.35. What are the major problems in your area

| Sr. No. | Type of Problems | Proposed Solution |
|---------|------------------|-------------------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

Q.36. Do rock carvings/historical places exist in the village

a. Yes _____ b. No _____

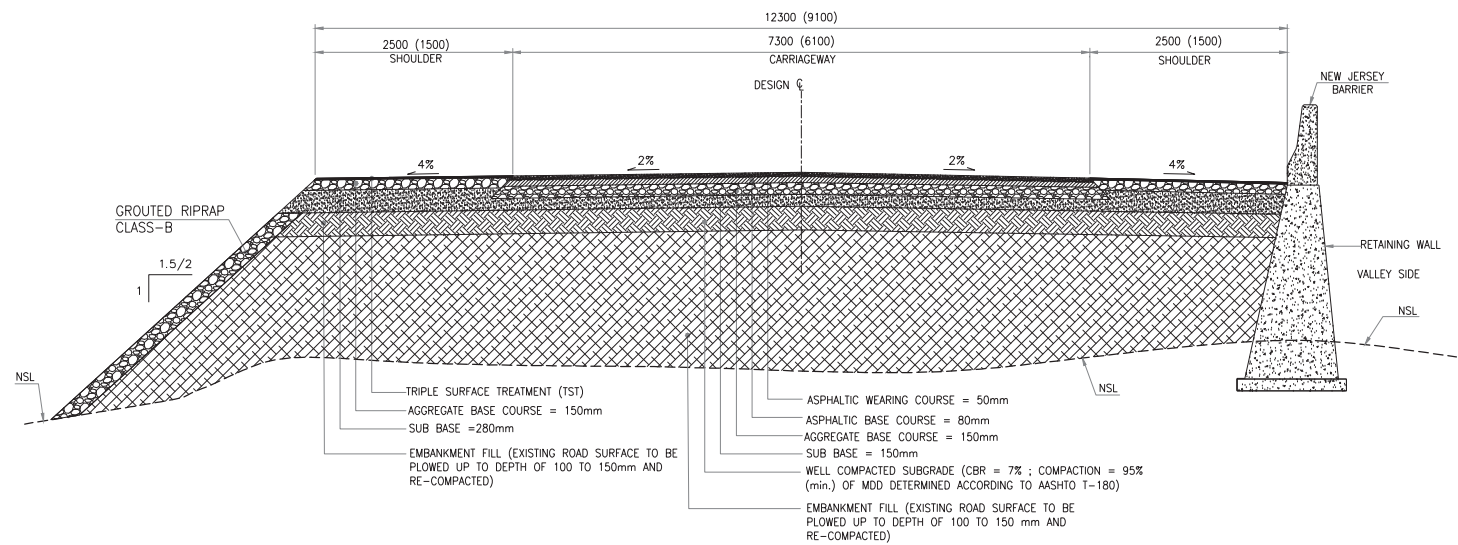
Q.37. If Yes

| Sr. No. | Name | Number | Location |
|---------|------------------|--------|----------|
| A | Rock Carvings | | |
| B | Historical Ruins | | |
| C | Old Graveyards | | |
| D | Others (specify) | | |

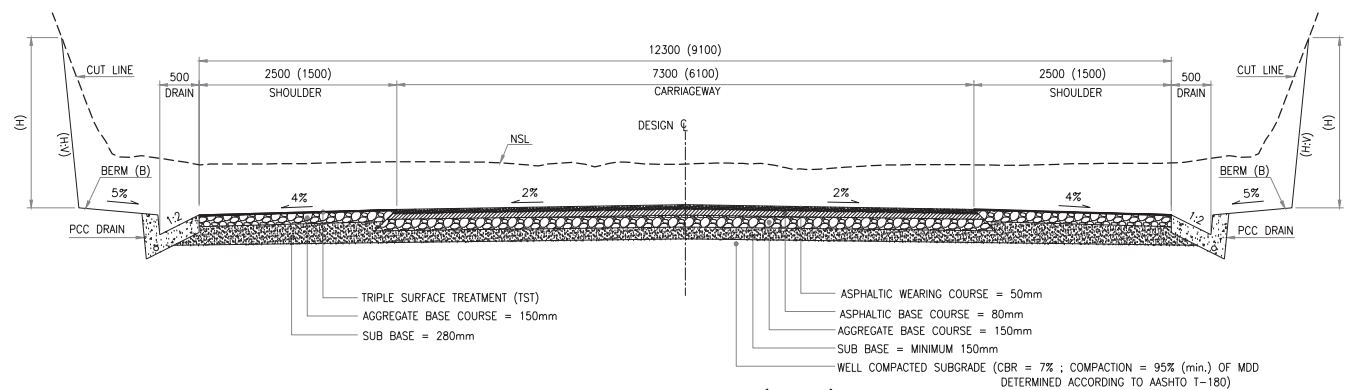
Q.38. How the matters related to property dispute about the control and consumption of natural sources of the area are settled?

| | |
|----------------------|----------------------|
| Head of the Tribe | Jirgah |
| Council of Ulemahs | Head of the Families |
| Government Officials | Others |

Comments of the Interviewer:



ROAD CROSS SECTION (FILL)



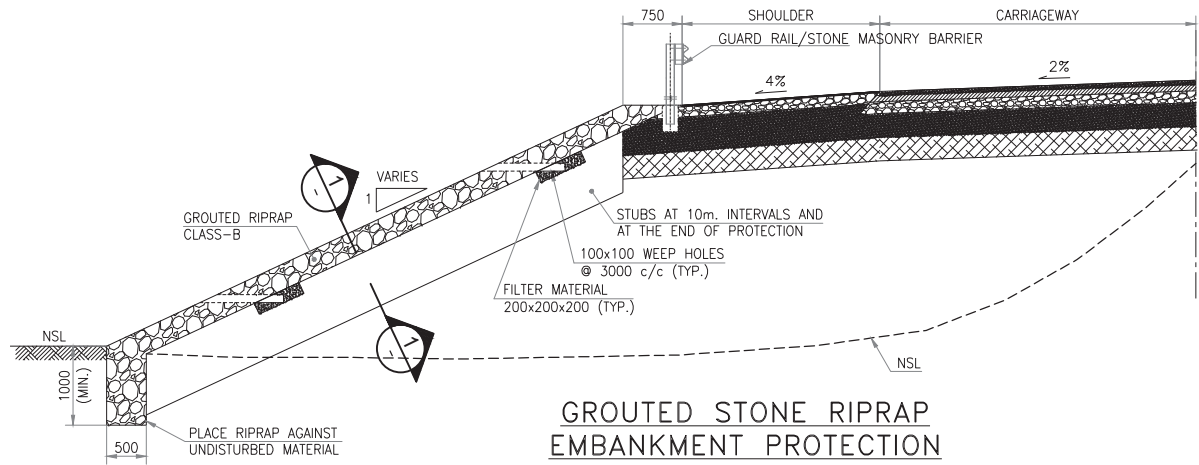
ROAD CROSS SECTION (CUT)

| CUT SLOPE DETAILS (Meters) | | | | |
|----------------------------|-----------------------------------|-------------------|--------------------|-------------------|
| S.No | TYPE OF ROCK | CUT SLOPE (H:V) | HEIGHT OF BERM (H) | WIDTH OF BERM (B) |
| 1. | (SOFT ROCK WITH SLOPE PROTECTION) | (H:V) 1:3 | 5.0 | 1.0 |
| 2. | (MEDIUM ROCK) | (H:V) 1:4 | 7.0 | 1.0 |
| 3. | (HARD ROCK) | (H:V) 1:10 to 1:6 | 10.0 | 1.0 |
| 4. | COMMON MATERIAL | (H:V) 2:1 | - | - |

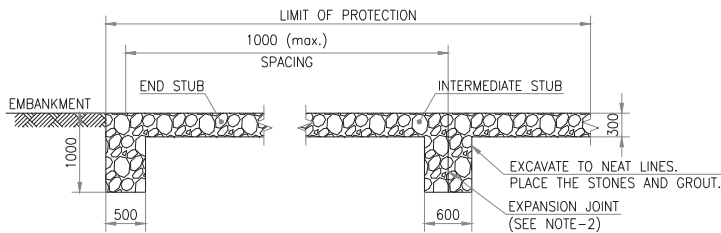
*SOURCE:- GEOLOGICAL SOCIETY OF ENGINEERING GEOLOGY SPECIAL PUBLICATION NO : 24 (TABLE C2.3.)

NOTES:-

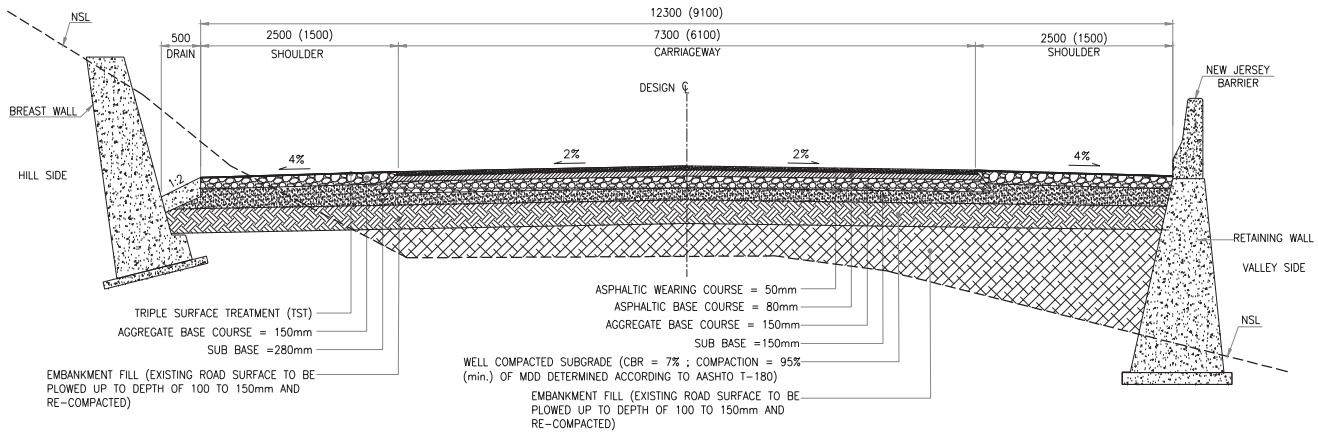
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
- EXPANSION JOINT IN GROUTED RIPRAP SHALL BE PROVIDED AT A MAXIMUM INTERVAL OF 10m.
- IN CASE ROCK IS ENCOUNTERED DEPTH AND WIDTH OF PROTECTION WORKS SHALL BE ADJUSTED AS DIRECTED BY ENGINEER.
- WHERE THE PROPOSED R.C.C RETAINING WALLS ARE BEING CONSTRUCTED THE R.C.C BARRIER (NEW JERSEY BARRIER) SHALL BE PROVIDED (FOR DETAILS, REFER TYPICAL DETAILS OF R.C.C RETAINING WALLS STRUCTURAL DWG NO. JSR\FWO\EW\RW02.)
- WHERE THE PROPOSED RETAINING WALLS ARE BEING CONSTRUCTED AS STONE MASONRY WALLS, THE STONE MASONRY BARRIER OF SIZE 1.0m (L) X 0.60m (B) X 0.90 (H) SHALL BE PROVIDED AND EMBEDDED 300mm BENEATH THE ROAD SURFACE WITH 1.0m SPACING FOR PROPER DRAINAGE. PROVISION OF METAL BEAM GUARD RAIL (W-BEAM) SHALL BE PROVIDED AT SHARP HORIZONTAL CURVES WITH PROPER FIXING OF STEEL POSTS BENEATH THE GROUND SURFACE AND WHERE EMBANKMENT HEIGHT IS GREATER THAN 3.0m.



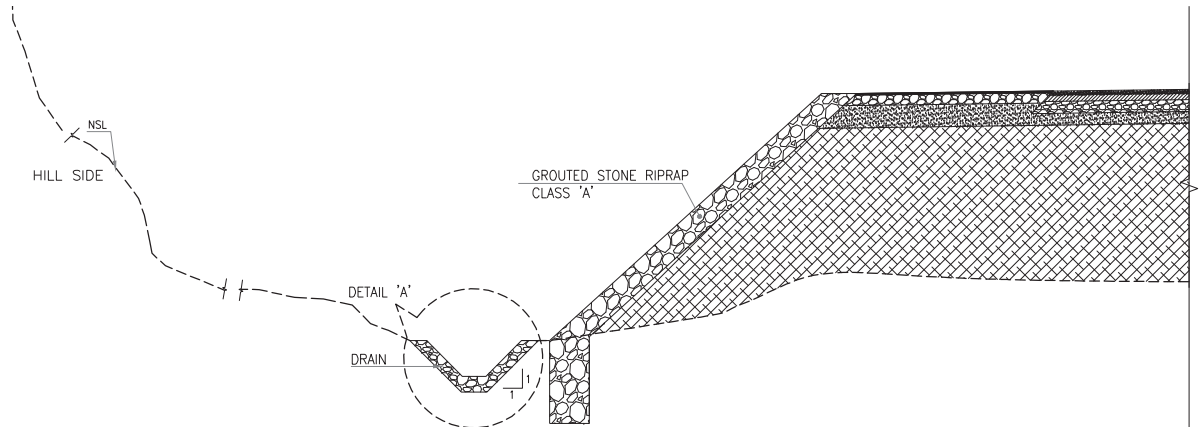
GROUTED STONE RIPRAP EMBANKMENT PROTECTION



SECTION 1-1

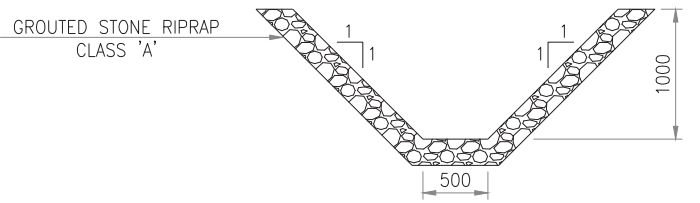


ROAD CROSS SECTION (CUT / FILL)



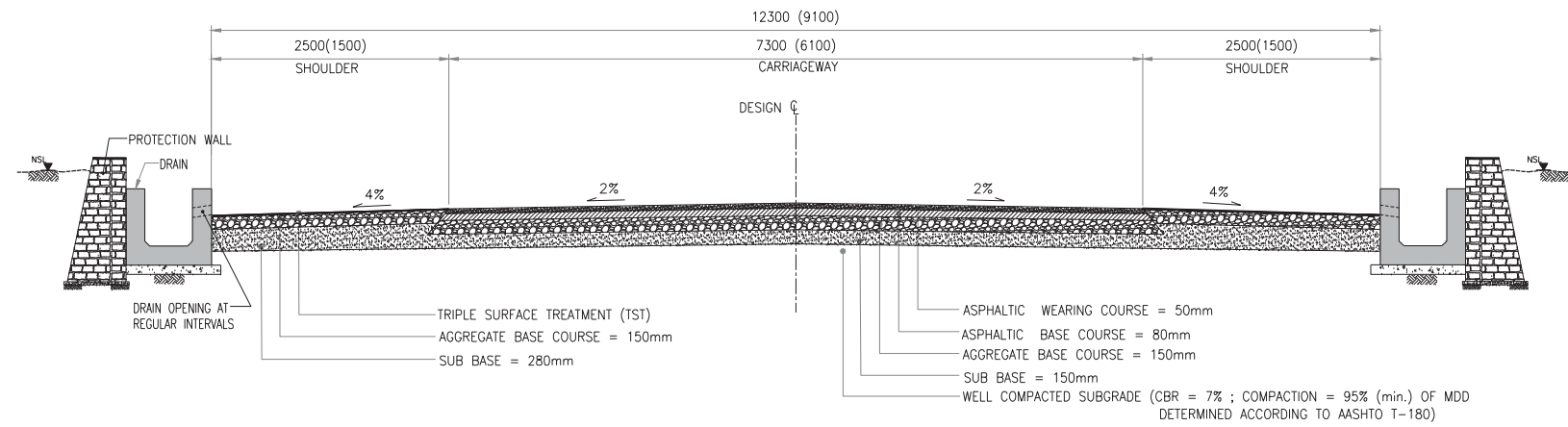
NOTES:-

- CHANNEL (0.50m X 1.0m) TO BE APPLIED TO CATCH WATER RUNOFF FROM MOUNTAIN, LONGITUDINALLY ALONG THE ROAD.
- THE CHANNEL IS TO BE ADEQUATELY CONNECTED TO THE NEAREST CROSS DRAINAGE STRUCTURE.
- THIS DRAIN SHALL ALSO BE PROVIDED AT LOCATIONS WHERE THEIR IS SUBSTANTIAL GAP BETWEEN ROAD EMBANKMENT AND THE HILL SIDE AND SHEET FLOW OF RAINWATER TO BE COLLECTED IN THIS DRAIN.

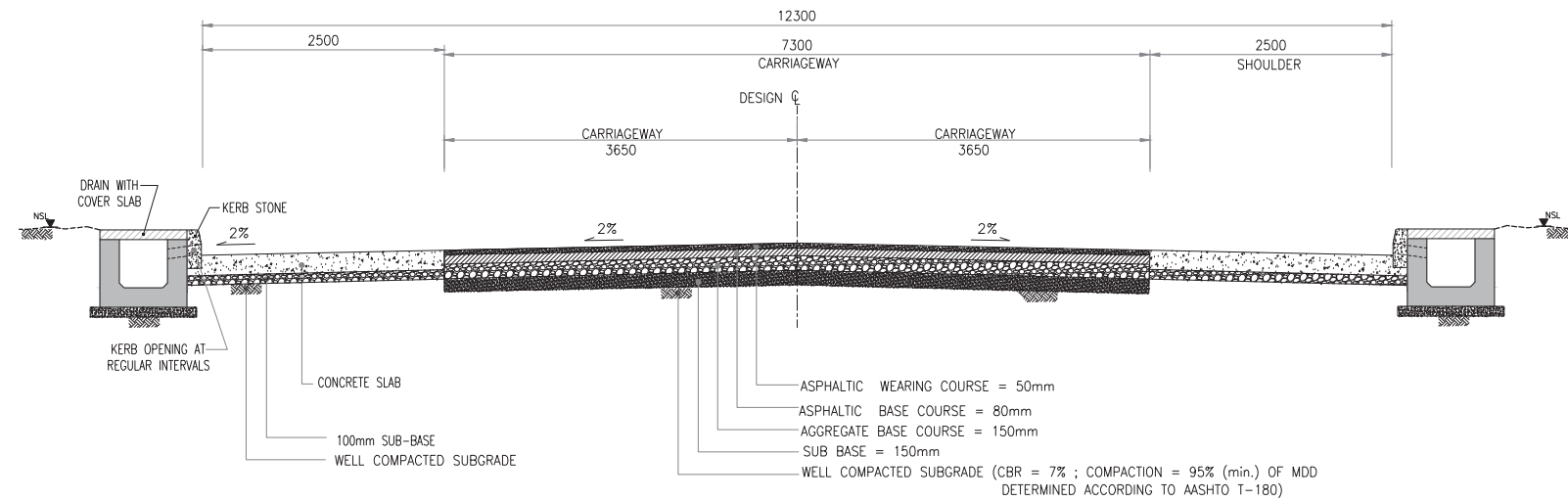


DETAIL 'A'

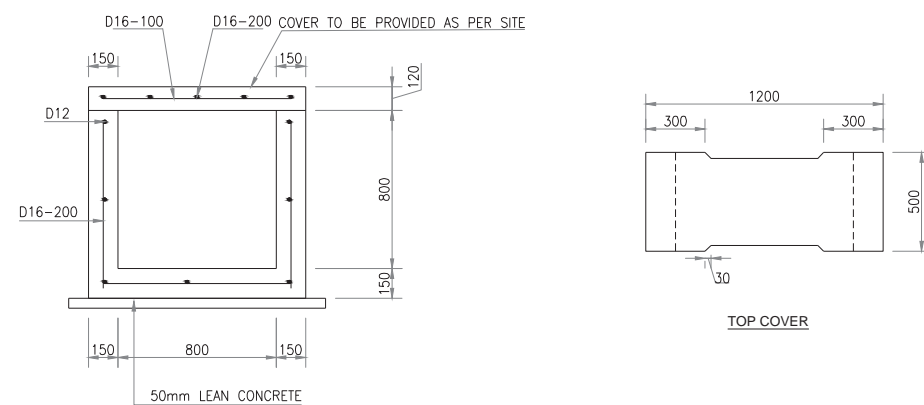
| Schedule of Grouted Stone RipRap Drain | | | |
|--|------------|------------|------------|
| Sr No | Srart RD | End RD | Length (m) |
| 1 | KM 94+400 | KM 94+750 | 250 |
| 2 | KM 96+700 | KM 97+100 | 400 |
| 3 | KM 120+900 | KM 123+400 | 3500 |
| 4 | KM 136+300 | KM 136+500 | 500 |



ROAD CROSS SECTION (CULTIVATED AREAS)



ROAD CROSS SECTION (BUILT-UP AREAS)



COVERED/UNCOVERED SIDE DRAIN TYPICAL DETAIL

NOTE:

1. IN BUILT-UP AREAS, IF THE LAND ACQUIRED HAS AN AVAILABILITY OF R.O.W 12.30m, THEN THE PAVEMENT STRUCTURE TYPE SHALL BE CHANGED FROM RIGID TO FLEXIBLE PAVEMENT WITH P.C.C SHOULDERS OF 2.50m ON BOTH SIDES ACCORDINGLY.

Client



GOVERNMENT OF PAKISTAN
MINISTRY OF COMMUNICATIONS
NATIONAL HIGHWAY AUTHORITY

EPC Contractor



FRONTIER WORKS ORGANIZATION
(F.W.O.)

Design Consultant (JV)

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Project

IMPROVEMENT, WIDENING &
UPGRADATION
JAGLOT - SKARDU ROAD

Title

TYPICAL ROAD CROSS SECTION FOR
BUILT-UP AND CULTIVATED AREAS

| | | | | | | | | | | | | | | | | | | | |
|----------|--|-----|--|---------|--|----------|--|-----------|--|-----------------------|--|----------------------|--|------|--|-----------|--|---------------|--|
| | | | | | | | | | | DRAWING No. | | | | REV. | | | | | |
| | | | | | | | | | | JSR/FWO/RD/DD/TC-002 | | | | 01 | | | | | |
| | | | | | | | | | | Drawn by | | SNA | | Date | | Oct, 2018 | | Drawing Scale | |
| | | | | | | | | | | | | Checked by | | MFA | | Date | | Oct, 2018 | |
| | | | | | | | | | | | | Authorized by | | DSN | | Date | | Oct, 2018 | |
| 01 | | SNA | | SMALI | | MFA | | JULY 2018 | | TYPICAL DRAIN DETAILS | | | | | | | | | |
| 00 | | SNA | | SMALI | | MFA | | JULY 2018 | | CONSTRUCTION ISSUE | | | | | | | | | |
| Revision | | By | | Checked | | Approved | | Date | | Description | | JSR-FWO-RD-DD-TC-002 | | | | | | | |
| | | | | | | | | | | | | Plot Scale | | | | | | | |
| | | | | | | | | | | | | 1:1 A1 | | | | | | | |
| | | | | | | | | | | | | 1:2 A3 | | | | | | | |

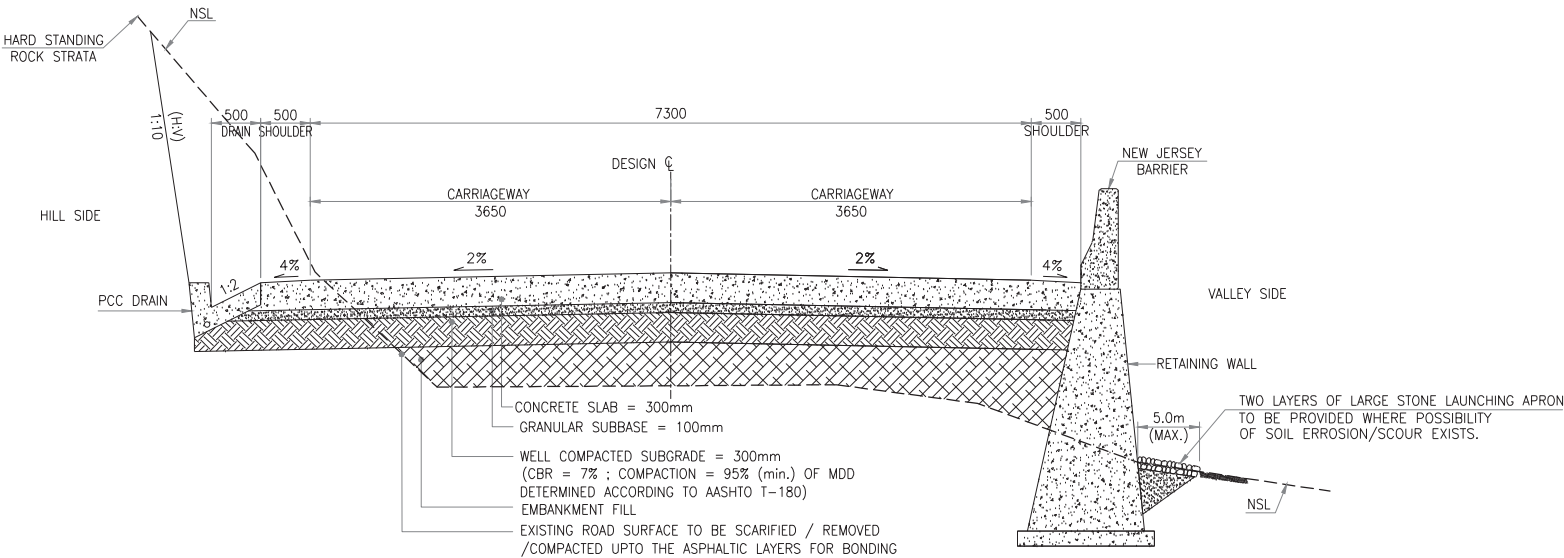
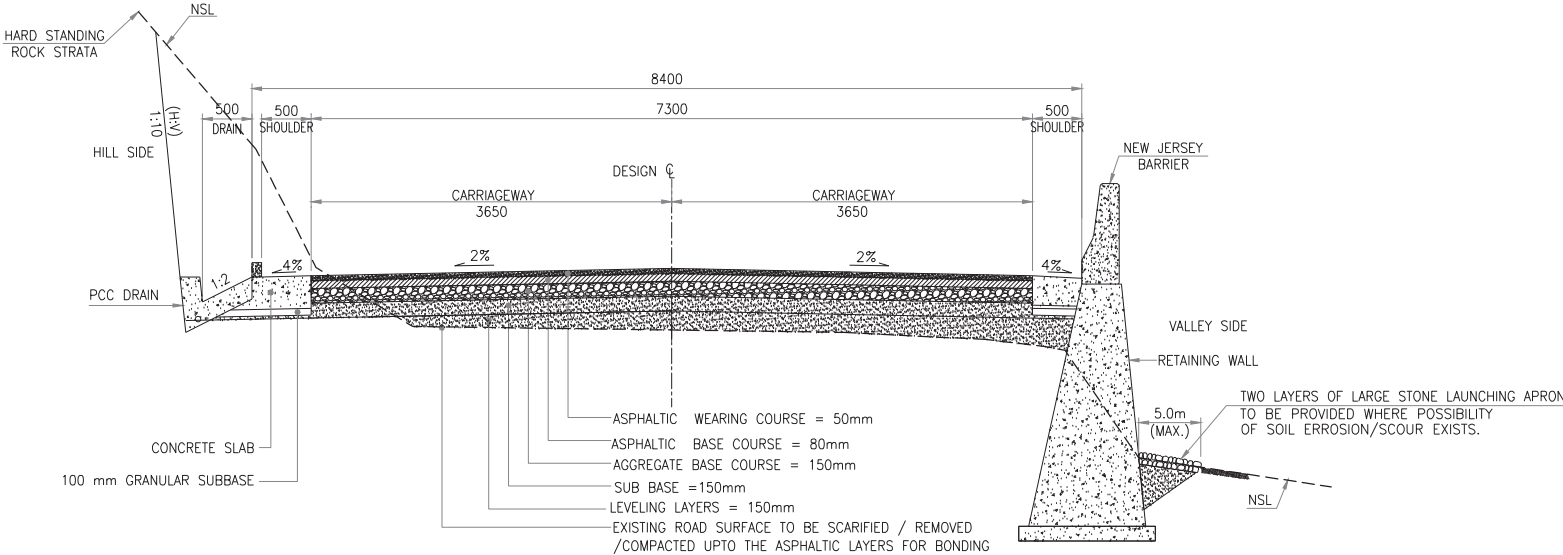
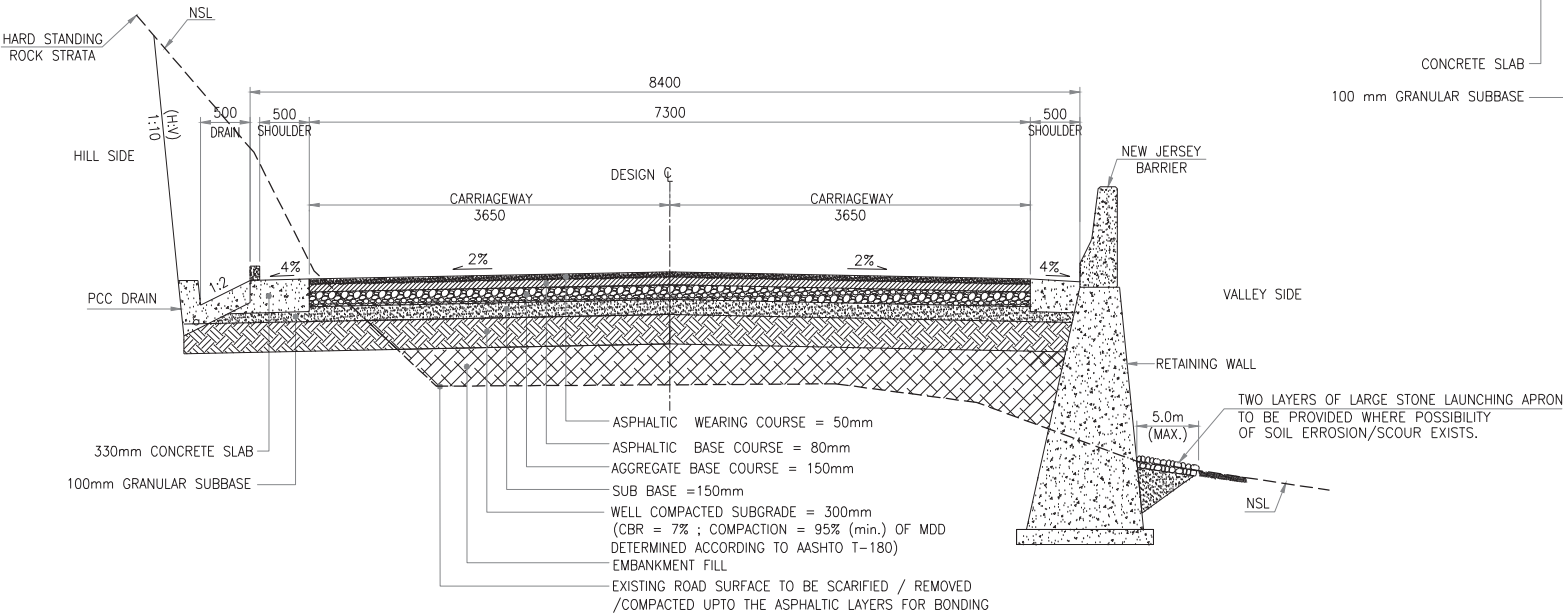
CONSTRUCTION ISSUE

NOTES:
(FOR PAVEMENT STRUCTURE IN CUT)

1. EXISTING ROAD SURFACE SHALL BE PROPERLY DRESSED, LEVELED AND SLOPED TOWARDS THE DRAIN APPROPRIATELY (IN CASE OF ROCK MATERIAL)
2. EXISTING ROAD SURFACE SHALL BE PROPERLY DRESSED, LEVELED AND SLOPED TOWARDS THE DRAIN AND COMPACTED TO 95% AASHTO MODIFIED DRY DENSITY (IN CASE OF MATERIAL OTHER THAN ROCK WITH CBR >= 15%)
3. UNSUITABLE SOILS WHICH DONOT MEET THE SPECIFIED REQUIREMENTS SHALL BE REMOVED AND REPLACED WITH SUITABLE SOILS.
4. BREAST WALLS OF REQUIRED HEIGHT AS PER SITE CONDITIONS SHALL BE PROVIDED WHERE ROCK CLASSIFICATION DEPICTS LOOSE STRATA OR SOFT ROCK MATERIAL IN CUT SECTION.

(FOR PAVEMENT STRUCTURE IN FILL)

1. EXISTING ROAD SURFACE SHALL BE PROPERLY DRESSED, LEVELED AND SLOPED TOWARDS THE DRAIN APPROPRIATELY (IN CASE OF MATERIAL OTHER THAN ROCK WITH CBR >= 15%)
2. EXISTING ROAD SURFACE SHALL BE PROPERLY DRESSED, LEVELED AND SLOPED TOWARDS THE DRAIN AND COMPACTED TO 95% AASHTO MODIFIED DRY DENSITY (IN CASE OF ROCK MATERIAL)
3. UNSUITABLE SOILS WHICH DONOT MEET THE SPECIFIED REQUIREMENTS SHALL BE REMOVED AND REPLACED WITH SUITABLE SOILS.



NOTE:-

1. IF THE CUTTING SLOPE IN HARD STANDING ROCK WILL NOT BE POSSIBLE, C-CUT SECTION SHOULD BE APPLIED.
2. FOR DETAILS OF R.C.C NEW JERSEY BARRIER, REFER TYPICAL RETAINING WALLS STRUCTURAL DWG NO. JSR/FWO/EW/RW02

Client



GOVERNMENT OF PAKISTAN
MINISTRY OF COMMUNICATIONS
NATIONAL HIGHWAY AUTHORITY

EPC Contractor



FRONTIER WORKS ORGANIZATION
(F.W.O.)

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CPM Engineering Consultants

Project

IMPROVEMENT, WIDENING &
UPGRADATION
JAGLOT - SKARDU ROAD

Title

TYPICAL ROAD CROSS SECTION WITH
COMPROMISE SHOULDERS

| Revision | By | Checked | Approved | Date | Description |
|----------|-----|---------|----------|-----------|--------------------|
| 00 | SNA | SMALI | MFA | JULY 2018 | CONSTRUCTION ISSUE |

DRAWING No. JSR/FWO/RD/DD/TC-003

| | | | |
|---------------|-----|------|-----------|
| Drawn by | SNA | Date | Oct, 2018 |
| Checked by | MFA | Date | Oct, 2018 |
| Authorized by | DSN | Date | Oct, 2018 |

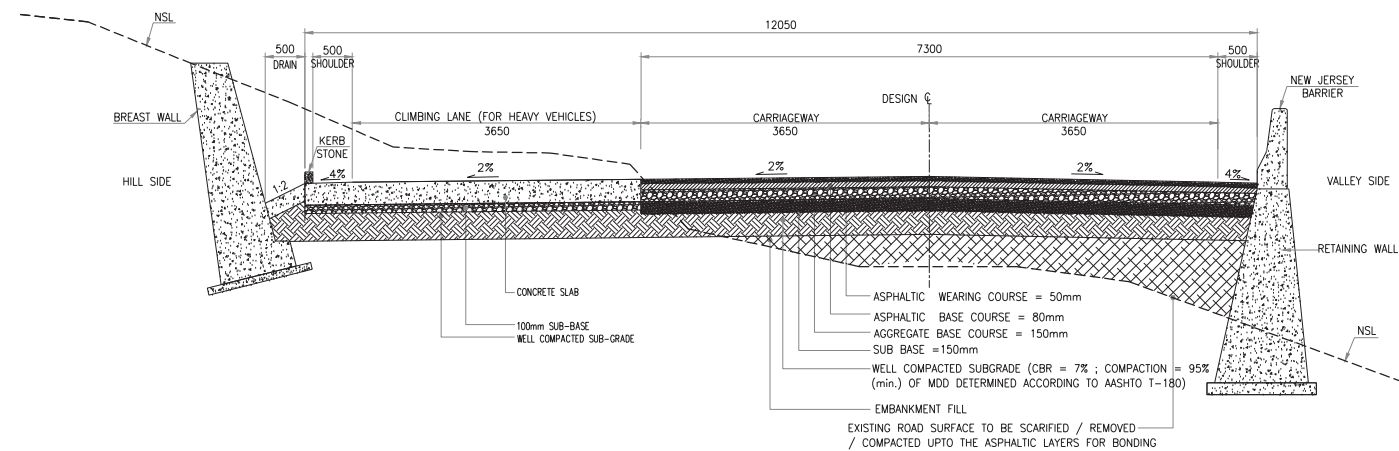
JSR-FWO-RD-DD-TC-003

REV.

Drawing Scale

Plot Scale
1:1
1:2
A1
A3

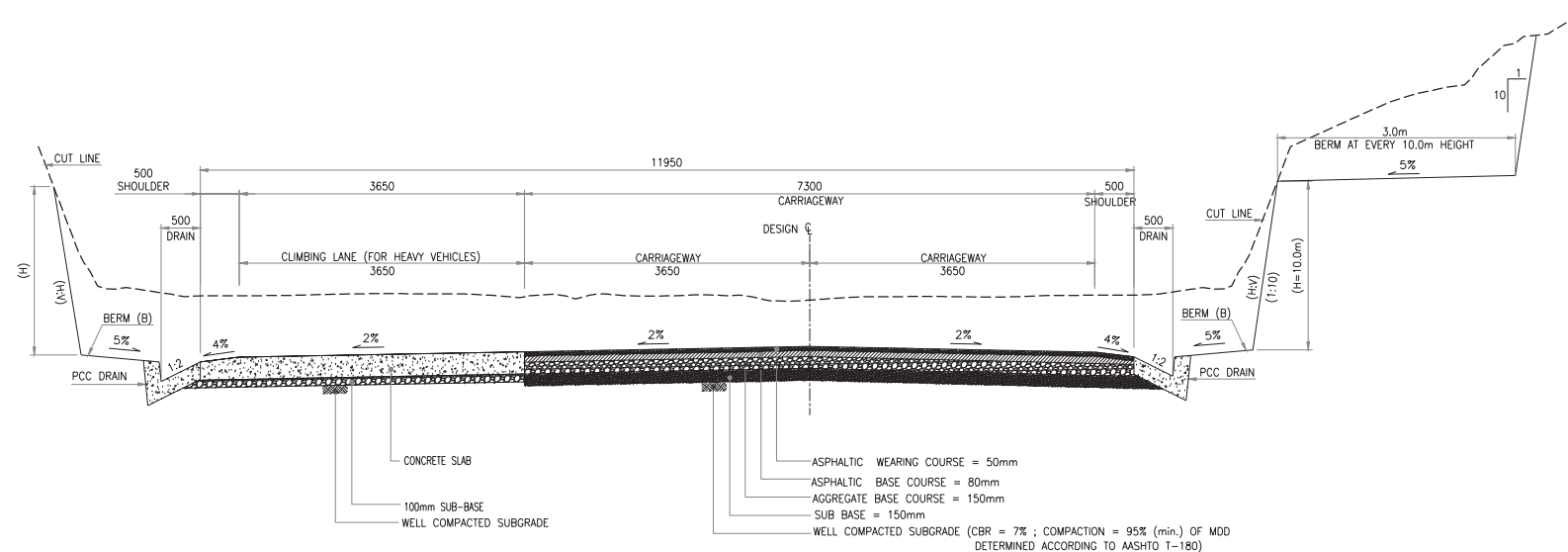
CONSTRUCTION ISSUE



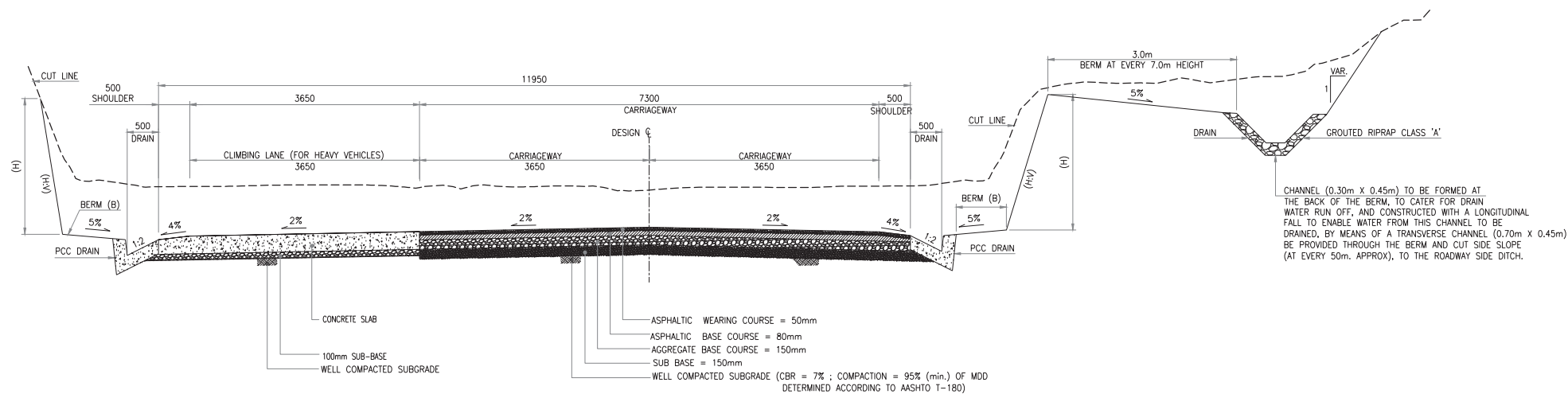
ROAD CROSS SECTION AT CLIMBING LANE (CUT/FILL)

NOTE:-

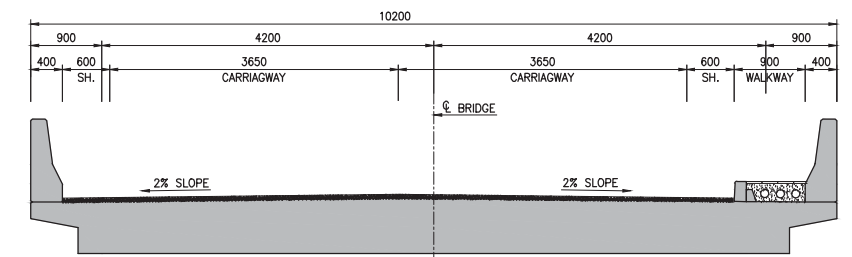
HILL EMBANKMENT SLOPE SHALL BE USED WHERE RETAINING WALL CAN BE AVOIDED. ALSO CUT SLOPE CAN BE USED WHERE BREAST WALL WILL NOT BE REQUIRED (HARD ROCK AREAS).



ROAD CROSS SECTION AT CLIMBING LANE (HARD ROCK CUT)



ROAD CROSS SECTION AT CLIMBING LANE (MEDIUM & SOFT ROCK CUT)



BRIDGE X-SECTION 7.3 CARRIAGEWAY WITH WALKWAY

| CLIMBING LANE SECTION | | | |
|-----------------------|-----------|-----------|--------|
| Sr No | Start RD | End RD | LENGTH |
| 1 | KM 68+050 | KM 68+850 | 0.800 |
| 2 | KM 93+400 | KM 94+400 | 1.000 |
| Total | | | 1.8 Km |

| List of Proposed Bridges | | |
|--------------------------|---------|----------------------------------|
| Sr. No. | Station | Proposed Bridge Span Arrangement |
| 1 | 1+450 | 18m + 67.5m + 13.5m |
| 2 | 10+250 | 3 x 25m |
| 3 | 16+200 | 1 x 35m |
| 4 | 17+000 | 3 x 20m |
| 5 | 17+850 | 1 x 35m |
| 6 | 18+125 | 1 x 40m |
| 7 | 18+650 | 1 x 35m |
| 8 | 21+850 | 1 x 40m |
| 9 | 25+075 | 1 x 18m |
| 10 | 25+050 | 1 x 25m |
| 11 | 26+350 | 1 x 17m |
| 12 | 30+650 | 1 x 30m |
| 13 | 34+075 | 1 x 11m |
| 14 | 37+150 | 1 x 28m |
| 15 | 49+270 | 1 x 54m |
| 16 | 49+500 | 1 x 40m |
| 17 | 52+575 | 1 x 35m |
| 18 | 56+700 | 1 x 24m |
| 19 | 59+000 | 1 x 35m |
| 20 | 64+320 | 1 x 10m |
| 21 | 72+300 | 1 x 23m |
| 22 | 75+200 | 1 x 18m |
| 23 | 93+375 | 1 x 25m |
| 24 | 95+600 | 1 x 30m |
| 25 | 97+600 | 1 x 40m |
| 26 | 98+570 | TBC* |
| 27 | 99+775 | 1 x 35m |
| 28 | 105+225 | TBC** |
| 29 | 107+700 | 2 x 40m |
| 30 | 112+470 | 1 x 45m |
| 31 | 114+470 | 1 x 30m |
| 32 | 117+300 | 1 x 25m |
| 33 | 127+000 | 1 x 67.5m |
| 34 | 130+250 | 1 x 25m |
| 35 | 134+150 | 1 x 25m |
| 36 | 134+600 | 27m + 81m + 27m |
| 37 | 147+650 | 1 x 11m |

Continued

List of Proposed Culverts (Pipe Culverts)

| Sr. No. | Chainage | No. of Pipes | Diameter (mm) |
|----------------|-----------------|---------------------|----------------------|
| 1 | 20+525 | 1 | 600 |
| 2 | 20+715 | 1 | 600 |
| 3 | 20+815 | 1 | 600 |
| 4 | 20+875 | 1 | 600 |
| 5 | 21+050 | 1 | 600 |
| 6 | 21+400 | 1 | 600 |
| 7 | 21+480 | 1 | 600 |
| 8 | 21+525 | 1 | 600 |
| 9 | 21+600 | 1 | 600 |
| 10 | 21+645 | 1 | 600 |
| 11 | 21+690 | 1 | 600 |
| 12 | 21+750 | 1 | 600 |
| 13 | 21+800 | 1 | 600 |
| 14 | 22+240 | 1 | 600 |
| 15 | 22+330 | 1 | 600 |
| 16 | 22+560 | 1 | 600 |
| 17 | 26+420 | 1 | 600 |
| 18 | 26+550 | 1 | 600 |
| 19 | 26+620 | 1 | 600 |
| 20 | 26+760 | 1 | 600 |
| 21 | 26+880 | 1 | 600 |
| 22 | 27+040 | 1 | 600 |
| 23 | 27+100 | 1 | 600 |
| 24 | 27+260 | 1 | 600 |
| 25 | 27+405 | 1 | 600 |
| 26 | 27+440 | 1 | 600 |
| 27 | 27+470 | 1 | 600 |
| 28 | 27+540 | 1 | 600 |
| 29 | 27+685 | 1 | 600 |
| 30 | 27+765 | 1 | 600 |
| 31 | 27+805 | 1 | 600 |
| 32 | 27+865 | 1 | 600 |
| 33 | 27+945 | 1 | 600 |
| 34 | 30+355 | 1 | 600 |
| 35 | 30+490 | 1 | 600 |
| 36 | 30+760 | 1 | 600 |
| 37 | 30+955 | 1 | 600 |

| | | | |
|----|---------|---|-----|
| 38 | 31+065 | 1 | 600 |
| 39 | 82+020 | 1 | 600 |
| 40 | 86+600 | 1 | 600 |
| 41 | 84+750 | 1 | 600 |
| 42 | 94+600 | 1 | 600 |
| 43 | 102+420 | 1 | 600 |
| 44 | 107+055 | 1 | 600 |
| 45 | 107+145 | 1 | 600 |
| 46 | 107+195 | 1 | 600 |
| 47 | 107+210 | 1 | 600 |
| 48 | 107+250 | 1 | 600 |
| 49 | 107+260 | 1 | 600 |
| 50 | 107+320 | 1 | 600 |
| 51 | 107+370 | 1 | 600 |
| 52 | 107+380 | 1 | 600 |
| 53 | 108+210 | 1 | 600 |
| 54 | 112+915 | 1 | 600 |
| 55 | 113+920 | 1 | 600 |
| 56 | 117+210 | 1 | 600 |
| 57 | 123+720 | 1 | 600 |
| 58 | 124+150 | 1 | 600 |
| 59 | 124+470 | 1 | 600 |
| 60 | 124+585 | 1 | 600 |
| 61 | 124+850 | 1 | 600 |
| 62 | 124+950 | 1 | 600 |
| 63 | 125+020 | 1 | 600 |
| 64 | 125+190 | 1 | 600 |
| 65 | 125+850 | 1 | 600 |
| 66 | 126+040 | 1 | 600 |
| 67 | 126+070 | 1 | 600 |
| 68 | 126+155 | 1 | 600 |
| 69 | 126+170 | 1 | 600 |
| 70 | 126+225 | 1 | 600 |
| 71 | 126+310 | 1 | 600 |
| 72 | 126+370 | 1 | 600 |
| 73 | 126+435 | 1 | 600 |
| 74 | 126+470 | 1 | 600 |
| 75 | 126+500 | 1 | 600 |
| 76 | 126+550 | 1 | 600 |
| 77 | 126+745 | 1 | 600 |
| 78 | 126+820 | 1 | 600 |

| | | | |
|-----|---------|---|-----|
| 79 | 127+780 | 1 | 600 |
| 80 | 127+900 | 1 | 600 |
| 81 | 127+975 | 1 | 600 |
| 82 | 128+375 | 1 | 600 |
| 83 | 128+450 | 1 | 600 |
| 84 | 128+545 | 1 | 600 |
| 85 | 128+600 | 1 | 600 |
| 86 | 128+720 | 1 | 600 |
| 87 | 128+835 | 1 | 600 |
| 88 | 129+035 | 1 | 600 |
| 89 | 129+135 | 1 | 600 |
| 90 | 129+180 | 1 | 600 |
| 91 | 130+235 | 1 | 600 |
| 92 | 130+600 | 1 | 600 |
| 93 | 130+715 | 1 | 600 |
| 94 | 131+005 | 1 | 600 |
| 95 | 133+010 | 1 | 600 |
| 96 | 133+030 | 1 | 600 |
| 97 | 133+060 | 1 | 600 |
| 98 | 133+320 | 1 | 600 |
| 99 | 133+425 | 1 | 600 |
| 100 | 133+625 | 1 | 600 |
| 101 | 136+500 | 1 | 600 |
| 102 | 136+585 | 1 | 600 |
| 103 | 136+695 | 1 | 600 |
| 104 | 137+715 | 1 | 600 |
| 105 | 137+730 | 1 | 600 |
| 106 | 137+750 | 1 | 600 |
| 107 | 137+780 | 1 | 600 |
| 108 | 137+825 | 1 | 600 |
| 109 | 138+320 | 1 | 600 |
| 110 | 138+850 | 1 | 600 |
| 111 | 139+970 | 1 | 600 |
| 112 | 141+290 | 1 | 600 |
| 113 | 141+560 | 1 | 600 |
| 114 | 142+100 | 1 | 600 |
| 115 | 142+660 | 1 | 600 |
| 116 | 143+040 | 1 | 600 |
| 117 | 143+900 | 1 | 600 |
| 118 | 144+710 | 1 | 600 |
| 119 | 144+975 | 1 | 600 |

| | | | |
|-----|---------|---|-----|
| 120 | 145+935 | 1 | 600 |
| 121 | 146+390 | 1 | 600 |
| 122 | 146+480 | 1 | 600 |
| 123 | 147+510 | 1 | 600 |
| 124 | 147+610 | 1 | 600 |
| 125 | 147+720 | 1 | 600 |
| 126 | 148+015 | 1 | 600 |
| 127 | 149+680 | 1 | 600 |
| 128 | 149+790 | 1 | 600 |
| 129 | 149+950 | 1 | 600 |
| 130 | 149+965 | 1 | 600 |
| 131 | 149+980 | 1 | 600 |
| 132 | 150+390 | 1 | 600 |
| 133 | 150+650 | 1 | 600 |
| 134 | 150+930 | 1 | 600 |
| 135 | 151+150 | 1 | 600 |
| 136 | 151+165 | 1 | 600 |
| 137 | 151+205 | 1 | 600 |
| 138 | 151+245 | 1 | 600 |
| 139 | 151+275 | 1 | 600 |
| 140 | 151+285 | 1 | 600 |
| 141 | 151+610 | 1 | 600 |
| 142 | 151+905 | 1 | 600 |
| 143 | 151+950 | 1 | 600 |
| 144 | 152+065 | 1 | 600 |
| 145 | 152+130 | 1 | 600 |
| 146 | 152+410 | 1 | 600 |
| 147 | 152+495 | 1 | 600 |
| 148 | 152+500 | 1 | 600 |
| 149 | 152+505 | 1 | 600 |
| 150 | 152+740 | 1 | 600 |
| 151 | 152+895 | 1 | 600 |
| 152 | 153+050 | 1 | 600 |
| 153 | 153+095 | 1 | 600 |
| 154 | 153+155 | 1 | 600 |
| 155 | 153+395 | 1 | 600 |
| 156 | 153+410 | 1 | 600 |
| 157 | 153+580 | 1 | 600 |
| 158 | 153+625 | 1 | 600 |
| 159 | 153+970 | 1 | 600 |
| 160 | 154+275 | 1 | 600 |

| | | | |
|-----|---------|---|-----|
| 161 | 154+450 | 1 | 600 |
| 162 | 154+650 | 1 | 600 |
| 163 | 154+655 | 1 | 600 |
| 164 | 154+690 | 1 | 600 |
| 165 | 154+695 | 1 | 600 |
| 166 | 154+700 | 1 | 600 |
| 167 | 154+905 | 1 | 600 |
| 168 | 155+115 | 1 | 600 |
| 169 | 155+160 | 1 | 600 |
| 170 | 155+675 | 1 | 600 |

| List of Proposed Culverts (Box Culverts) | | | |
|--|------------------|-------------------|--------------|
| Sr. No. | STATION (Design) | Proposed Culverts | |
| | | No. of Cells | Size (m x m) |
| 1 | 0+960 | 1 | 1.5x1.5 |
| 2 | 1+335 | 1 | 1.5x1.5 |
| 3 | 1+900 | 1 | 1.5x1.5 |
| 4 | 2+165 | 1 | 1.5x1.5 |
| 5 | 2+475 | 1 | 1.5x1.5 |
| 6 | 3+030 | 1 | 2.0x1.5 |
| 7 | 3+565 | 1 | 1.5x1.5 |
| 8 | 3+915 | 1 | 1.5x1.5 |
| 9 | 4+860 | 1 | 1.5x1.5 |
| 10 | 4+895 | 1 | 1.5x1.5 |
| 11 | 5+150 | 1 | 1.5x1.5 |
| 12 | 5+415 | 1 | 1.5x1.5 |
| 13 | 5+590 | 1 | 1.5x1.5 |
| 14 | 6+070 | 1 | 1.5x1.5 |
| 15 | 6+442 | 1 | 1.5x1.5 |
| 16 | 6+505 | 1 | 1.5x1.5 |
| 17 | 9+040 | 1 | 1.5x1.5 |
| 18 | 9+139 | 1 | 1.5x1.5 |
| 19 | 9+530 | 1 | 1.5x1.5 |
| 20 | 9+737 | 1 | 1.5x1.5 |
| 21 | 9+875 | 1 | 1.5x1.5 |
| 22 | 10+555 | 1 | 1.5x1.5 |
| 23 | 10+706 | 1 | 1.5x1.5 |
| 24 | 11+300 | 1 | 1.5x1.5 |
| 25 | 11+585 | 1 | 1.5x1.5 |
| 26 | 11+700 | 1 | 1.5x1.5 |
| 27 | 12+400 | 1 | 2.0x1.5 |
| 28 | 12+645 | 1 | 1.5x1.5 |
| 29 | 12+895 | 1 | 1.5x1.5 |
| 30 | 13+240 | 1 | 1.5x1.5 |
| 31 | 13+930 | 1 | 1.5x1.5 |
| 32 | 14+015 | 2 | 1.5x1.5 |
| 33 | 14+235 | 1 | 1.5x1.5 |
| 34 | 14+535 | 1 | 1.5x1.5 |
| 35 | 14+630 | 1 | 1.5x1.5 |
| 36 | 15+753 | 1 | 1.5x1.5 |
| 37 | 15+925 | 1 | 1.5x1.5 |
| 38 | 16+515 | 1 | 1.5x1.5 |

| | | | |
|----|--------|---|---------|
| 39 | 16+591 | 1 | 1.5x1.5 |
| 40 | 16+815 | 2 | 2.0x2.0 |
| 41 | 17+521 | 1 | 1.5x1.5 |
| 42 | 17+710 | 2 | 1.5x1.5 |
| 43 | 17+860 | 3 | 2.0x1.5 |
| 44 | 18+005 | 1 | 1.5x1.5 |
| 45 | 18+960 | 1 | 1.5x1.5 |
| 46 | 19+165 | 1 | 1.5x1.5 |
| 47 | 19+306 | 1 | 1.5x1.5 |
| 48 | 19+887 | 1 | 1.5x1.5 |
| 49 | 20+105 | 1 | 1.5x1.5 |
| 50 | 20+317 | 1 | 1.5x1.5 |
| 51 | 20+355 | 1 | 1.5x1.5 |
| 52 | 20+623 | 1 | 1.5x1.5 |
| 53 | 20+630 | 1 | 1.5x1.5 |
| 54 | 20+905 | 2 | 1.5x1.5 |
| 55 | 21+210 | 1 | 1.5x1.5 |
| 56 | 22+000 | 1 | 1.5x1.5 |
| 57 | 22+560 | 2 | 2.5x2.0 |
| 58 | 22+765 | 3 | 1.5x1.5 |
| 59 | 23+018 | 1 | 1.5x1.5 |
| 60 | 23+335 | 1 | 1.5x1.5 |
| 61 | 23+560 | 1 | 1.5x1.5 |
| 62 | 24+220 | 1 | 1.5x1.5 |
| 63 | 24+501 | 1 | 1.5x1.5 |
| 64 | 24+630 | 2 | 2.0x2.0 |
| 65 | 25+095 | 1 | 1.5x1.5 |
| 66 | 25+555 | 1 | 1.5x1.5 |
| 67 | 25+945 | 3 | 2.0x1.5 |
| 68 | 25+969 | 1 | 1.5x1.5 |
| 69 | 28+135 | 1 | 1.5x1.5 |
| 70 | 28+490 | 3 | 2.0x2.0 |
| 71 | 29+145 | 3 | 2.0x1.5 |
| 72 | 29+419 | 1 | 1.5x1.5 |
| 73 | 30+050 | 1 | 1.5x1.5 |
| 74 | 32+920 | 1 | 1.5x1.5 |
| 75 | 32+955 | 1 | 1.5x1.5 |
| 76 | 33+170 | 1 | 1.5x1.5 |
| 77 | 33+930 | 1 | 1.5x1.5 |
| 78 | 34+021 | 1 | 1.5x1.5 |
| 79 | 34+175 | 1 | 1.5x1.5 |

| | | | |
|---|--------|---|---------|
| 80 | 34+305 | 1 | 1.5x1.5 |
| 81 | 34+705 | 2 | 1.5x1.5 |
| 82 | 34+905 | 1 | 1.5x1.5 |
| 83 | 35+195 | 1 | 1.5x1.5 |
| 84 | 35+305 | 1 | 1.5x1.5 |
| 85 | 35+495 | 1 | 1.5x1.5 |
| 86 | 35+805 | 2 | 1.5x1.5 |
| 87 | 36+443 | 1 | 2.0x1.5 |
| 88 | 36+589 | 1 | 1.5x1.5 |
| 89 | 36+815 | 2 | 2.0X1.5 |
| 90 | 37+030 | 1 | 1.5x1.5 |
| 91 | 37+217 | 1 | 1.5x1.5 |
| 92 | 37+690 | 2 | 1.5x1.5 |
| 93 | 37+790 | 2 | 1.5x1.5 |
| 94 | 37+991 | 1 | 1.5x1.5 |
| 95 | 38+240 | 3 | 2.0X1.5 |
| 96 | 39+180 | 1 | 1.5x1.5 |
| 97 | 39+945 | 1 | 1.5x1.5 |
| 98 | 40+045 | 1 | 1.5x1.5 |
| 99 | 40+730 | 1 | 1.5x1.5 |
| 100 | 41+315 | 1 | 1.5x1.5 |
| 101 | 41+517 | 2 | 2.0x1.5 |
| 102 | 42+565 | 1 | 2.0x1.5 |
| 103 | 43+081 | 1 | 1.5x1.5 |
| 104 | 43+765 | 1 | 1.5x1.5 |
| 105 | 44+790 | 1 | 1.5x1.5 |
| Station Equation 45+072 (back) = 40+000 (ahead) | | | |
| 106 | 40+800 | 1 | 2.0x1.5 |
| 107 | 41+600 | 2 | 1.5x1.5 |
| 108 | 42+230 | 1 | 1.5x1.5 |
| 109 | 43+120 | 3 | 2.0x2.0 |
| 110 | 43+800 | 1 | 1.5x1.5 |
| 111 | 43+500 | 2 | 1.5x1.5 |
| 112 | 44+400 | 1 | 1.5x1.5 |
| 113 | 44+700 | 1 | 1.5x1.5 |
| 114 | 45+100 | 1 | 1.5x1.5 |
| 115 | 45+260 | 1 | 1.5x1.5 |
| 116 | 45+413 | 1 | 1.5x1.5 |
| 117 | 46+205 | 1 | 1.5x1.5 |
| 118 | 46+295 | 1 | 1.5x1.5 |
| 119 | 46+520 | 1 | 1.5x1.5 |

| | | | |
|-----|--------|---|---------|
| 120 | 46+625 | 1 | 1.5x1.5 |
| 121 | 47+000 | 3 | 2.5x2.5 |
| 122 | 47+080 | 1 | 2.0x1.5 |
| 123 | 47+310 | 3 | 2.0x1.5 |
| 124 | 47+425 | 2 | 1.5x1.5 |
| 125 | 48+125 | 3 | 1.5x1.5 |
| 126 | 48+300 | 1 | 1.5x1.5 |
| 127 | 48+529 | 1 | 1.5x1.5 |
| 128 | 50+035 | 1 | 1.5x1.5 |
| 129 | 50+399 | 1 | 1.5x1.5 |
| 130 | 50+670 | 1 | 1.5x1.5 |
| 131 | 50+970 | 1 | 1.5x1.5 |
| 132 | 51+285 | 1 | 1.5x1.5 |
| 133 | 51+330 | 1 | 1.5x1.5 |
| 134 | 51+425 | 2 | 2.0x1.5 |
| 135 | 51+700 | 1 | 1.5x1.5 |
| 136 | 52+080 | 1 | 1.5x1.5 |
| 137 | 52+850 | 1 | 1.5x1.5 |
| 138 | 53+115 | 2 | 2.0x1.5 |
| 139 | 53+720 | 1 | 1.5x1.5 |
| 140 | 54+115 | 1 | 1.5x1.5 |
| 141 | 54+170 | 1 | 1.5x1.5 |
| 142 | 54+325 | 1 | 1.5x1.5 |
| 143 | 54+450 | 1 | 1.5x1.5 |
| 144 | 54+590 | 1 | 1.5x1.5 |
| 145 | 54+670 | 1 | 1.5x1.5 |
| 146 | 54+730 | 3 | 2.0x2.0 |
| 147 | 54+980 | 2 | 2.0x1.5 |
| 148 | 55+585 | 1 | 1.5x1.5 |
| 149 | 56+030 | 1 | 1.5x1.5 |
| 150 | 57+565 | 2 | 2.0x1.5 |
| 151 | 57+645 | 3 | 2.0x1.5 |
| 152 | 59+070 | 1 | 1.5x1.5 |
| 153 | 59+705 | 1 | 1.5x1.5 |
| 154 | 60+410 | 1 | 2.0x1.5 |
| 155 | 60+646 | 1 | 1.5x1.5 |
| 156 | 61+250 | 2 | 2.0x1.5 |
| 157 | 61+285 | 1 | 1.5x1.5 |
| 158 | 61+370 | 2 | 2.0x2.0 |
| 159 | 62+485 | 1 | 1.5x1.5 |
| 160 | 62+930 | 1 | 1.5x1.5 |

| | | | |
|-----|--------|---|---------|
| 161 | 63+420 | 2 | 2.0x1.5 |
| 162 | 63+782 | 1 | 1.5x1.5 |
| 163 | 65+183 | 1 | 1.5x1.5 |
| 164 | 65+734 | 1 | 1.5x1.5 |
| 165 | 65+815 | 3 | 2.0x2.0 |
| 166 | 67+054 | 1 | 1.5x1.5 |
| 167 | 67+670 | 3 | 2.0x2.0 |
| 168 | 68+059 | 1 | 1.5x1.5 |
| 169 | 70+808 | 1 | 1.5x1.5 |
| 170 | 73+899 | 1 | 1.5x1.5 |
| 171 | 74+665 | 1 | 2.0x1.5 |
| 172 | 75+505 | 1 | 1.5x1.5 |
| 173 | 75+810 | 1 | 1.5x1.5 |
| 174 | 76+291 | 1 | 1.5x1.5 |
| 175 | 76+710 | 1 | 2.0x1.5 |
| 176 | 78+135 | 1 | 1.5x1.5 |
| 177 | 79+345 | 1 | 1.5x1.5 |
| 178 | 81+065 | 1 | 1.5x1.5 |
| 179 | 82+895 | 1 | 1.5x1.5 |
| 180 | 83+775 | 3 | 2.5x2.5 |
| 181 | 84+391 | 1 | 1.5x1.5 |
| 182 | 85+117 | 1 | 1.5x1.5 |
| 183 | 86+150 | 1 | 1.5x1.5 |
| 184 | 86+290 | 3 | 2.0x2.0 |
| 185 | 86+681 | 1 | 1.5x1.5 |
| 186 | 86+910 | 1 | 1.5x1.5 |
| 187 | 86+940 | 1 | 1.5x1.5 |
| 188 | 87+560 | 1 | 1.5x1.5 |
| 189 | 87+885 | 1 | 1.5x1.5 |
| 190 | 88+070 | 1 | 1.5x1.5 |
| 191 | 88+199 | 1 | 1.5x1.5 |
| 192 | 89+590 | 1 | 1.5x1.5 |
| 193 | 92+030 | 1 | 2.0x1.5 |
| 194 | 92+356 | 1 | 1.5x1.5 |
| 195 | 92+950 | 1 | 1.5x1.5 |
| 196 | 95+775 | 1 | 1.5x1.5 |
| 197 | 95+970 | 1 | 1.5x1.5 |
| 198 | 95+985 | 1 | 1.5x1.5 |
| 199 | 96+025 | 1 | 1.5x1.5 |
| 200 | 96+171 | 1 | 1.5x1.5 |
| 201 | 96+365 | 1 | 1.5x1.5 |

| | | | |
|-----|---------|---|---------|
| 202 | 97+690 | 1 | 1.5x1.5 |
| 203 | 97+761 | 1 | 1.5x1.5 |
| 204 | 97+820 | 1 | 1.5x1.5 |
| 205 | 97+955 | 3 | 2.5x2.0 |
| 206 | 98+045 | 1 | 1.5x1.5 |
| 207 | 98+090 | 3 | 2.5x2.5 |
| 208 | 99+265 | 1 | 1.5x1.5 |
| 209 | 99+845 | 1 | 1.5x1.5 |
| 210 | 100+022 | 1 | 1.5x1.5 |
| 211 | 100+709 | 1 | 1.5x1.5 |
| 212 | 101+420 | 1 | 1.5x1.5 |
| 213 | 101+892 | 1 | 1.5x1.5 |
| 214 | 103+410 | 1 | 1.5x1.5 |
| 215 | 104+853 | 1 | 1.5x1.5 |
| 216 | 106+079 | 1 | 1.5x1.5 |
| 217 | 106+882 | 1 | 1.5x1.5 |
| 218 | 107+505 | 1 | 1.5x1.5 |
| 219 | 107+610 | 1 | 2.0x1.5 |
| 220 | 107+790 | 1 | 2.0x1.5 |
| 221 | 107+840 | 1 | 1.5x1.5 |
| 222 | 108+684 | 1 | 1.5x1.5 |
| 223 | 109+125 | 1 | 2.0x1.5 |
| 224 | 109+702 | 1 | 1.5x1.5 |
| 225 | 110+391 | 1 | 1.5x1.5 |
| 226 | 111+375 | 1 | 1.5x1.5 |
| 227 | 111+500 | 2 | 2.0x2.0 |
| 228 | 112+725 | 1 | 1.5x1.5 |
| 229 | 112+833 | 1 | 1.5x1.5 |
| 230 | 113+172 | 1 | 1.5x1.5 |
| 231 | 113+625 | 2 | 1.5x1.5 |
| 232 | 114+042 | 1 | 1.5x1.5 |
| 233 | 114+320 | 3 | 2.0x2.0 |
| 234 | 114+862 | 1 | 1.5x1.5 |
| 235 | 116+470 | 1 | 1.5x1.5 |
| 236 | 116+620 | 1 | 1.5x1.5 |
| 237 | 116+776 | 1 | 1.5x1.5 |
| 238 | 117+000 | 1 | 1.5x1.5 |
| 239 | 117+899 | 1 | 1.5x1.5 |
| 240 | 118+561 | 1 | 1.5x1.5 |
| 241 | 118+920 | 2 | 2.5x2.0 |
| 242 | 119+130 | 1 | 1.5x1.5 |

| | | | |
|-----|---------|---|---------|
| 243 | 120+788 | 1 | 1.5x1.5 |
| 244 | 122+338 | 1 | 1.5x1.5 |
| 245 | 122+944 | 1 | 1.5x1.5 |
| 246 | 124+320 | 2 | 1.5x1.5 |
| 247 | 124+500 | 2 | 2.0x1.5 |
| 248 | 124+655 | 2 | 2.0x1.5 |
| 249 | 125+105 | 2 | 2.0x2.0 |
| 250 | 126+590 | 2 | 2.0x2.0 |
| 251 | 126+660 | 1 | 1.5x1.5 |
| 252 | 128+014 | 1 | 1.5x1.5 |
| 253 | 128+880 | 1 | 1.5x1.5 |
| 254 | 128+935 | 3 | 2.0x1.5 |
| 255 | 130+086 | 1 | 1.5x1.5 |
| 256 | 130+696 | 1 | 1.5x1.5 |
| 257 | 130+920 | 1 | 1.5x1.5 |
| 258 | 132+160 | 1 | 1.5x1.5 |
| 259 | 132+660 | 1 | 1.5x1.5 |
| 260 | 133+735 | 1 | 1.5x1.5 |
| 261 | 135+300 | 1 | 1.5x1.5 |
| 262 | 135+530 | 1 | 1.5x1.5 |
| 263 | 135+700 | 1 | 1.5x1.5 |
| 264 | 135+800 | 1 | 1.5x1.5 |
| 265 | 136+300 | 1 | 1.5x1.5 |
| 266 | 136+340 | 1 | 1.5x1.5 |
| 267 | 137+038 | 1 | 1.5x1.5 |
| 268 | 137+120 | 1 | 1.5x1.5 |
| 269 | 137+688 | 1 | 1.5x1.5 |
| 270 | 139+110 | 3 | 2.0x2.0 |
| 271 | 139+693 | 1 | 1.5x1.5 |
| 272 | 142+235 | 1 | 1.5x1.5 |
| 273 | 143+655 | 1 | 1.5x1.5 |
| 274 | 143+910 | 3 | 2.0x2.0 |
| 275 | 143+930 | 1 | 1.5x1.5 |
| 276 | 144+662 | 1 | 1.5x1.5 |
| 277 | 151+420 | 3 | 2.5x2.5 |
| 278 | 152+251 | 1 | 1.5x1.5 |
| 279 | 154+863 | 1 | 1.5x1.5 |
| 280 | 155+760 | 1 | 1.5x1.5 |
| 281 | 155+810 | 1 | 1.5x1.5 |
| 282 | 155+935 | 1 | 1.5x1.5 |
| 283 | 156+020 | 1 | 1.5x1.5 |

| | | | |
|-----|---------|---|---------|
| 284 | 156+085 | 1 | 1.5x1.5 |
| 285 | 156+230 | 1 | 1.5x1.5 |
| 286 | 156+420 | 1 | 1.5x1.5 |
| 287 | 156+460 | 1 | 1.5x1.5 |

List of Machinery

| Sr. No | RD | | Name of Machine | As per Site |
|--------|-------|---------|------------------|-------------|
| | From | To | | |
| 1 | 0+000 | 164+000 | Excavator | 56 |
| 2 | | | Air-Compressor | 42 |
| 3 | | | Dyna Mazda | 12 |
| 4 | | | Concrete Mixer | 23 |
| 5 | | | Dozer | 7 |
| 6 | | | Loader | 32 |
| 7 | | | Tractor Trolleys | 42 |
| 8 | | | Dumper | 49 |
| 9 | | | Generator | 17 |
| 10 | | | Bulldozer | 1 |
| 11 | | | Water Pump | 7 |
| 12 | | | Fuel Bozer | 4 |
| 13 | | | Grader | 11 |
| 14 | | | Roller | 12 |
| 15 | | | Water Bozer | 24 |
| 16 | | | Vehicles | 43 |
| Total | | | | 382 |

ANNEX-F

Results of Air Quality Monitoring at Gamba

| Sr. No. | Date - Time | CO | NO | NO2 | SO2 | O3 | PM2.5 | PM10 |
|---------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | mg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ |
| 1 | 8/5/2018 15:08 | 0.21 | 1.22 | 5.59 | 0.56 | 2.19 | 24.21 | 71.36 |
| 2 | 8/5/2018 16:08 | 0.28 | 1.80 | 6.63 | 0.92 | 5.19 | 29.03 | 73.89 |
| 3 | 8/5/2018 17:08 | 0.17 | 1.31 | 5.75 | 0.69 | 3.18 | 28.08 | 83.98 |
| 4 | 8/5/2018 18:08 | 0.19 | 1.43 | 5.97 | 0.74 | 3.70 | 26.66 | 86.68 |
| 5 | 8/5/2018 19:08 | 0.22 | 1.49 | 6.06 | 0.78 | 3.89 | 26.95 | 80.21 |
| 6 | 8/5/2018 20:08 | 0.21 | 1.48 | 6.04 | 0.77 | 3.85 | 26.88 | 76.67 |
| 7 | 8/5/2018 21:08 | 0.26 | 1.64 | 6.32 | 0.85 | 4.48 | 27.88 | 90.65 |
| 8 | 8/5/2018 22:08 | 0.29 | 1.07 | 5.16 | 0.75 | 2.43 | 23.47 | 98.68 |
| 9 | 8/5/2018 23:08 | 0.30 | 1.10 | 6.44 | 1.24 | 3.97 | 31.21 | 96.72 |
| 10 | 8/6/2018 0:08 | 0.44 | 1.55 | 6.22 | 1.15 | 3.70 | 29.87 | 102.04 |
| 11 | 8/6/2018 1:08 | 0.36 | 1.28 | 5.63 | 0.95 | 3.00 | 26.47 | 95.70 |
| 12 | 8/6/2018 2:08 | 0.28 | 1.33 | 5.71 | 0.98 | 3.10 | 26.97 | 96.60 |
| 13 | 8/6/2018 3:08 | 0.58 | 2.05 | 5.78 | 1.71 | 3.08 | 28.79 | 83.72 |
| 14 | 8/6/2018 4:08 | 0.50 | 1.75 | 5.03 | 1.34 | 2.83 | 26.69 | 98.77 |
| 15 | 8/6/2018 5:08 | 0.53 | 1.70 | 5.09 | 1.23 | 2.87 | 26.52 | 91.17 |
| 16 | 8/6/2018 6:08 | 0.42 | 1.45 | 4.59 | 0.77 | 2.55 | 24.19 | 92.88 |
| 17 | 8/6/2018 7:08 | 0.61 | 1.90 | 4.32 | 0.53 | 2.39 | 22.92 | 99.43 |
| 18 | 8/6/2018 8:08 | 0.64 | 1.98 | 5.65 | 0.70 | 2.52 | 23.72 | 84.47 |
| 19 | 8/6/2018 9:08 | 0.36 | 1.55 | 5.25 | 0.99 | 3.47 | 31.44 | 97.43 |
| 20 | 8/6/2018 10:08 | 0.15 | 1.07 | 5.04 | 0.78 | 2.95 | 28.80 | 91.85 |
| 21 | 8/6/2018 11:08 | 0.14 | 1.04 | 5.02 | 0.76 | 2.91 | 28.60 | 93.07 |
| 22 | 8/6/2018 12:08 | 0.16 | 1.09 | 5.06 | 0.80 | 2.96 | 28.87 | 91.96 |
| 23 | 8/6/2018 13:08 | 0.12 | 0.98 | 5.00 | 0.73 | 2.81 | 28.10 | 92.26 |
| 24 | 8/6/2018 14:08 | 0.30 | 1.33 | 5.19 | 1.12 | 3.65 | 32.25 | 98.64 |
| AVERAGE | | 0.32 | 1.44 | 5.52 | 0.91 | 3.24 | 27.44 | 90.37 |
| MINIMUM | | 0.12 | 0.98 | 4.32 | 0.53 | 2.19 | 22.92 | 71.36 |
| MAXIMUM | | 0.64 | 2.05 | 6.63 | 1.71 | 5.19 | 32.25 | 102.04 |
| NEQS | | 5 | 40 | 80 | 120 | 80.00 | 35.00 | 150.00 |

Results of Air Quality Monitoring at Shengus

| Sr. No. | Date - Time | CO | NO | NO2 | SO2 | O3 | PM2.5 | PM10 |
|----------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | mg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ |
| 1 | 8/6/2018 20:03 | 0.33 | 1.56 | 6.32 | 0.97 | 4.61 | 28.10 | 70.86 |
| 2 | 8/6/2018 21:03 | 0.29 | 1.82 | 5.77 | 0.65 | 3.18 | 25.81 | 76.62 |
| 3 | 8/6/2018 22:03 | 0.13 | 1.16 | 5.48 | 1.00 | 3.05 | 25.60 | 83.31 |
| 4 | 8/6/2018 23:03 | 0.14 | 1.18 | 5.50 | 1.00 | 2.86 | 27.54 | 82.26 |
| 5 | 8/7/2018 0:03 | 0.30 | 1.80 | 6.81 | 0.99 | 5.83 | 30.06 | 77.22 |
| 6 | 8/7/2018 1:03 | 0.22 | 1.60 | 6.38 | 0.65 | 4.84 | 28.48 | 72.16 |
| 7 | 8/7/2018 2:03 | 0.26 | 1.81 | 6.77 | 0.63 | 5.69 | 28.79 | 86.34 |
| 8 | 8/7/2018 3:03 | 0.17 | 1.22 | 5.77 | 0.65 | 3.33 | 26.03 | 84.72 |
| 9 | 8/7/2018 4:03 | 0.25 | 1.66 | 6.37 | 0.63 | 4.61 | 28.10 | 70.86 |
| 10 | 8/7/2018 5:03 | 0.27 | 1.76 | 6.57 | 0.90 | 5.06 | 28.82 | 73.23 |
| 11 | 8/7/2018 6:03 | 0.30 | 1.88 | 6.77 | 0.97 | 5.52 | 29.55 | 75.57 |
| 12 | 8/7/2018 7:03 | 0.16 | 1.22 | 5.60 | 0.63 | 2.86 | 27.54 | 82.26 |
| 13 | 8/7/2018 8:03 | 0.17 | 1.35 | 5.83 | 0.70 | 3.38 | 26.11 | 84.97 |
| 14 | 8/7/2018 9:03 | 0.18 | 1.41 | 5.95 | 0.73 | 3.65 | 26.55 | 75.68 |
| 15 | 8/7/2018 10:03 | 0.28 | 1.91 | 6.85 | 0.96 | 5.69 | 28.79 | 86.34 |
| 16 | 8/7/2018 11:03 | 0.14 | 1.29 | 5.72 | 0.66 | 3.15 | 25.75 | 83.82 |
| 17 | 8/7/2018 12:03 | 0.19 | 1.33 | 5.81 | 0.69 | 3.33 | 26.03 | 84.72 |
| 18 | 8/7/2018 13:03 | 0.22 | 1.69 | 6.45 | 0.86 | 4.79 | 24.38 | 71.91 |
| 19 | 8/7/2018 14:03 | 0.12 | 1.10 | 5.38 | 0.75 | 3.78 | 26.76 | 79.67 |
| 20 | 8/7/2018 15:03 | 0.27 | 1.73 | 6.50 | 0.89 | 4.90 | 28.56 | 72.35 |
| 21 | 8/7/2018 16:03 | 0.11 | 1.02 | 5.23 | 0.54 | 2.01 | 26.18 | 77.80 |
| 22 | 8/7/2018 5:03 | 0.36 | 1.25 | 5.55 | 0.87 | 2.89 | 28.91 | 102.93 |
| 23 | 8/7/2018 6:03 | 0.44 | 1.49 | 6.09 | 1.10 | 3.54 | 29.07 | 92.76 |
| 24 | 8/7/2018 7:03 | 0.30 | 1.09 | 5.18 | 0.73 | 2.46 | 23.59 | 98.91 |
| AVERAGE | | 0.23 | 1.47 | 6.03 | 0.80 | 3.96 | 27.30 | 81.14 |
| MINIMUM | | 0.11 | 1.02 | 5.18 | 0.54 | 2.01 | 23.59 | 70.86 |
| MAXIMUM | | 0.44 | 1.91 | 6.85 | 1.10 | 5.83 | 30.06 | 102.93 |
| NEQS | | 5 | 40 | 80 | 120 | 80.00 | 35.00 | 150.00 |

Results of Air Quality Monitoring at Dambudaass

| Sr. No. | Date - Time | CO | NO | NO2 | SO2 | O3 | PM2.5 | PM10 |
|----------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | mg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ |
| 1 | 8/4/2018 9:44 | 0.11 | 1.18 | 8.35 | 1.15 | 3.67 | 28.48 | 91.26 |
| 2 | 8/4/2018 10:44 | 0.14 | 1.16 | 8.34 | 1.16 | 3.59 | 28.41 | 83.45 |
| 3 | 8/4/2018 11:44 | 0.22 | 1.92 | 8.91 | 1.20 | 4.67 | 31.00 | 99.55 |
| 4 | 8/4/2018 12:44 | 0.11 | 1.02 | 5.23 | 0.54 | 4.01 | 26.18 | 77.77 |
| 5 | 8/4/2018 13:44 | 0.19 | 1.35 | 5.81 | 0.70 | 3.33 | 26.03 | 77.31 |
| 6 | 8/4/2018 14:44 | 0.14 | 1.19 | 5.55 | 0.62 | 4.15 | 27.36 | 89.03 |
| 7 | 8/4/2018 15:44 | 0.28 | 1.70 | 6.41 | 0.56 | 2.16 | 24.15 | 71.16 |
| 8 | 8/4/2018 16:44 | 0.16 | 1.36 | 5.84 | 0.71 | 3.43 | 26.21 | 85.23 |
| 9 | 8/4/2018 17:44 | 0.14 | 1.52 | 6.12 | 0.78 | 4.03 | 27.17 | 81.00 |
| 10 | 8/4/2018 18:44 | 0.21 | 1.45 | 6.00 | 0.94 | 5.21 | 29.05 | 87.05 |
| 11 | 8/4/2018 19:44 | 0.43 | 1.43 | 5.97 | 1.05 | 3.41 | 28.32 | 91.37 |
| 12 | 8/4/2018 20:44 | 0.28 | 1.05 | 5.09 | 0.89 | 2.96 | 26.15 | 95.18 |
| 13 | 8/4/2018 21:44 | 0.29 | 1.04 | 5.08 | 0.88 | 2.95 | 26.11 | 97.78 |
| 14 | 8/4/2018 22:44 | 0.35 | 1.22 | 5.26 | 0.75 | 2.53 | 23.98 | 99.66 |
| 15 | 8/4/2018 23:44 | 0.47 | 1.52 | 6.16 | 1.14 | 3.64 | 29.42 | 93.40 |
| 16 | 8/5/2018 0:44 | 0.45 | 1.45 | 5.04 | 0.67 | 2.29 | 22.75 | 105.19 |
| 17 | 8/5/2018 1:44 | 0.65 | 2.04 | 5.78 | 1.58 | 3.11 | 28.40 | 95.66 |
| 18 | 8/5/2018 2:44 | 0.53 | 1.72 | 5.13 | 1.25 | 2.88 | 26.72 | 91.63 |
| 19 | 8/5/2018 3:44 | 0.55 | 1.75 | 5.16 | 1.30 | 2.92 | 29.84 | 99.06 |
| 20 | 8/5/2018 4:44 | 0.61 | 1.79 | 5.26 | 1.38 | 2.98 | 27.24 | 100.13 |
| 21 | 8/5/2018 5:44 | 0.56 | 1.77 | 5.21 | 1.34 | 2.95 | 26.99 | 99.51 |
| 22 | 8/5/2018 6:44 | 0.37 | 1.41 | 4.47 | 0.66 | 2.47 | 23.82 | 92.04 |
| 23 | 8/5/2018 7:44 | 0.39 | 1.53 | 5.28 | 1.01 | 3.44 | 31.32 | 97.21 |
| 24 | 8/5/2018 8:44 | 0.15 | 1.03 | 5.03 | 0.76 | 2.87 | 28.45 | 96.14 |
| AVERAGE | | 0.32 | 1.44 | 5.85 | 0.96 | 3.32 | 27.23 | 91.53 |
| MINIMUM | | 0.11 | 1.02 | 4.47 | 0.54 | 2.16 | 22.75 | 71.16 |
| MAXIMUM | | 0.65 | 2.04 | 8.91 | 1.58 | 5.21 | 31.32 | 105.19 |
| NEQS | | 5 | 40 | 80 | 120 | 80.00 | 35.00 | 150.00 |

3. Results and Discussion

This section of the report presents the testing results of Ambient Air (CO, NO, NO₂, SO₂, O₃, PM₁₀, PM_{2.5}) and Noise Level Monitoring were measured at Identified sampling location to get an overview of the air quality. The results of measure concentration at each the location is given in Table below.

3.1 GAMBA SKARDU

Table 3-1: Ambient Air Quality Monitoring Results

| Sr. No. | Parameters | Avg. Sampling Time | Unit | NEQS | Average Concentration |
|---------|-------------------------------------|--------------------|-------------------|------|-----------------------|
| 1 | Carbon Monoxide (CO) | 24 | mg/m ³ | 5 | 0.32 |
| 2 | Nitric oxide (NO) | 24 | µg/m ³ | 40 | 1.44 |
| 3 | Nitrogen Dioxide (NO ₂) | 24 | µg/m ³ | 80 | 5.52 |
| 4 | Sulphur Dioxide (SO ₂) | 24 | µg/m ³ | 120 | 0.91 |
| 5 | Ozone (O ₃) | 24 | µg/m ³ | 80 | 3.24 |
| 6 | PM _{2.5} | 24 | µg/m ³ | 35 | 27.44 |
| 7 | PM ₁₀ | 24 | µg/m ³ | 150 | 90.37 |

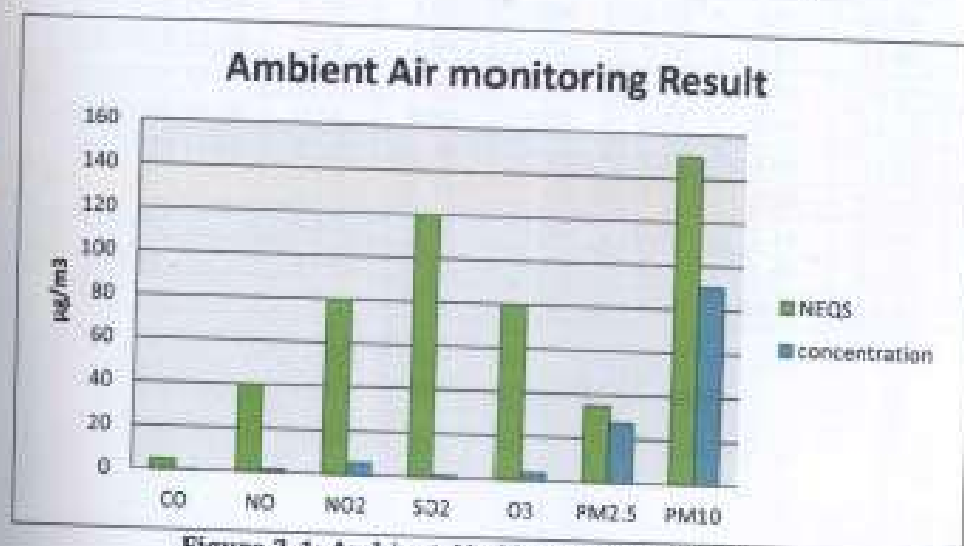


Figure 3-1: Ambient Air Monitoring Results

For detail Monitoring please see the Table 3.1

| Sr. No. | Date - Time | CO | NO | NO ₂ | SO ₂ | O ₃ | PM2.5 | PM10 |
|----------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | mg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ |
| 1 | 8/5/2018 15:08 | 0.21 | 1.22 | 5.59 | 0.56 | 2.19 | 24.21 | 71.36 |
| 2 | 8/5/2018 16:08 | 0.28 | 1.80 | 6.63 | 0.92 | 5.19 | 29.03 | 73.89 |
| 3 | 8/5/2018 17:08 | 0.17 | 1.31 | 5.75 | 0.69 | 3.18 | 28.08 | 83.98 |
| 4 | 8/5/2018 18:08 | 0.19 | 1.43 | 5.97 | 0.74 | 3.70 | 26.66 | 86.68 |
| 5 | 8/5/2018 19:08 | 0.22 | 1.49 | 6.06 | 0.78 | 3.89 | 26.95 | 80.21 |
| 6 | 8/5/2018 20:08 | 0.21 | 1.46 | 6.04 | 0.77 | 3.85 | 26.88 | 76.67 |
| 7 | 8/5/2018 21:08 | 0.26 | 1.64 | 6.32 | 0.85 | 4.48 | 27.88 | 90.65 |
| 8 | 8/5/2018 22:08 | 0.29 | 1.07 | 5.16 | 0.75 | 2.43 | 23.47 | 98.68 |
| 9 | 8/5/2018 23:08 | 0.30 | 1.10 | 6.44 | 1.24 | 3.97 | 31.21 | 96.72 |
| 10 | 8/6/2018 0:08 | 0.44 | 1.55 | 6.22 | 1.15 | 3.70 | 29.87 | 102.04 |
| 11 | 8/6/2018 1:08 | 0.36 | 1.28 | 5.63 | 0.95 | 3.00 | 26.47 | 95.70 |
| 12 | 8/6/2018 2:08 | 0.28 | 1.33 | 5.71 | 0.98 | 3.10 | 26.97 | 96.60 |
| 13 | 8/6/2018 3:08 | 0.58 | 2.05 | 5.78 | 1.71 | 3.08 | 28.79 | 83.72 |
| 14 | 8/6/2018 4:08 | 0.50 | 1.75 | 5.03 | 1.34 | 2.83 | 26.69 | 98.77 |
| 15 | 8/6/2018 5:08 | 0.53 | 1.70 | 5.09 | 1.23 | 2.87 | 26.52 | 91.17 |
| 16 | 8/6/2018 6:08 | 0.42 | 1.45 | 4.59 | 0.77 | 2.55 | 24.19 | 92.88 |
| 17 | 8/6/2018 7:08 | 0.61 | 1.90 | 4.32 | 0.53 | 2.39 | 22.92 | 99.43 |
| 18 | 8/6/2018 8:08 | 0.64 | 1.98 | 5.65 | 0.70 | 2.52 | 23.72 | 84.47 |
| 19 | 8/6/2018 9:08 | 0.36 | 1.55 | 5.25 | 0.99 | 3.47 | 31.44 | 97.43 |
| 20 | 8/6/2018 10:08 | 0.15 | 1.07 | 5.04 | 0.78 | 2.95 | 28.80 | 91.85 |
| 21 | 8/6/2018 11:08 | 0.14 | 1.04 | 5.02 | 0.76 | 2.91 | 28.60 | 93.07 |
| 22 | 8/6/2018 12:08 | 0.16 | 1.09 | 5.06 | 0.80 | 2.96 | 28.87 | 91.96 |
| 23 | 8/6/2018 13:08 | 0.12 | 0.98 | 5.00 | 0.73 | 2.81 | 28.10 | 92.26 |
| 24 | 8/6/2018 14:08 | 0.30 | 1.33 | 5.19 | 1.12 | 3.65 | 32.25 | 98.64 |
| AVERAGE | | 0.32 | 1.44 | 5.52 | 0.91 | 3.24 | 27.44 | 90.37 |
| MINIMUM | | 0.12 | 0.98 | 4.32 | 0.53 | 2.19 | 22.92 | 71.36 |
| MAXIMUM | | 0.64 | 2.05 | 6.63 | 1.71 | 5.19 | 32.25 | 102.04 |
| NEQS | | 5 | 40 | 80 | 120 | 80.00 | 35.00 | 150.00 |

3.2 SHENGUS

Table 3-2: Ambient Air Quality Monitoring Results

| Sr. No. | Parameters | Avg. Sampling Time | Unit | NEQS | Average Concentration |
|---------|-------------------------------------|--------------------|-------------------|------|-----------------------|
| 1 | Carbon Monoxide (CO) | 24 | mg/m ³ | 5 | 0.23 |
| 2 | Nitric oxide (NO) | 24 | µg/m ³ | 40 | 1.47 |
| 3 | Nitrogen Dioxide (NO ₂) | 24 | µg/m ³ | 80 | 6.03 |
| 4 | Sulphur Dioxide (SO ₂) | 24 | µg/m ³ | 120 | 0.80 |
| 5 | Ozone (O ₃) | 24 | µg/m ³ | 80 | 3.96 |
| 6 | PM _{2.5} | 24 | µg/m ³ | 35 | 27.30 |
| 7 | PM ₁₀ | 24 | µg/m ³ | 150 | 81.14 |

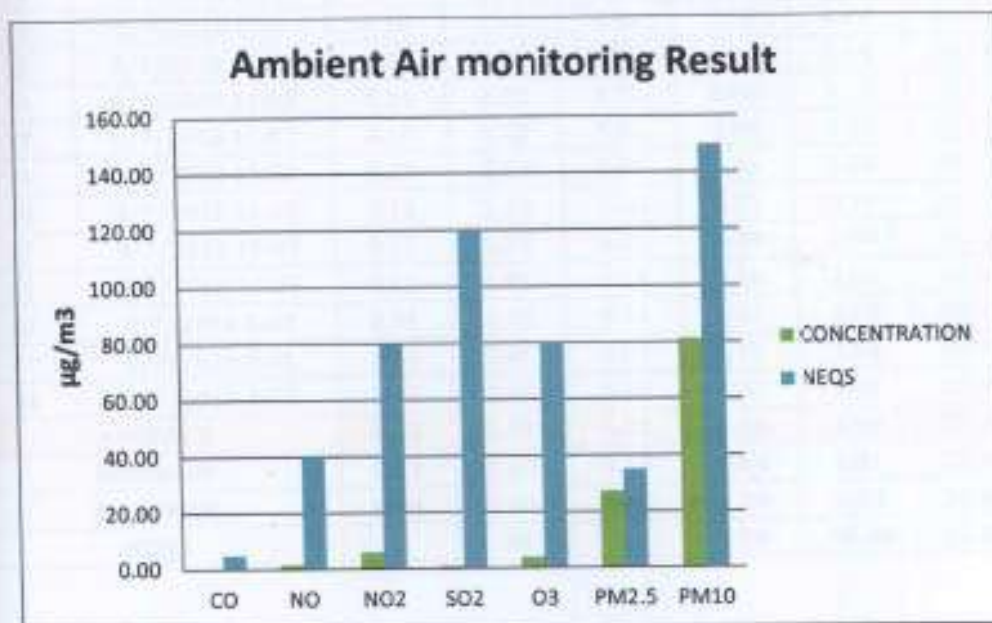


Figure 3-2: Ambient Air Monitoring Results

For detail Monitoring please see the Table 3.2

| Sr. No. | Date - Time | CO | NO | NO ₂ | SO ₂ | O ₃ | PM2.5 | PM10 |
|----------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | mg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ |
| 1 | 8/6/2018 20:03 | 0.33 | 1.56 | 6.32 | 0.97 | 4.61 | 28.10 | 70.86 |
| 2 | 8/6/2018 21:03 | 0.29 | 1.82 | 5.77 | 0.65 | 3.18 | 25.81 | 76.62 |
| 3 | 8/6/2018 22:03 | 0.13 | 1.16 | 5.48 | 1.00 | 3.05 | 25.60 | 83.31 |
| 4 | 8/6/2018 23:03 | 0.14 | 1.18 | 5.50 | 1.00 | 2.86 | 27.54 | 82.26 |
| 5 | 8/7/2018 0:03 | 0.30 | 1.80 | 6.81 | 0.99 | 5.83 | 30.06 | 77.22 |
| 6 | 8/7/2018 1:03 | 0.22 | 1.60 | 6.38 | 0.65 | 4.84 | 28.48 | 72.16 |
| 7 | 8/7/2018 2:03 | 0.26 | 1.81 | 6.77 | 0.63 | 5.69 | 28.79 | 86.34 |
| 8 | 8/7/2018 3:03 | 0.17 | 1.22 | 5.77 | 0.65 | 3.33 | 26.03 | 84.72 |
| 9 | 8/7/2018 4:03 | 0.25 | 1.66 | 6.37 | 0.63 | 4.61 | 28.10 | 70.86 |
| 10 | 8/7/2018 5:03 | 0.27 | 1.76 | 6.57 | 0.90 | 5.06 | 28.82 | 73.23 |
| 11 | 8/7/2018 6:03 | 0.30 | 1.88 | 6.77 | 0.97 | 5.52 | 29.55 | 75.57 |
| 12 | 8/7/2018 7:03 | 0.16 | 1.22 | 5.60 | 0.63 | 2.86 | 27.54 | 82.26 |
| 13 | 8/7/2018 8:03 | 0.17 | 1.35 | 5.83 | 0.70 | 3.38 | 26.11 | 84.97 |
| 14 | 8/7/2018 9:03 | 0.18 | 1.41 | 5.95 | 0.73 | 3.65 | 26.55 | 75.68 |
| 15 | 8/7/2018 10:03 | 0.28 | 1.91 | 6.85 | 0.96 | 5.69 | 28.79 | 86.34 |
| 16 | 8/7/2018 11:03 | 0.14 | 1.29 | 5.72 | 0.66 | 3.15 | 25.75 | 83.82 |
| 17 | 8/7/2018 12:03 | 0.19 | 1.33 | 5.81 | 0.69 | 3.33 | 26.03 | 84.72 |
| 18 | 8/7/2018 13:03 | 0.22 | 1.69 | 6.45 | 0.85 | 4.79 | 24.38 | 71.91 |
| 19 | 8/7/2018 14:03 | 0.12 | 1.10 | 5.38 | 0.75 | 3.78 | 26.76 | 79.67 |
| 20 | 8/7/2018 15:03 | 0.27 | 1.73 | 6.50 | 0.89 | 4.90 | 28.56 | 72.35 |
| 21 | 8/7/2018 16:03 | 0.11 | 1.02 | 5.23 | 0.54 | 2.01 | 26.18 | 77.80 |
| 22 | 8/7/2018 5:03 | 0.36 | 1.25 | 5.55 | 0.87 | 2.89 | 28.91 | 102.93 |
| 23 | 8/7/2018 6:03 | 0.44 | 1.49 | 6.09 | 1.10 | 3.54 | 29.07 | 92.76 |
| 24 | 8/7/2018 7:03 | 0.30 | 1.09 | 5.18 | 0.73 | 2.46 | 23.59 | 98.91 |
| AVERAGE | | 0.23 | 1.47 | 6.03 | 0.80 | 3.96 | 27.30 | 81.14 |
| MINIMUM | | 0.11 | 1.02 | 5.18 | 0.54 | 2.01 | 23.59 | 70.86 |
| MAXIMUM | | 0.44 | 1.91 | 6.85 | 1.10 | 5.83 | 30.06 | 102.93 |
| NEQS | | 5 | 40 | 80 | 120 | 80.00 | 35.00 | 150.00 |

3.3 DAMBUDAAS

Table 3-3: Ambient Air Quality Monitoring Results.

| Sr. No. | Parameters | Avg. Sampling Time | Unit | NEQS | Average Concentration |
|---------|-------------------------------------|--------------------|-------------------|------|-----------------------|
| 1 | Carbon Monoxide (CO) | 24 | mg/m ³ | 5 | 0.32 |
| 2 | Nitric oxide (NO) | 24 | µg/m ³ | 40 | 1.44 |
| 3 | Nitrogen Dioxide (NO ₂) | 24 | µg/m ³ | 80 | 5.85 |
| 4 | Sulphur Dioxide (SO ₂) | 24 | µg/m ³ | 120 | 0.96 |
| 5 | Ozone (O ₃) | 24 | µg/m ³ | 80 | 3.32 |
| 6 | PM _{2.5} | 24 | µg/m ³ | 35 | 27.23 |
| 7 | PM ₁₀ | 24 | µg/m ³ | 150 | 91.53 |

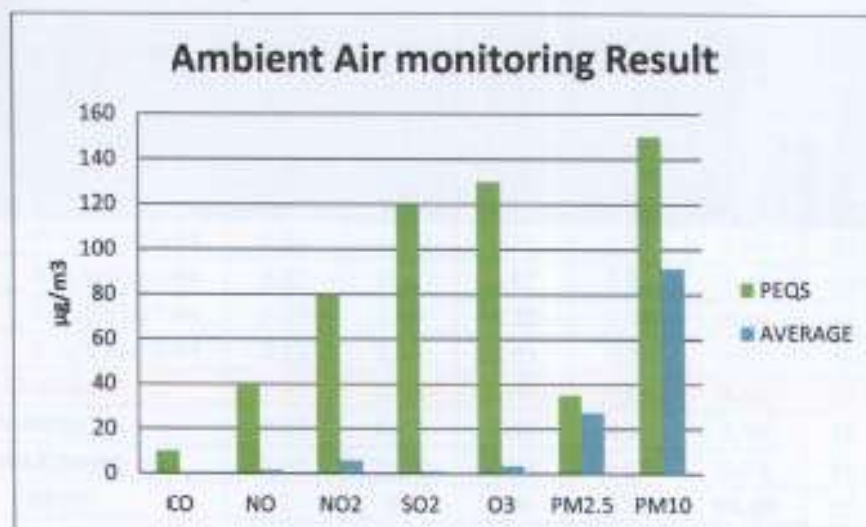


Figure 3-3: Ambient Air Monitoring Results

For detail Monitoring please see the Table 3.3

| Sr. No. | Date - Time | CO | NO | NO ₂ | SO ₂ | O ₃ | PM2.5 | PM10 |
|----------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | mg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ | µg/m ³ |
| 1 | 8/4/2018 9:44 | 0.11 | 1.18 | 8.35 | 1.15 | 3.67 | 28.48 | 91.26 |
| 2 | 8/4/2018 10:44 | 0.14 | 1.16 | 8.34 | 1.16 | 3.59 | 28.41 | 83.45 |
| 3 | 8/4/2018 11:44 | 0.22 | 1.92 | 8.91 | 1.20 | 4.67 | 31.00 | 99.55 |
| 4 | 8/4/2018 12:44 | 0.11 | 1.02 | 5.23 | 0.54 | 4.01 | 26.18 | 77.77 |
| 5 | 8/4/2018 13:44 | 0.19 | 1.35 | 5.81 | 0.70 | 3.33 | 26.03 | 77.31 |
| 6 | 8/4/2018 14:44 | 0.14 | 1.19 | 5.55 | 0.62 | 4.15 | 27.36 | 89.03 |
| 7 | 8/4/2018 15:44 | 0.28 | 1.70 | 6.41 | 0.56 | 2.16 | 24.15 | 71.16 |
| 8 | 8/4/2018 16:44 | 0.16 | 1.36 | 5.84 | 0.71 | 3.43 | 26.21 | 85.23 |
| 9 | 8/4/2018 17:44 | 0.14 | 1.52 | 6.12 | 0.78 | 4.03 | 27.17 | 81.00 |
| 10 | 8/4/2018 18:44 | 0.21 | 1.45 | 6.00 | 0.94 | 5.21 | 29.05 | 87.05 |
| 11 | 8/4/2018 19:44 | 0.43 | 1.43 | 5.97 | 1.05 | 3.41 | 28.32 | 91.37 |
| 12 | 8/4/2018 20:44 | 0.28 | 1.05 | 5.09 | 0.89 | 2.96 | 26.15 | 95.18 |
| 13 | 8/4/2018 21:44 | 0.29 | 1.04 | 5.08 | 0.88 | 2.95 | 26.11 | 97.78 |
| 14 | 8/4/2018 22:44 | 0.35 | 1.22 | 5.26 | 0.75 | 2.53 | 23.98 | 99.66 |
| 15 | 8/4/2018 23:44 | 0.47 | 1.52 | 6.16 | 1.14 | 3.64 | 29.42 | 93.40 |
| 16 | 8/5/2018 0:44 | 0.45 | 1.45 | 5.04 | 0.67 | 2.29 | 22.75 | 105.19 |
| 17 | 8/5/2018 1:44 | 0.65 | 2.04 | 5.78 | 1.58 | 3.11 | 28.40 | 95.66 |
| 18 | 8/5/2018 2:44 | 0.53 | 1.72 | 5.13 | 1.25 | 2.88 | 26.72 | 91.63 |
| 19 | 8/5/2018 3:44 | 0.55 | 1.75 | 5.16 | 1.30 | 2.92 | 29.84 | 99.06 |
| 20 | 8/5/2018 4:44 | 0.61 | 1.79 | 5.26 | 1.38 | 2.98 | 27.24 | 100.13 |
| 21 | 8/5/2018 5:44 | 0.56 | 1.77 | 5.21 | 1.34 | 2.95 | 26.99 | 99.51 |
| 22 | 8/5/2018 6:44 | 0.37 | 1.41 | 4.47 | 0.66 | 2.47 | 23.82 | 92.04 |
| 23 | 8/5/2018 7:44 | 0.39 | 1.53 | 5.28 | 1.01 | 3.44 | 31.32 | 97.21 |
| 24 | 8/5/2018 8:44 | 0.15 | 1.03 | 5.03 | 0.76 | 2.87 | 28.45 | 96.14 |
| AVERAGE | | 0.32 | 1.44 | 5.85 | 0.96 | 3.32 | 27.23 | 91.53 |
| MINIMUM | | 0.11 | 1.02 | 4.47 | 0.54 | 2.16 | 22.75 | 71.16 |
| MAXIMUM | | 0.65 | 2.04 | 8.91 | 1.58 | 5.21 | 31.32 | 105.19 |
| NEQS | | 5 | 40 | 80 | 120 | 80.00 | 35.00 | 150.00 |



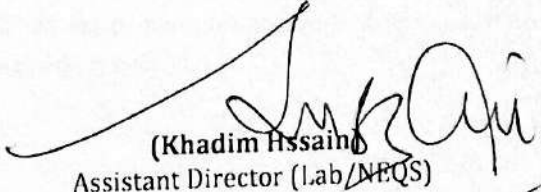
Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
Shahrah-e-Quaid-e-Azam, Khomer, Gilgit
Ph# 05811-920679, Fax 05811-922016

Ref: GB-EPA-WQMS-5(6)/2008

Gilgit, dated October 3rd, 2018

Subject: **RECEIVING**

An amount of Rs.84,000 (Eighty Four Thousand) have been received by the undersigned on 3rd of October 2018 on account of Water Quality Testing ground/surface water along Juglot-Skardu road Project from Engr. Behroz.


(Khadim Hssain)
Assistant Director (Lab/NEQS)



Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
Shahrah-e-Quaid-e-Azam, Khomer, Gilgit
Ph# 05811-920679, Fax 05811-922016

No. GB-EPA-WQMS-5(6)/2008

48563

Gilgit, dated October 3rd, 2018

To,

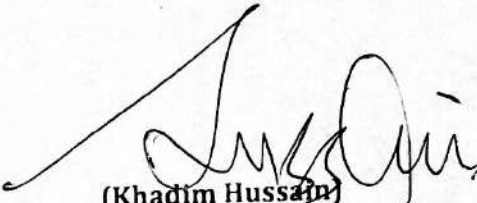
The Director,
Finite Engineering (Pvt) Ltd Islamabad.

Subject:

GROUND/SURFACE WATER TESTS ALONG JUGLOT-SKARDU ROAD PROJECT.

I am directed to refer your office letter No. nil dated 18th September, 2018 on the subject and to enclose herewith the results of water samples tested in Gilgit-Baltistan Environmental Protection Agency Laboratory as received.

Enclosed; As above


(Khadim Hussain)
Assistant Director (Lab/NEQS)



Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
Drinking Water Quality Test Report
Bacteriological and Physical Parameters

Doc No: LAB/WQM/001-A
Effective Date: 01/04/2010
Version No: 02
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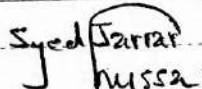
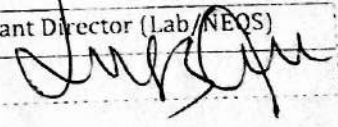
| | | | |
|---|-------------------------------------|-----------|----------------|
| Sampling Date: 17/09/2018 | Location: Along Juglot- Skardu Road | District: | Union council: |
| Methodology / Technique: Membrane Filtration Technique (MF) | | | |

Test Criteria: The water sample is tested against National Standards for Drinking Water Quality of Pakistan.

| Bacteriological Parameters | Physical Parameters | | | | | | |
|----------------------------|---------------------|-----------|------------------------|-------------------------|------------------|------------------|------------------|
| E.coli | pH | Turbidity | Total Dissolved Solids | Electrical Conductivity | Colour | Odour | Taste |
| 0/100 ml | 6.5-8.5 | < 5NTU | < 1000 ppm | ---- | Un Objectionable | Un Objectionable | Un Objectionable |

| S# | Sampling Point | Analysis Parameters | | | | | | | | |
|----|-----------------|----------------------------|---------------------|-----------|------------------------|-------------------------|-------|------------|-----------|-----------|
| | | Bacteriological Parameters | Physical Parameters | | | | | | | |
| | | E.coli | pH | Turbidity | Total Dissolved Solids | Electrical Conductivity | Temp. | Colour | Odour | Taste |
| 1 | S#1 Kachoori TW | 0 col/100ml | 7.8 | <5 NTU | 258 ppm | 369 μ S | 20°C | Colourless | Odourless | Tasteless |
| 2 | S#2 Kachoori SW | 0 col/100ml | 7.8 | <5 NTU | 310 ppm | 491 μ S | 20°C | Colourless | Odourless | Tasteless |
| 3 | S#3 Bagcha SW | 0 col/100ml | 7.9 | <5 NTU | 380 ppm | 570 μ S | 20°C | Colourless | Odourless | Tasteless |
| 4 | S#4 Bagcha TW | 0 col/100ml | 7.8 | <5 NTU | 331 ppm | 498 μ S | 20°C | Colourless | Odourless | Tasteless |

Conclusion: Results shows that the tested sample are within the limits of National Standards for Drinking Water Quality of Pakistan.

| Tested By | Verified By | Approved By |
|---|---|---|
| Name: Syed Waqar Hussain | Name: Syed Jarrar Hussain | Name: Khadim Hussain |
| Designation: Field Monitoring Assistant | Designation: Scientific Officer (Lab/NEQS) | Designation: Assistant Director (Lab/NEQS) |
| Signature & Date:  | Signature & Date:  | Signature & Date:  |



Government of Gilgit-Baltistan
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| | | | |
|--|--|------------------|-----------------------|
| Sampling Date: 18/09/2018 | Location: Along Juglot -Skardu Road | District: | Union council: |
| Methodology / Technique: Membrane Filtration Technique (MF) | | | |

Test Criteria: The water sample is tested against National Standards for Drinking Water Quality of Pakistan.

| Bacteriological Parameters | | Physical Parameters | | | | | |
|----------------------------|---------|---------------------|------------------------|-------------------------|------------------|------------------|------------------|
| E.coli | pH | Turbidity | Total Dissolved Solids | Electrical Conductivity | Colour | Odour | Taste |
| 0/100 ml | 6.5-8.5 | < 5NTU | < 1000 ppm | --- | Un Objectionable | Un Objectionable | Un Objectionable |

| S# | Sampling Point | Analysis Parameters | | | | | | | | |
|----|-----------------|----------------------------|-----|---------------------|------------------------|-------------------------|-------|------------|-----------|-----------|
| | | Bacteriological Parameters | | Physical Parameters | | | | | | |
| | | E.coli | pH | Turbidity | Total Dissolved Solids | Electrical Conductivity | Temp. | Colour | Odour | Taste |
| 5 | S#5 Dambodas TW | 0 col/100ml | 8.0 | <5 NTU | 65 ppm | 115 μ s | 20°C | Colourless | Odourless | Tasteless |
| 6 | S#6 Dambodas SW | 0 col/100ml | 7.8 | <5 NTU | 170 ppm | 223 μ s | 20°C | Colourless | Odourless | Tasteless |
| 7 | S#7 Astak TW | 0 col/100ml | 7.2 | 30 NTU | 280 ppm | 370 μ s | 20°C | Colourless | Odourless | Tasteless |
| 8 | S#8 Astak SW | 0 col/100ml | 6.8 | 80 NTU | 341 ppm | 465 μ s | 20°C | Colourless | Odourless | Tasteless |

Conclusion: Results shows that the Turbidity of Astak TW and Astak SW is high which is against the National Standards for Drinking Water Quality of Pakistan.

| Tested By | Verified By | Approved By |
|---|--|--|
| Name: Syed Waqar Hussain | Name: Syed Jarrar Hussain | Name: Khadim Hussain |
| Designation: Field Monitoring Assistant | Designation: Scientific Officer (Lab/NEQS) | Designation: Assistant Director (Lab/NEQS) |
| Signature & Date: | Signature & Date: | Signature & Date: |



Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
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Bacteriological and Physical Parameters

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| | | | |
|---|-------------------------------------|-----------|----------------|
| Sampling Date: 18/09/2018 | Location: Along Juglot- Skardu Road | District: | Union council: |
| Methodology / Technique: Membrane Filtration Technique (MF) | | | |

Test Criteria: The water sample is tested against National Standards for Drinking Water Quality of Pakistan.

| Test Criteria: The water sample is tested against National Standards for Drinking Water Quality | | | | | | | |
|---|---------------------|-----------|------------------------|-------------------------|------------------|------------------|------------------|
| Bacteriological Parameters | Physical Parameters | | | | | | |
| E.coli | pH | Turbidity | Total Dissolved Solids | Electrical Conductivity | Colour | Odour | Taste |
| 0/100 ml | 6.5-8.5 | < 5NTU | < 1000 ppm | ---- | Un Objectionable | Un Objectionable | Un Objectionable |

| S# | Sampling Point | Analysis Parameters | | | | | | | | |
|----|-----------------|----------------------------|-----|---------------------|------------------------|-------------------------|-------|------------|-----------|-----------|
| | | Bacteriological Parameters | | Physical Parameters | | | | | | |
| | | E.coli | pH | Turbidity | Total Dissolved Solids | Electrical Conductivity | Temp. | Colour | Odour | Taste |
| 9 | S#9 Shangus TW | 0 col/100ml | 7.1 | <5 NTU | 284 ppm | 388 μ s | 20°C | Colourless | Odourless | Tasteless |
| 10 | S#10 Shangus SW | 0 col/100ml | 7.3 | <5 NTU | 270 ppm | 305 μ s | 20°C | Colourless | Odourless | Tasteless |
| 11 | S#11 Juglot TW | 0 col/100ml | 8.1 | <5 NTU | 205 ppm | 370 μ s | 20°C | Colourless | Odourless | Tasteless |
| 12 | S#12 Hramosh TW | 0 col/100ml | 8.2 | <5 NTU | 345 ppm | 572 μ s | 20°C | Colourless | Odourless | Tasteless |

Conclusion: Results shows that the tested sample are within the limits of National Standards for Drinking Water Quality of Pakistan.

| Tested By | Verified By | Approved By |
|---|--|--|
| Name: Syed Waqar Hussain | Name: Syed Jarrar Hussain | Name: Khadim Hussain |
| Designation: Field Monitoring Assistant | Designation: Scientific Officer (Lab/NEQS) | Designation: Assistant Director (Lab/NEQS) |
| Signature & Date: | Signature & Date: | Signature & Date: |



Gilgit-Baltistan Environmental Protection Agency

Drinking Water Quality Test Report

Chemical Parameters

Doc No: LAB/WQM/001-B
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Version No: 02
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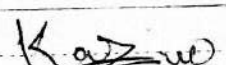
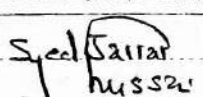
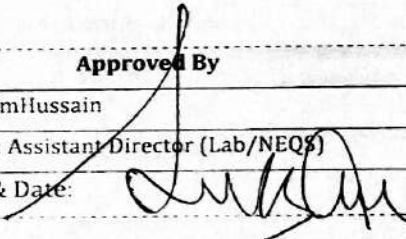
| | | | |
|--|-------------------------------------|-----------|----------------|
| Sampling Date: 17/9/2018 | Location: Along Juglot- Skardu Road | District: | Union council: |
| Methodology / Technique: Voltammetry and Photometry (Metalysers HM 2000 and Metalometer HM 2000) | | | |

Test Criteria: The water samples are tested against National Standards for Drinking Water Quality of Pakistan.

| Standard Values for Pakistan (mg/l) | | | | | | | | | | | |
|-------------------------------------|--------|----|------|-------|------|-------|-----|-------|-----|--|--|
| As | Hg | Cu | Al | Fe | Mn | Cr6 | Zn | Ni | B | | |
| ≤0.05 | ≤0.001 | 2 | ≤0.2 | ----- | ≤0.5 | ≤0.05 | 5.0 | ≤0.02 | 0.3 | | |

| Sr # | Sampling point | Analysis Parameters (mg/l) | | | | | | | | | |
|------|-----------------|----------------------------|----|----|------|------|----|------|----|-----|-----|
| | | As | Hg | Cu | Al | Fe | Mn | Cr6 | Zn | Ni | B |
| 1 | S#1 Kachoori TW | ND | ND | ND | ND | 0.02 | ND | 0.04 | ND | 0.1 | 0.1 |
| 2 | S#2 Kachoori SW | ND | ND | ND | 0.01 | 0.03 | ND | 0.05 | ND | 0.1 | 0.2 |
| 3 | S#3 Bagcha SW | 0.01 | ND | ND | 0.01 | 0.04 | ND | ND | ND | 0.2 | ND |
| 4 | S#4 Bagcha TW | ND | ND | ND | ND | 0.01 | ND | ND | ND | 0.1 | ND |

Conclusion: Tested results shows that the concentration of Nickel is against National Standards for Drinking Water Quality of Pakistan.

| Tested By | Verified By | Approved By |
|---|---|---|
| Name: Syed Waqar Hussain | Name: Syed Jarrar Hussain | Name: Khadim Hussain |
| Designation: Field Monitoring Assistant | Designation: Scientific Officer (Lab/NEQS) | Designation: Assistant Director (Lab/NEQS) |
| Signature & Date:  | Signature & Date:  | Signature & Date:  |



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Drinking Water Quality Test Report
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| | | | |
|--|-------------------------------------|-----------|----------------|
| Sampling Date: 18/9/2018 | Location: Along Juglot- Skardu Road | District: | Union council: |
| Methodology / Technique: Voltammetry and Photometry (Metalyser HM 2000 and Metalometer HM 2000) | | | |

Test Criteria: The water samples are tested against National Standards for Drinking Water Quality of Pakistan.

| Standard Values for Pakistan (mg/l) | | | | | | | | | | | |
|--------------------------------------|--------|----|------|-------|------|-------|-----|-------|-----|--|--|
| As | Hg | Cu | Al | Fe | Mn | Cr6 | Zn | Ni | B | | |
| ≤0.05 | ≤0.001 | 2 | ≤0.2 | ----- | ≤0.5 | ≤0.05 | 5.0 | ≤0.02 | 0.3 | | |

| Sr # | Sampling point | Analysis Parameters (mg/l) | | | | | | | | | |
|------|-----------------|----------------------------|----|----|------|------|----|------|----|-----|-----|
| | | As | Hg | Cu | Al | Fe | Mn | Cr6 | Zn | Ni | B |
| 5 | S#5 Dambodas TW | ND | ND | ND | ND | ND | ND | 0.02 | ND | 0.1 | 0.2 |
| 6 | S#6 Dambodas SW | ND | ND | ND | ND | ND | ND | 0.06 | ND | 0.2 | 0.3 |
| 7 | S#7 Astak TW | ND | ND | ND | 0.01 | 0.02 | ND | 0.07 | ND | 0.1 | ND |
| 8 | S#8 Astak SW | ND | ND | ND | 0.02 | 0.03 | ND | 0.10 | ND | 0.1 | ND |

Conclusion: Tested results shows that the concentration of Nickel and Chromium6 is against National Standards for Drinking Water Quality of Pakistan.

| Tested By | Verified By | Approved By |
|---|--|--|
| Name: Syed Waqar Hussain | Name: Syed Jarrar Hussain | Name: Khadim Hussain |
| Designation: Field Monitoring Assistant | Designation: Scientific Officer (Lab/NEQS) | Designation: Assistant Director (Lab/NEQS) |
| Signature & Date: | Signature & Date: | Signature & Date: |



Gilgit-Baltistan Environmental Protection Agency

Drinking Water Quality Test Report

Chemical Parameters

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| | | | |
|---|-------------------------------------|-----------|----------------|
| Sampling Date: 18/9/2018 | Location: Along Juglot- Skardu Road | District: | Union council: |
| Methodology / Technique: Voltammetry and Photometry (Metalyser HM 2000 and Metalometer HM 2000) | | | |

Test Criteria: The water samples are tested against National Standards for Drinking Water Quality of Pakistan.

| Standard Values for Pakistan (mg/l) | | | | | | | | | | |
|-------------------------------------|--------|----|------|-------|------|-------|-----|-------|-----|--|
| As | Hg | Cu | Al | Fe | Mn | Cr6 | Zn | Ni | B | |
| ≤0.05 | ≤0.001 | 2 | ≤0.2 | ----- | ≤0.5 | ≤0.05 | 5.0 | ≤0.02 | 0.3 | |

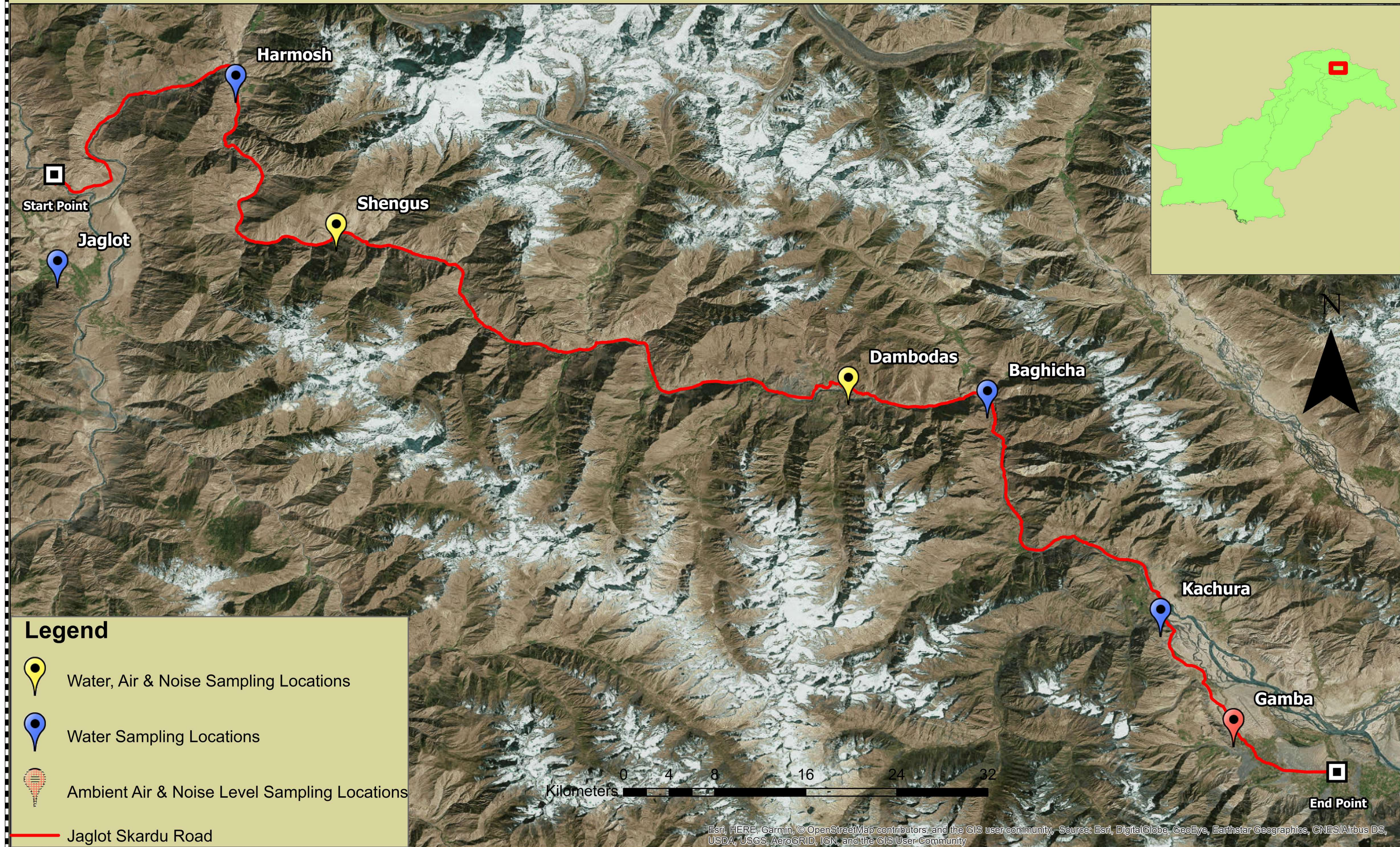
| Sr # | Sampling point | Analysis Parameters (mg/l) | | | | | | | | | |
|------|------------------|----------------------------|----|------|-----|------|----|------|----|-----|----|
| | | As | Hg | Cu | Al | Fe | Mn | Cr6 | Zn | Ni | B |
| 9 | S#9 Shangus TW | ND | ND | 0.6 | ND | ND | ND | 0.01 | ND | ND | ND |
| 10 | S#10 Shangus SW | ND | ND | 1.54 | ND | ND | ND | 0.02 | ND | ND | ND |
| 11 | S#11 Juglot TW | ND | ND | ND | ND | ND | ND | ND | ND | 0.1 | ND |
| 12 | S#12 Heramosh TW | ND | ND | ND | 0.2 | 0.03 | ND | ND | ND | 0.1 | ND |

Conclusion: Tested results shows that the concentration of Nickel is against National Standards for Drinking Water Quality of Pakistan.

| Tested By | Verified By | Approved By |
|---|--|--|
| Name: Syed Waqar Hussain | Name: Syed Jarrar Hussain | Name: Khadim Hussain |
| Designation: Field Monitoring Assistant | Designation: Scientific Officer (Lab/NEQS) | Designation: Assistant Director (Lab/NEQS) |
| Signature & Date: | Signature & Date: | Signature & Date: |

Improvement, Widening and Up-gradation of Jaglot - Skardu Road

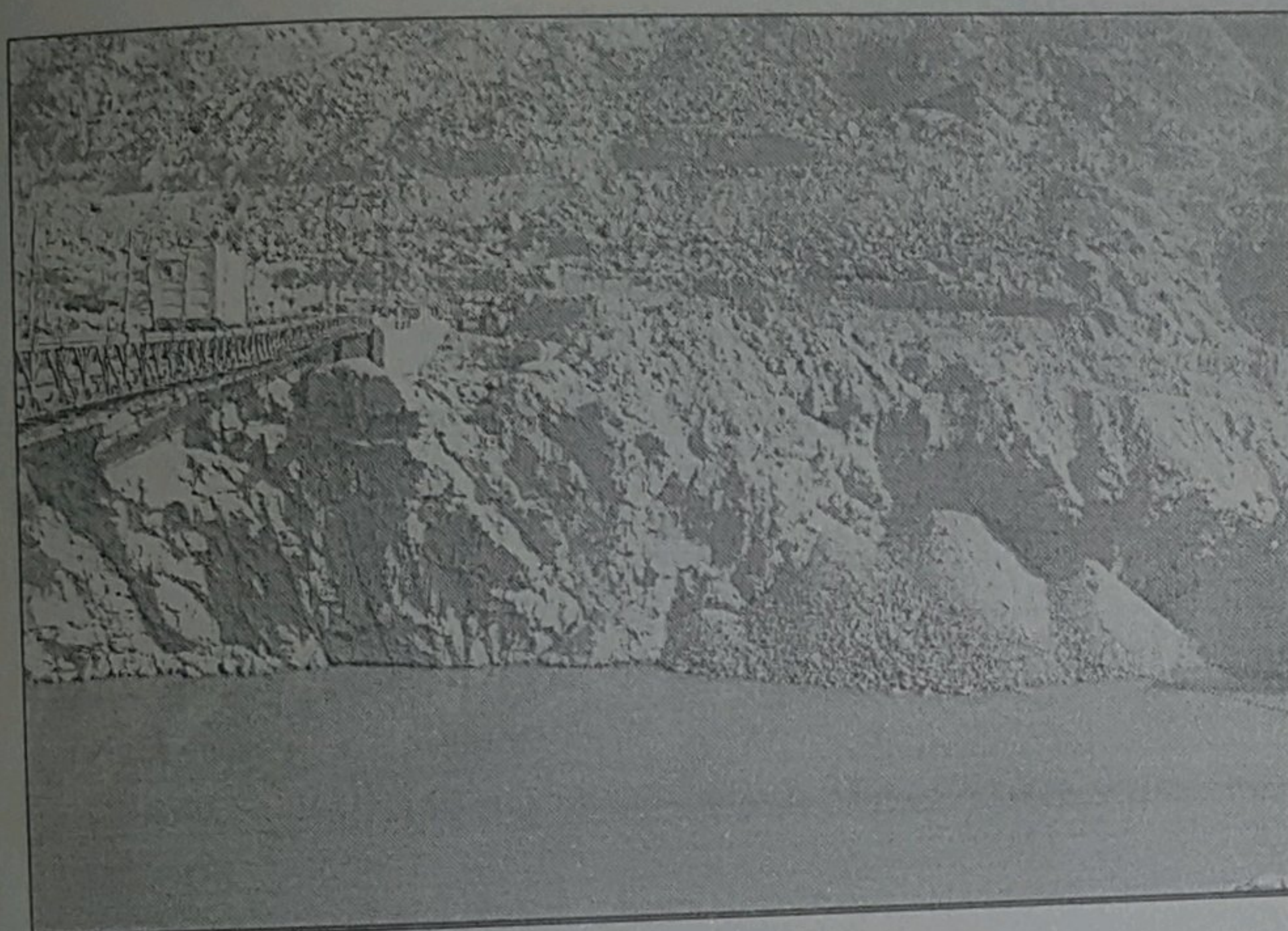
Location Map of Sampling Points



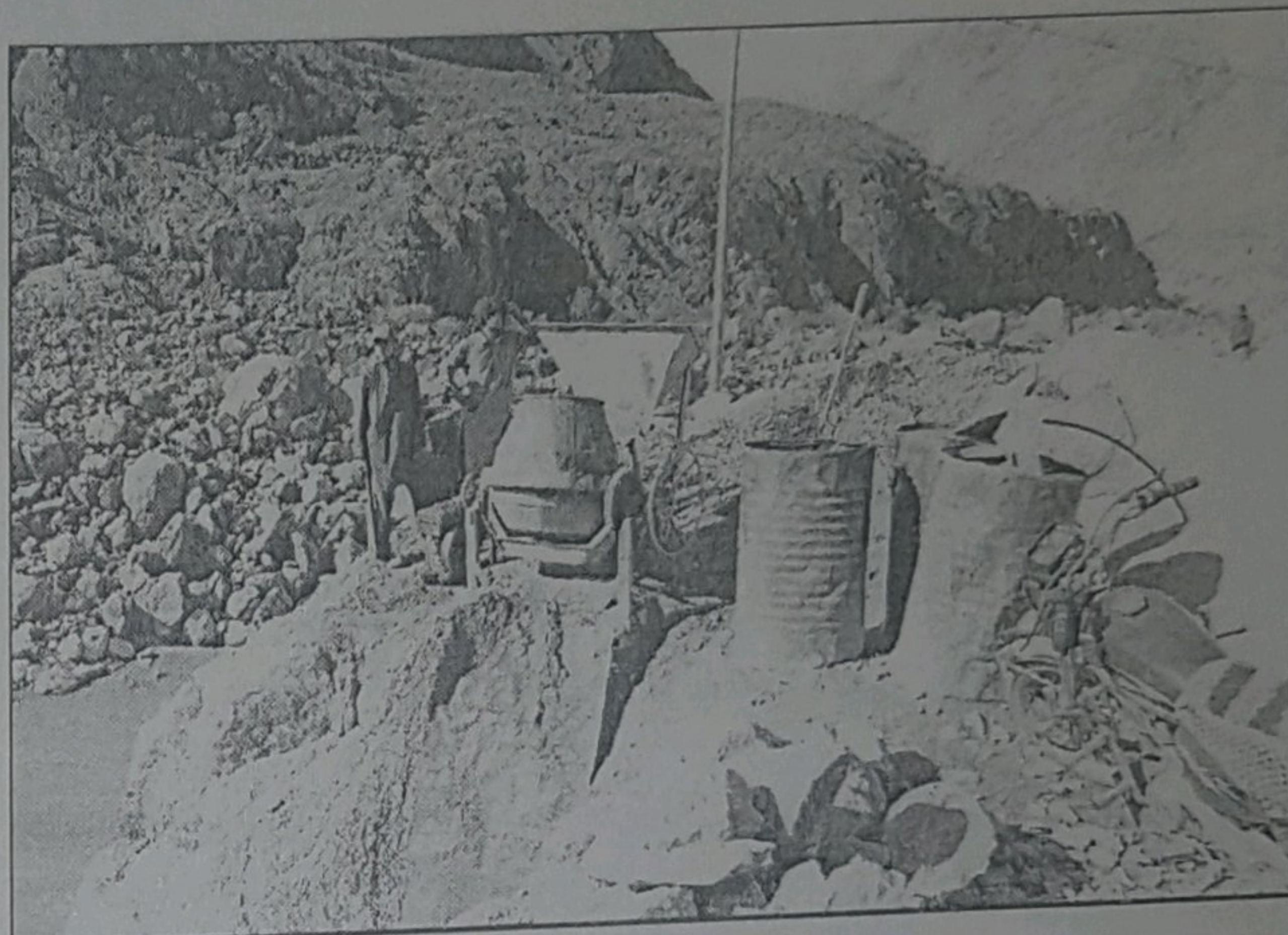


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(GB-EPA)

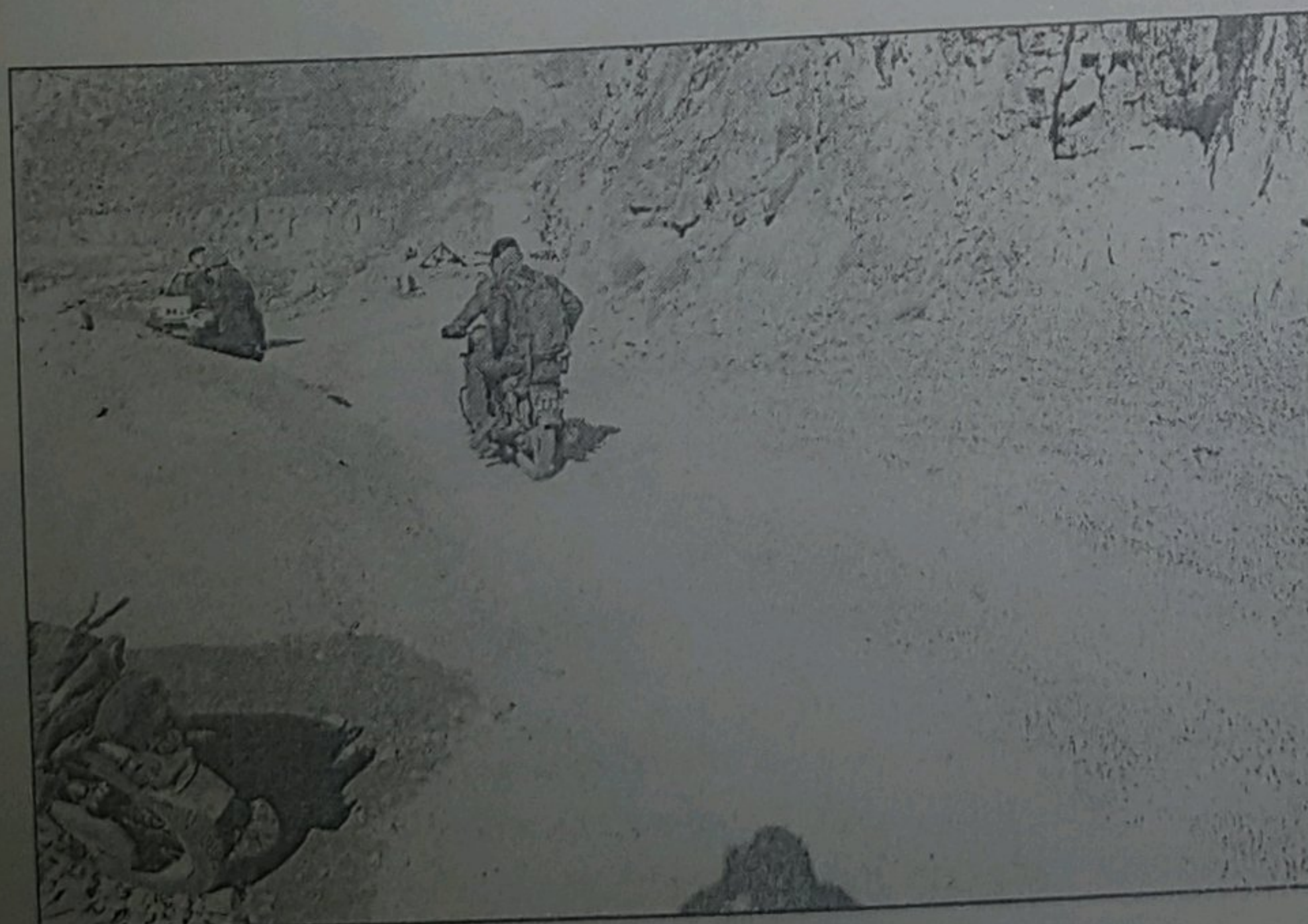
PICTORIAL VIEW:



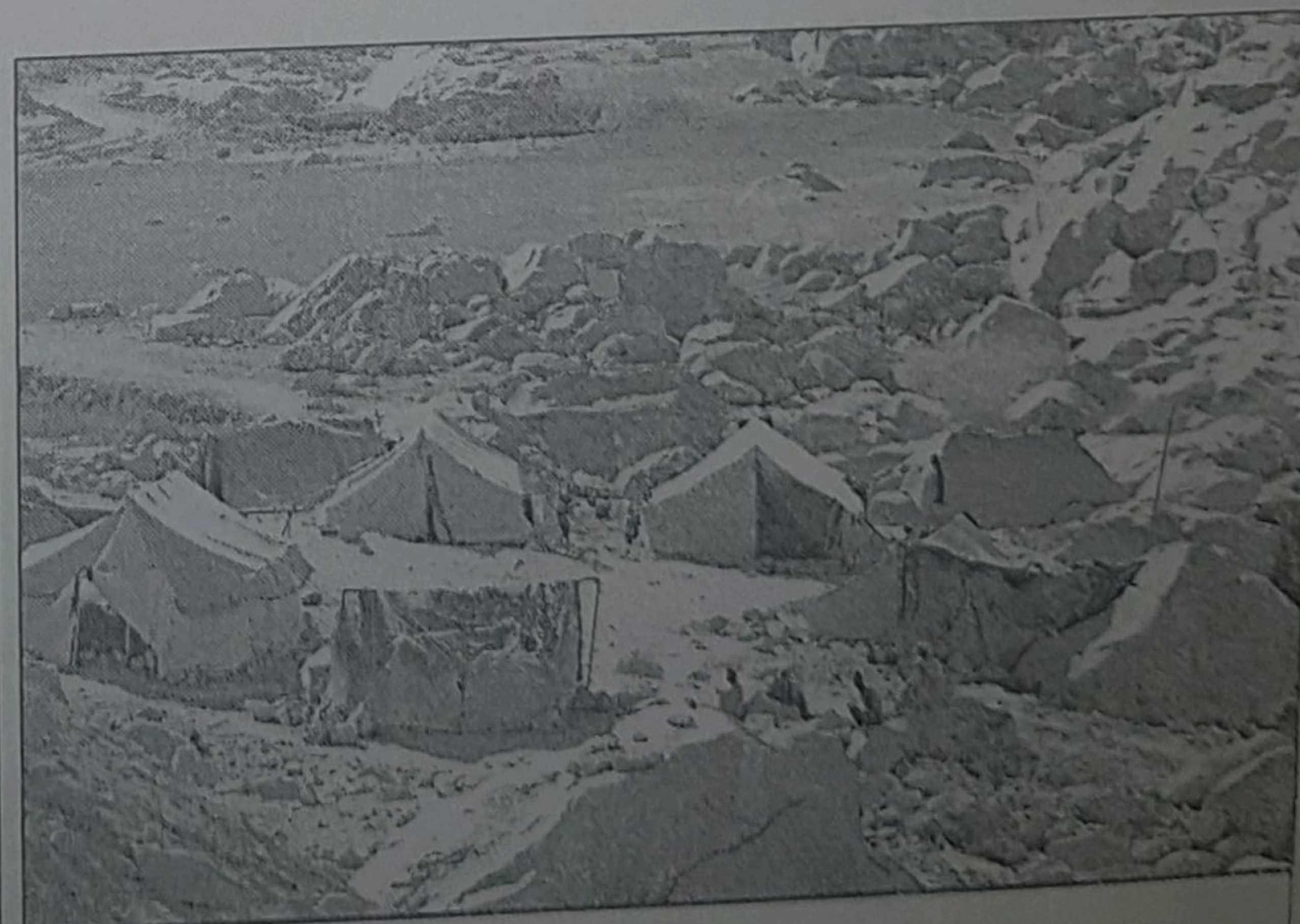
Photograph 01: Dumping of excavated material into river



Photograph 02: Workers without personal protective equipment



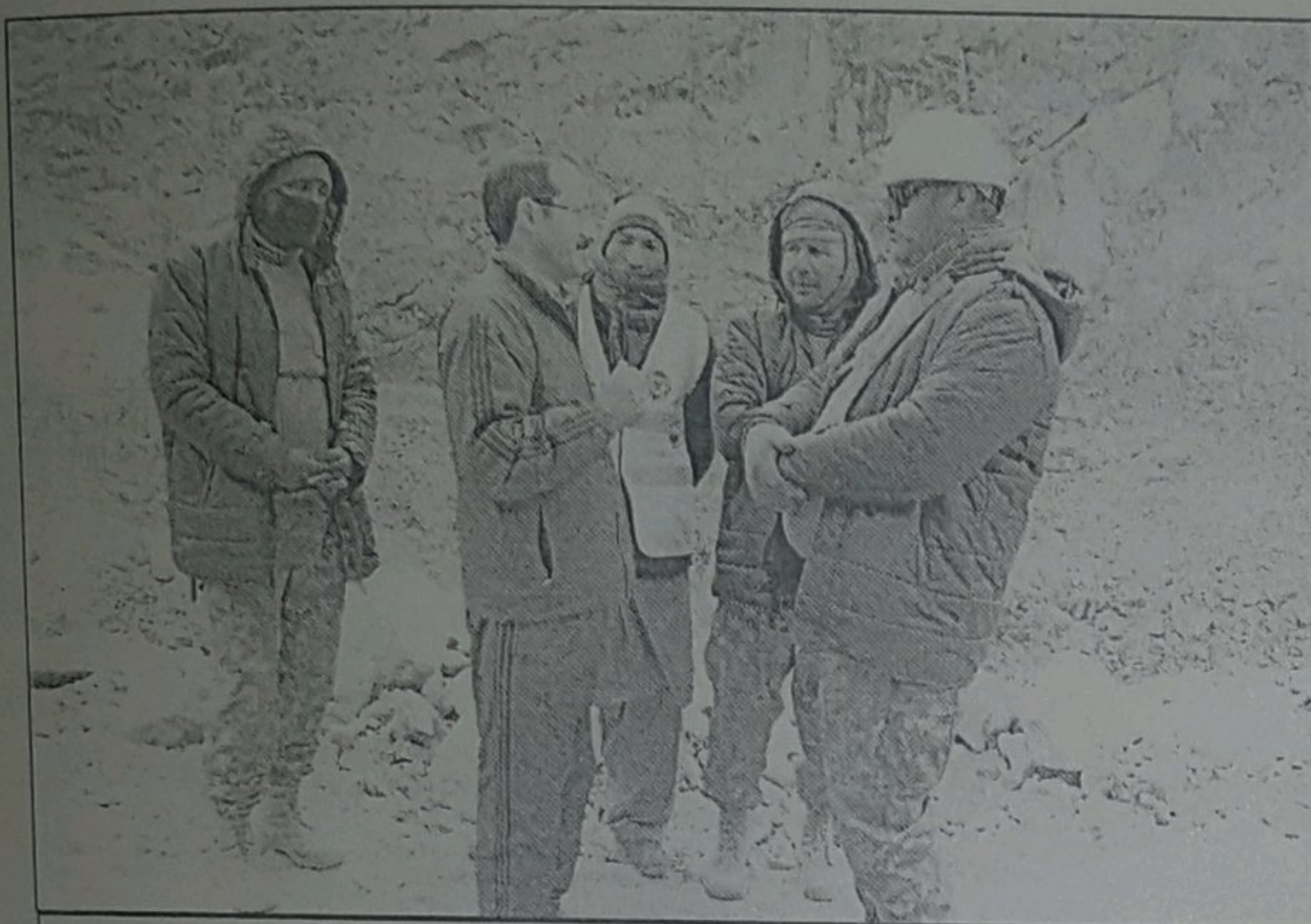
Photograph 03: Scattered pebbles and sand after use



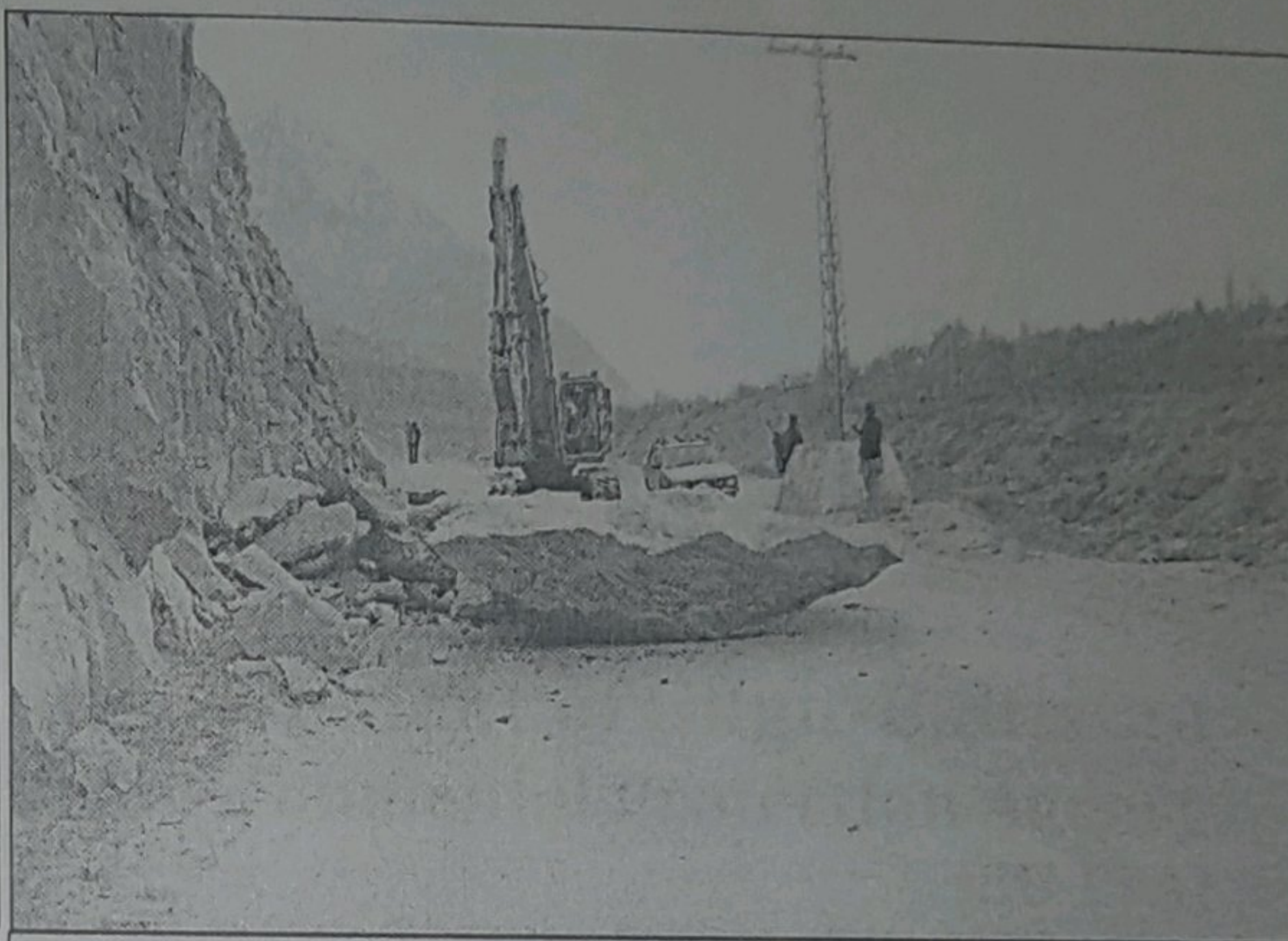
Photograph 04: Improper workers camp



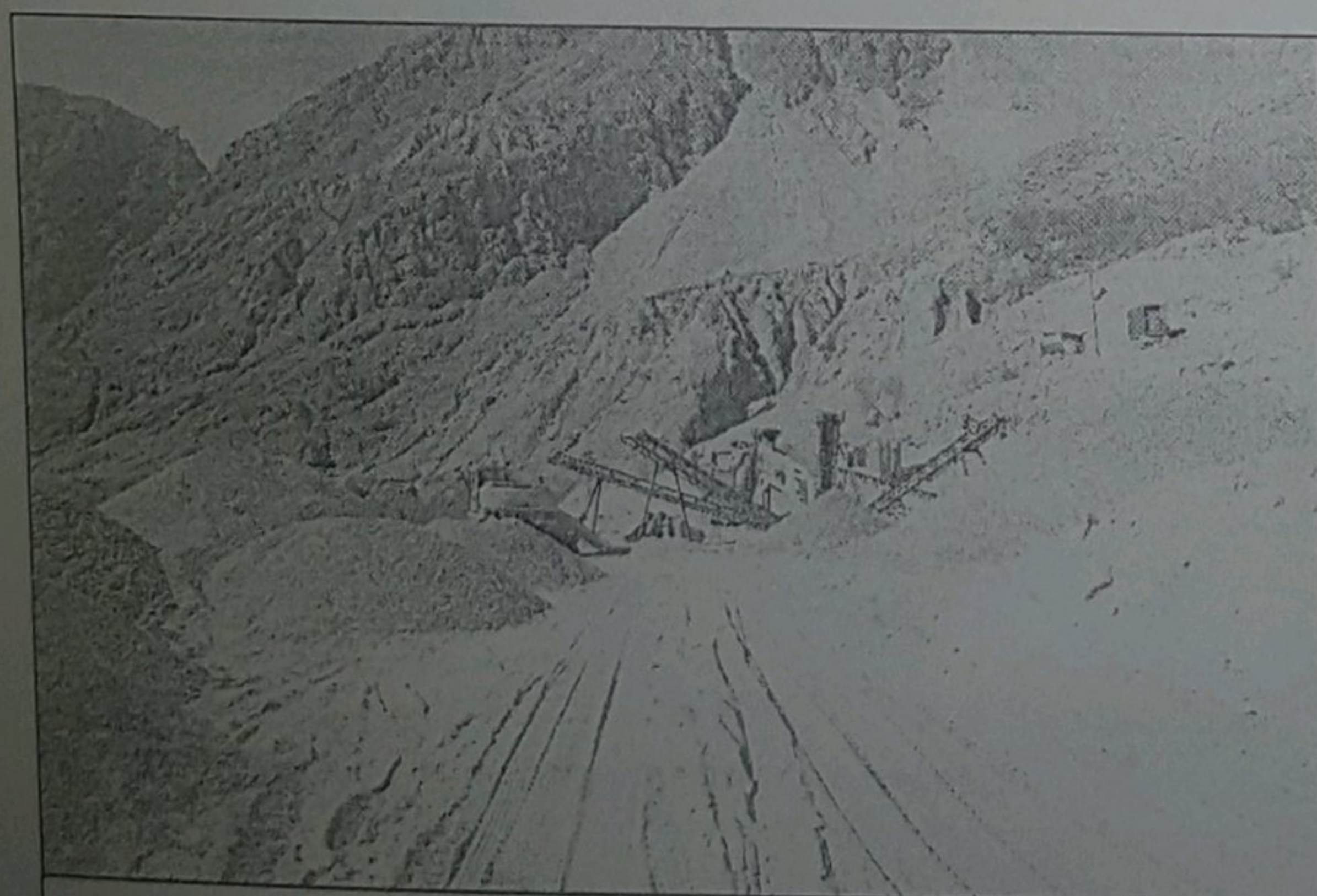
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Gilgit-Baltistan Environmental Protection Agency
(GB-EPA)



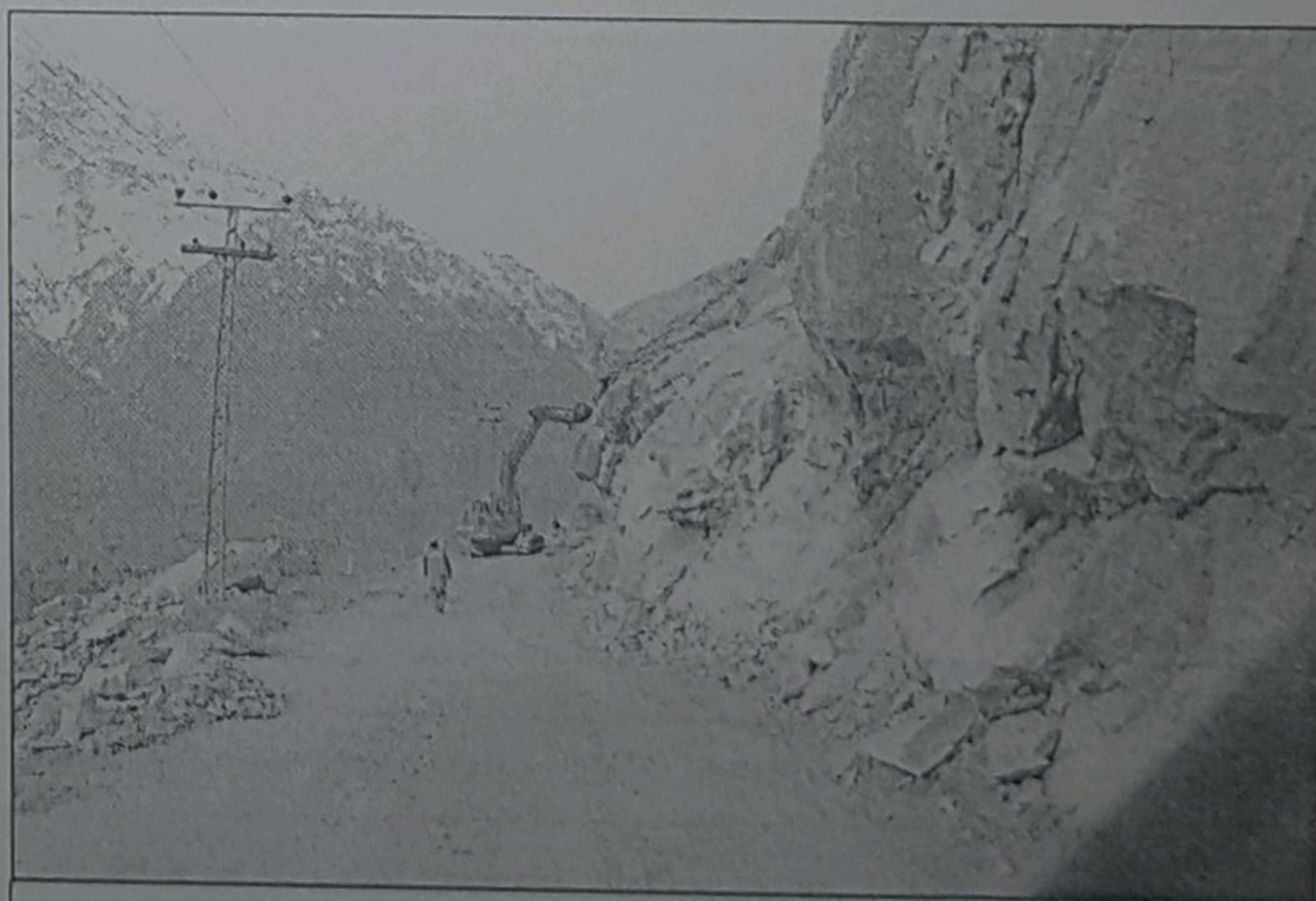
Photograph 05: Discussion with FWO personnel.



Photograph 06: Unsafe working conditions.



Photograph 07: Crush plant near Shangus adjacent to populated area.



Photograph 08: Working without safety signage.



Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
(GB-EPA)

GB-EPA-JSR-5(30)/2007

Gilgit the dated April 16th, 2018

To,

The Deputy Commissioner,
Skardu.

Subject: **RELOCATION OF CRUSH PLANTS SITUATED AT SHANGUS, DAMBUDAS AND HOTO SKARDU**

With reference to this Agency's letter of even number dated 6th March, 2018 addressed to NHA regarding the relocation of crush plants installed at populated areas at Shangus, Dambudas and Hoto. As these crushing units are creating huge dust emissions with noise which is highly detrimental to the health of nearby populace and also deteriorates the aesthetics of built environment. Establishment of crushing units within Populated areas is violation of Gilgit Baltistan Environmental Protection Act 2015.

2. Monitoring report is enclosed for you kind necessary action to relocate these crushing units installed at Shangus and Hoto Skardu in consultation with GB-EPA to avoid any conflict between the communities and proponent in future.

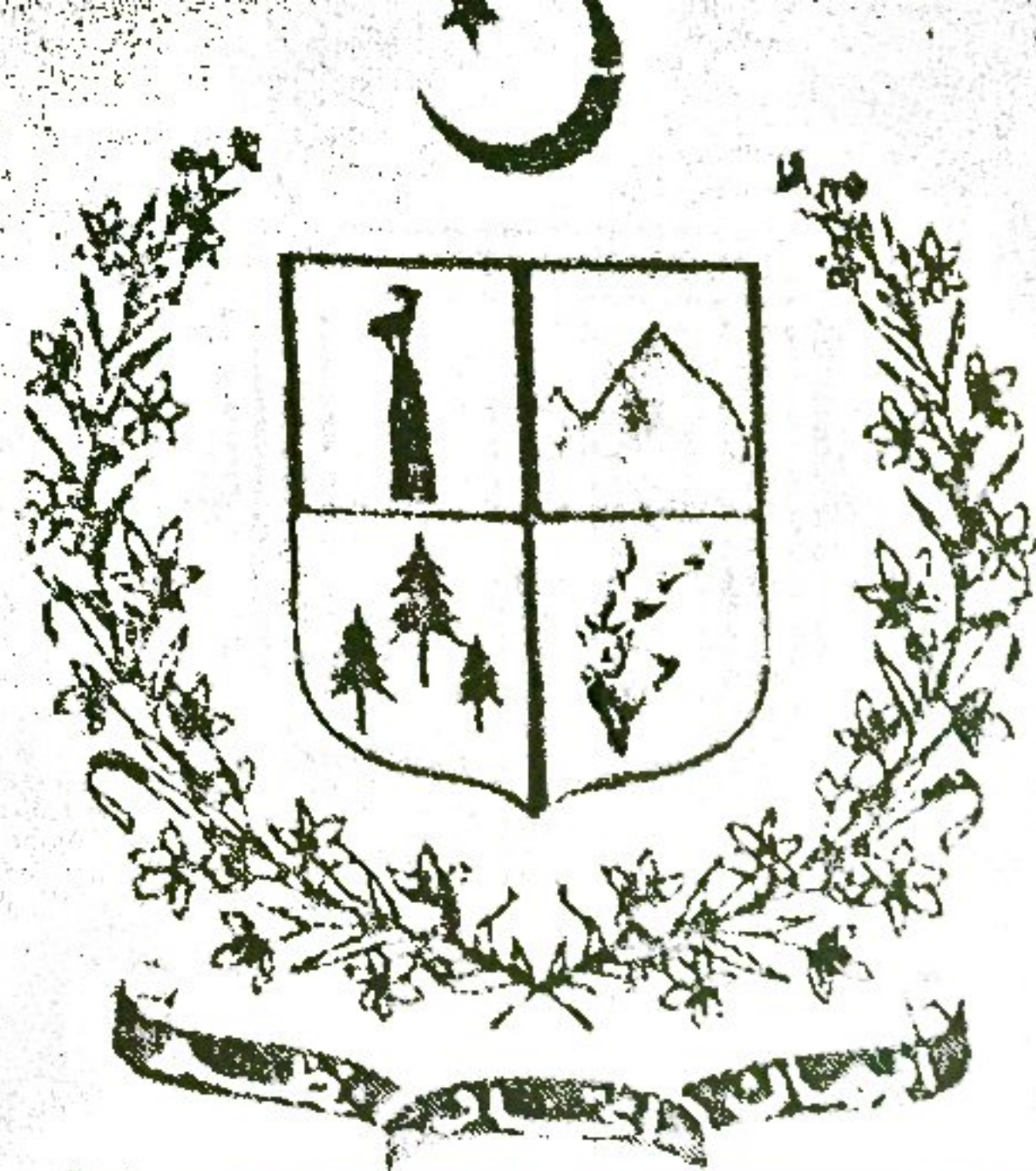

(SHEHZAD HASAN SHIGRI)
Director

Cc;

1. The Additional Secretary to the Chief Secretary GB, Gilgit
2. PSO to Secretary Environment GB, Gilgit
3. The Director NHA, Gilgit
4. PS to Commissioner, Baltistan Region

0/L

GB-EPA, Gilgit
Date 16-04-18
Page No. 479/6-21



Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
(GB-EPA)

FIELD VISIT REPORT OF WIDENING AND IMPROVEMENT OF JUGLOT SKARDU ROAD PROJECT

GB-EPA Monitoring Team:

Khadim Hussain
Syed Waqar Hussain

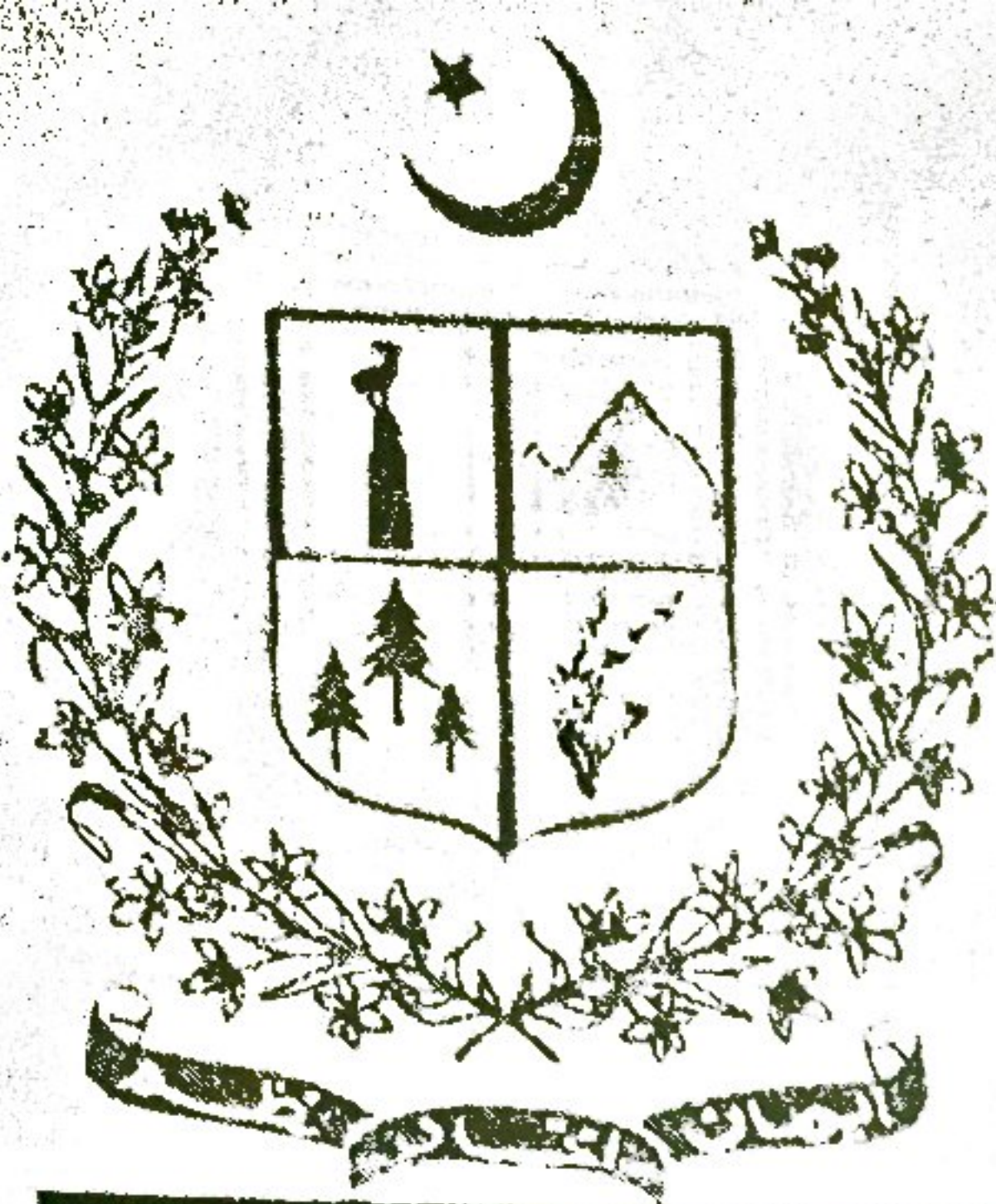
Assistant Director (R&D)
Field Monitoring Assistant

Visit Date: February 09, 2018

Legal/Enforcement team of GB-EPA carried out field monitoring of Jaglot Skardu Road Project in order to check environmental noncompliance, health and safety of workers, environmental mitigation measures taken by contractor, community grievances and traffic management. During the visit a meeting with the community and FWO officials held near Shangus Camp.

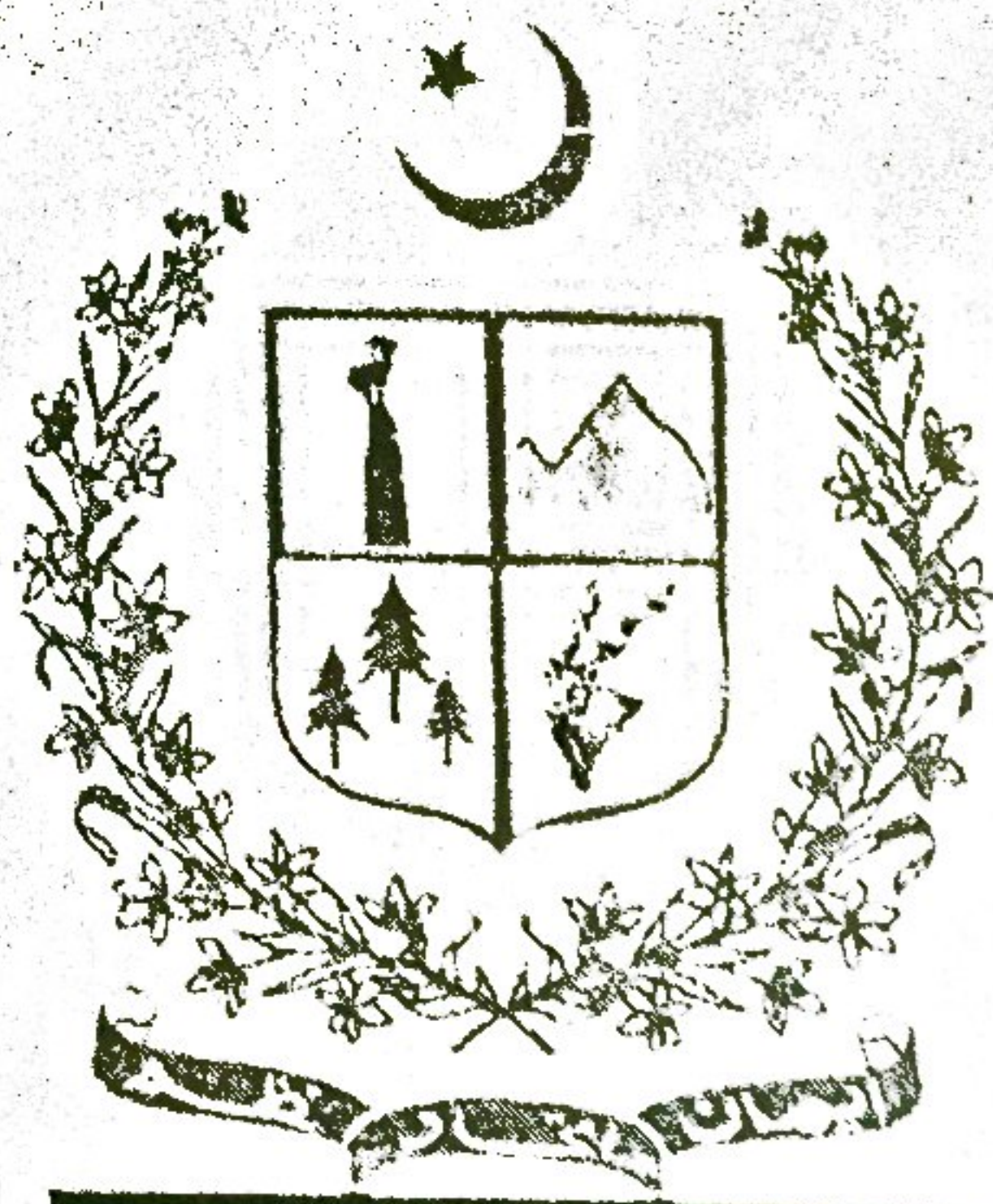
During the visit following observation were noted:

| Sr.# | Observation | | Remarks | Mitigations/ Suggestions |
|------|------------------|-------------------|--|--|
| 1. | Land Acquisition | | Land acquired without any proper agreement for project activities which may escalate conflicts between project proponent and community. | Land should be acquired with written agreements to avoid conflicts with the community. |
| 2. | Dust Emissions | Vehicular Traffic | No mitigation measure observed to reduce dust emission by public transport as well as project machinery on roads unpaved for widening. | Impose speed limits and regular water sprinkling to avoid dust emission. |
| | | Crush Plants | High emissions were observed from crush plants installed within populated areas. Crush plants situated at Shangus and Dambudas in specific are very critical as the emissions from these crush plants are very high causing health hazard to nearby community and workers. Rocks and boulders being used for crush contain precious stones and minerals; dust emitting from these rocks contain toxic chemicals which may cause serious health concerns. Complain has been | Relocation of crush plants at a safe distance from community. Water sprinkling to control dust emission. |



Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
(GB-EPA)

| | | | |
|----|---|--|--|
| | | received from Shangus community against the crush plant installed at community land adjacent to the populated area, claiming the death of a woman instigated by dust emission.(Annexed) | |
| 3. | Installation of Sign boards(Warning) | Warning signs for guiding the local traffic and workers were not displayed. | Clearly visible signs of any special measures on entering a site should be display. |
| 4. | Dumping and storage of construction materials | Improper management of construction material (cement bags, sand and pebbles) was observed at the site during and after working hours that may cause slip and trip hazards to the labors and traffic passing thereby. | Stored and used materials should be covered and properly dispose-off after use. |
| 5. | Excavated material | No proper management of excavated material. The excavated material dumped directly into the Indus river | Excavated material should be reused in back filling and leveling of road or should be disposed-off properly. |
| 6. | Personal Protective Equipment (PPE) | No welfare facilities like rest rooms (toilets) were present at any point throughout the project area. Proper personal protective equipment was not provided to workers according to the nature of work. | PPE like breathing equipment and overalls in dust and blasting areas, face shields for flying particles, helmets, goggles, footwear in areas where exposed to falling, rolling and piercing objects, hearing protection like ear buds and ear muffs, in noisy areas. |
| 7. | Campsite | Currently there is no solid waste management and sewage system in camp area. Workers dispose-off the waste material and discharge grey and black water directly into the river and nearby streams. | Establish waste management plan, provide proper rest room facility and avoid disposing the waste into the river. |
| 8. | Traffic management | No traffic management plan and working hours are defined and displayed. Due to which | Prepare traffic management plan and display working hours right from Alam Bridge at Gilgit |



Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency
(GB-EPA)

| | | | |
|----|---------------------------|---|---|
| | | passengers travelling on the road are facing inconvenience in reaching their destination on time. | and Ayub Bridge at Skardu. Specify the location, duration and time of blocked area and convey it to the district administration and major transport companies to avoid any inconvenience for regular traffic. |
| 9. | Safety precautions | No safety precautions were taken to avoid any incident and accident on the working site. | To minimize the risk of any accident and incident arising from construction activities, safety precautions, like controlled blasting, installation of crush machinery away from populated area, installation of fixed safeguards with machinery, signage display at a safe distance from construction site should be taken. |




ANNEX-J

Representatives from the Concerned Departments for Stakeholder Meeting

| Sr. No. | Name (Designation and Department with office address) | Contact No. | | Email address | Signature |
|---------|--|-------------|-------------|---------------|-----------|
| | | PTCL | Mobile No. | | |
| 1. | Abdul Latif Shaikh (AD) NHA | | 03555744766 | | |
| 2. | Shahid Hussain Qureshi | AER | 0306212666 | | |
| 3. | Zahid Ali Khan (Deputy Director Agriculture Skurdu) | | 03445952262 | | |
| 4. | Inayat Ali | | | | |
| 5. | Wildlife (Range Forset Officer) | | 03555224536 | | |
| 6. | Mohammad Ishaq (Mines and Minerals) | | 03119806493 | | |
| 7. | Dr. Fida Hussain (DD Livestock) | | 03555552120 | | |
| 8. | Muhammad Qader (E Engineer) | | 03101555725 | | |
| 9. | Taj Muhammad (XEN B&R) | | 03555550357 | | |
| 10. | Shair Ali (RFO (??)) | | 03556055307 | | |
| 11. | Muhammad Bashir (SWO) | | 03418995340 | | |
| 12. | Najaf Ali (SDO HQ) | | 03469555801 | | |
| 13. | Shehzad Burg (Assistant Director) | | 03555551581 | | |
| 14. | Major Adnan (SCO) | | | | |
| 15. | Ghulam Muhammad (Industrial department) Incharge Skd (Admin) | | 03465394435 | | |
| 16. | Mohd. Hassan (DK-District Qanomgi) Revenue Department | | 03465530875 | | |
| 17. | Ghulam Muhammad Nasir (DDE Skd) | 960009 | 035551871 | | |
| 18. | Iftikhar Hussain (AEO) | | 03555555770 | | |
| 19. | Akhtar Hussain (Dy DEO) | | 03555037872 | | |

Scanned Attendance Sheet of the Representatives from various Departments

| S.No (1) | Name Designation & Dept. (with office address) (2) | Contact No. STEL M- (3) (4) | | E-mail - Sign (5) |
|-------------|---|----------------------------------|----------------|-------------------|
| | | (3) | (4) | |
| 1 | Abdul Latif Shaukat (AD) NHH | 03555744766 | | 4.11.1 |
| 2 | SHAHID HUSSAIN QURESHI AER | 0306212686 | | S. Shahid |
| 3 | Zahid Ali Khan Deputy Director Agr. Skd. | Agric | 03665952262 | |
| 4 | NAYAT ALI | | | |
| 5 | WILDLIF | R.F.O. (Range Forest Officer) | 03555224536 | |
| 6 | Mohd. B. Shaukat alliance as personnel. | | 03119806493 | |
| 7 | Dr Fida Hussain | D D Lurstick | 03555552120 | |
| 8 | Muhammad Qader | E Engg. W.R. | 08101555725 | |
| 9 | Taj Muhammad | XEN B&R | 03555550357 | |
| 10 | Shair Ali | RFO (Building & Const.) | 03556085307 | |
| 11 | Mahmud Bakhshi | SWD | 03418995340 | |
| 12 | Nayat Ali | SDO NA | 0346-9555801-2 | |
| 13 | Shahzad Buzg | Asst. Director | 03555551581 | |
| 14 | Major Asman | SCO | | |
| 15 | Ghulam. Muhammad (Industrial depart.) | Inspection Skd. { Adm. } | 03465394435 | |
| 16 | M. H. Hassan. DK (Dist. Gamoria) | Revenue dept | 03465530875 | |

| <u>S. No.</u> | <u>Name & Designation</u> <u>Duty.</u> | <u>PTCL</u> <u>3</u> | <u>M.</u> <u>(4)</u> | <u>Signature</u> |
|---------------|---|-------------------------|-------------------------|---|
| 1 | | | | |
| 1- | Ghulam Muhammad Kharir DPE Skardu | 960009 | 035551871 |  |
| 2. | Ghikhar Hussain AEO/ | | 0355555770 |  |
| 3. | Akhtar Hussain (DYDEO) | | 03555037872 |  |

Annex-K

| Start RD | End RD | Agricultural Land | Residential Buildings | Commercial Buildings | Mosques (Religious Places) Areas | Electric Poles | Telephones Poles |
|--------------|------------|-------------------|-----------------------|----------------------|----------------------------------|----------------|------------------|
| | | Sq. M | Sq. M | Sq. M | Sq. M | No. | No. |
| KM 00+000 | KM 10+000 | 0 | 249 | 0 | 25 | 1 | 0 |
| KM 10+000 | KM 20+000 | 0 | 297 | 0 | 49 | 13 | 0 |
| KM 20+000 | KM 30+000 | 858 | 1273 | 1832 | 30 | 47 | 7 |
| KM 30+000 | KM 40+000 | 2447 | 1123 | 403 | 0 | 4 | 0 |
| KM 40+000 | KM 50+000 | 0 | 137 | 113 | 93 | 0 | 0 |
| KM 50+000 | KM 60+000 | 0 | 121 | 13 | 16 | 4 | 0 |
| KM 60+000 | KM 70+000 | 0 | 214 | 0 | 0 | 55 | 0 |
| KM 70+000 | KM 80+000 | 0 | 1195 | 10 | 37 | 23 | 0 |
| KM 80+000 | KM 90+000 | 532 | 1254 | 268 | 62 | 0 | 0 |
| KM 90+000 | KM 100+000 | 6603 | 2529 | 3637 | 105 | 56 | 0 |
| KM 100+000 | KM 110+000 | 6647 | 243 | 374 | 0 | 122 | 0 |
| KM 110+000 | KM 120+000 | 18839 | 1085 | 109 | 12 | 109 | 0 |
| KM 120+000 | KM 130+000 | 0 | 942 | 304 | 0 | 29 | 0 |
| KM 130+000 | KM 140+000 | 18980 | 735 | 84 | 105 | 54 | 0 |
| KM 140+000 | KM 150+000 | 33320 | 442 | 666 | 0 | 30 | 9 |
| KM 150+000 | KM 155+476 | 0 | 4886 | 631 | 37 | 109 | 23 |
| Total | | 88226 | 16725 | 8444 | 571 | 656 | 39 |

Annex-L

| Settlement's Names | Design RD | Existing RD |
|--------------------|------------|-------------|
| Hanuchal | KM 22+100 | 21+700 |
| Sassi | KM 26+600 | 26+100 |
| Shahbtot | KM 30+100 | 29+700 |
| Shungus | KM 47+000 | 51+900 |
| Maloopa | KM 68+000 | 73+650 |
| Astak | KM 72+300 | 78+000 |
| Triko | KM 86+300 | 92+200 |
| Dambodas | KM 95+500 | 102+100 |
| Baghicha | KM 107+000 | 113+800 |
| Tungush | KM 112+500 | 119+400 |
| Garbidas | KM 117+700 | 124+200 |
| Chari | KM 126+000 | 133+100 |
| Kachura | KM 135+800 | 143+150 |
| Hoto | KM 145+800 | 152+550 |
| Gamba | KM 149+200 | 156+650 |
| Skardu | KM 155+600 | 163+150 |

Improvement, Up-gradation and Widening of Jaglot - Skardu Road

Location Map of Construction Camps



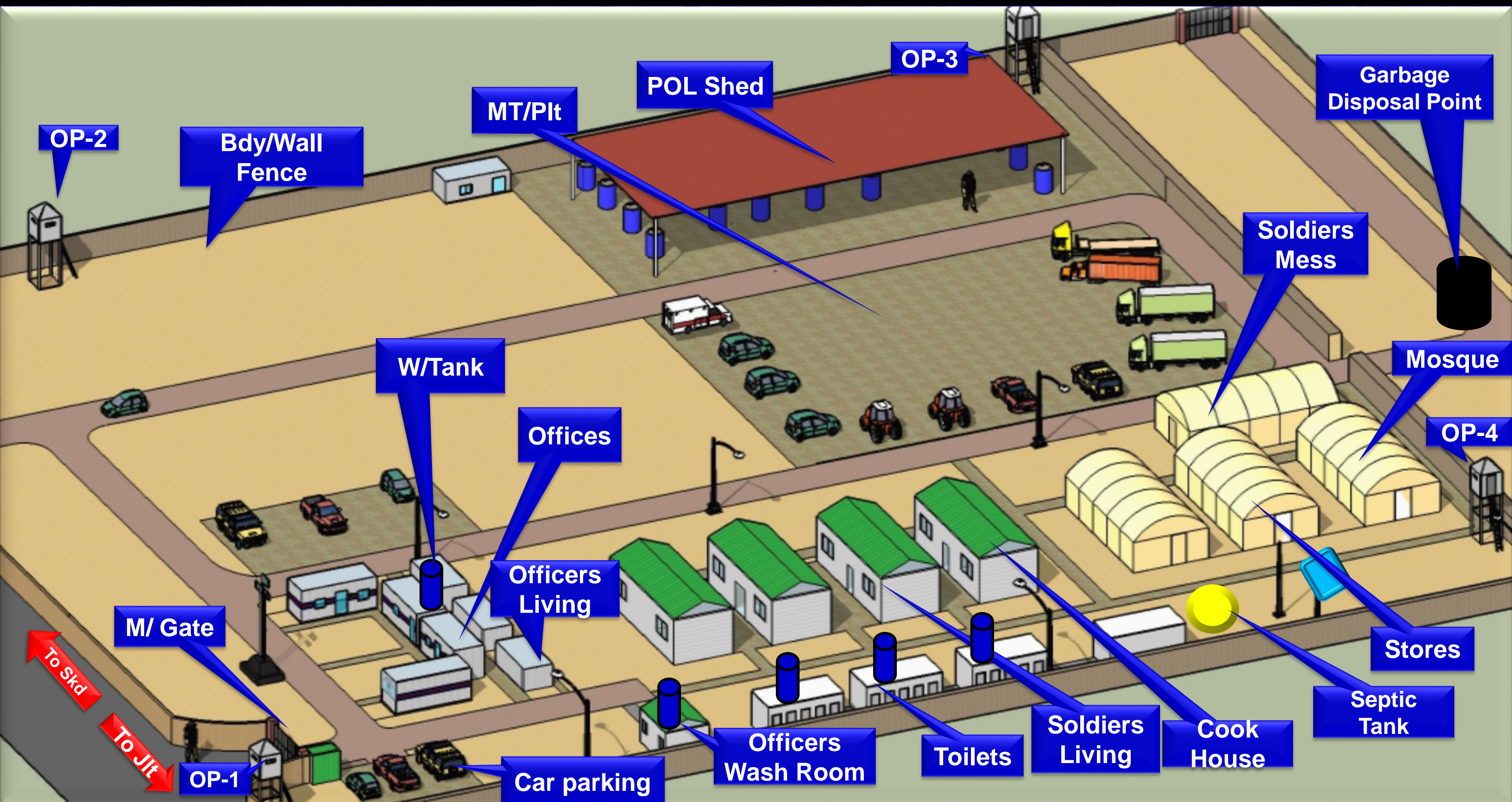
Improvement, Widening and Up-gradation of Jaglot - Skardu Road

Location Map of JSR Plants



CAMP LAYOUT

ANNEX-N



MOUNTAIN SIDE

Santory 1 and 2 with walkie talkie on both side of consrtuction zone

CONSTRUCTION ZONE

100 m

100 m

RIVER INDUS

Stop line for safety by applying cones
warning signs and barricades

Stop line for safety by applying cones
warning signs and barricades

