



PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY

**Management
Consulting Services for
Review of Feasibility Study,
Procurement of EPC Contractor
and Contract Management &
Administration of the**

**ATTABAD LAKE
HYDROPOWER PROJECT
(54 MW)**

**ENVIRONMENTAL
IMPACT ASSESSMENT
REPORT**

DOCUMENT NO: 4464-EIA

AHMC ATTABAD HYDROPOWER
MANAGEMENT CONSULTANTS



DOLSAR

**MANAGEMENT CONSULTING SERVICES FOR REVIEW OF FEASIBILITY STUDY,
PROCUREMENT OF EPC CONTRACTOR AND CONTRACT MANAGEMENT &
ADMINISTRATION OF ATTABAD LAKE HYDROPOWER PROJECT (54 MW)**

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ADP	Annual Development Programme
AHMC	Attabad Hydropower Management Consultant
AJK	Azad Jammu and Kashmir
AKDN	Aga Khan Development Network
AKF	Aga Khan Foundation
AKRSP	Aga Khan Rural Support Program
ALHPP	Attabad Lake Hydropower Project
AOI	Area of Influence
BCP	Building Code of Pakistan
BOD	Biochemical Oxygen demand
CAD	Computer Aided Design
CBOs	Community Based Organizations
CBD	Convention on Biological Diversity
CCHA	Community Controlled Hunting Area
CDM	Clean Development Mechanisms
CER	Certified Emission Reductions
CITES	Convention on the International Trade of Endangered Species
CPEC	China Pakistan Economic Corridor
dBa	Decibels (Equivalent to Scale A)
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMM	Environment Management and Monitoring
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPC	Engineering Procurement Construction
GB	Gilgit Baltistan
GBDMA	Gilgit Baltistan Disaster Management Authority
GHG	Green House Gases
GLOF	Glacial Lake Outburst Floods
GOP	Government of Pakistan
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GT	General Topographic
HPO	Hydro Planning Organization
IEE	Initial Environmental Examination
IFC	International Finance Corporation
KKH	Karakorum Highway
KNP	Khunjerab National Park
KP	Khyber Pakhtunkhwa
LAA	Land Acquisition Act
LPG	Liquefied Petroleum Gas
masl	Meters Above Sea Level
MW	Megawatt

MSDS	Material Safety Data Sheets
NESPAK	National Engineering Services Pakistan (Pvt.) Limited
NCS	National Conservation Strategy
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards
NGOs	Non-Governmental Organization
NPO	No Project Option
O&M	Operation and Maintenance
OBE	Operating Basis Earthquake
OSHA	Occupational Safety and Health Administration
PAPs	Project Affected Persons
PD	Project Director
PGA	Peak Ground Acceleration
PMU	Project Management Unit
RCC	Reinforced Cement Concrete
MC	Management Consultant
SOPs	Standard Operating Procedures
SPSS	Statistical Package for Social Sciences
TWA	Time-Weighted Average
TMP	Traffic Management Plan
WPD GB	Water and Power Department, Gilgit Baltistan
WAPDA	Water and Power Development Authority
WEC	WAPDA Environment Cell
WHO	World Health Organization

DISCLAIMER

This report has been updated by the Joint Venture (JV) of Attabad Hydropower Management Consultants (AHMC) for WAPDA, in the light of comments from GB EPA and WAPDA. The report is based on the project information given/available at the Feasibility Stage of the Project. However, some portions of this report have been updated based on the propositions made at the Feasibility Review Stage.

Any use, that a third party makes of this report, or any reliance on or decisions to be made based on it, is the responsibility of such party. AHMC accepts no responsibility for any decision made by any third party based on this report.

The Project is planned to be carried out on EPC mode wherein the Detailed Design shall be prepared by the EPC contractor. Therefore, the information given in this report may change as a result of changes in the design by the EPC Contractor. Changes in the design or other Project details may require the updation of this report. AHMC does not accept any responsibility for the changes in the conditions/recommendations provided in this report due to changes in design or other factors.

EXECUTIVE SUMMARY

Pakistan Water and Power Development Authority (WAPDA) intends to develop 54 MW Attabad Lake Hydropower Project (ALHPP¹) on Attabad Lake situated in the Hunza Valley of GB, Pakistan. ALHPP (36°18'28.87"N and 74°49'19.44"E) has been identified on Hunza River on Attabad Lake. Attabad Lake was formed on January 4, 2010, when a huge mass from the right bank of Hunza River slid down near Attabad Village and blocked Hunza River. The inflow filled upstream valley and created a reservoir 14 km long till the end of May 2010. Attabad Lake is about 15 km upstream of Ganish Bridge and about 115 km upstream from Gilgit. Therefore, ALHPP is planned to utilize the Attabad Lake water and head for the generation of the Hydel Electricity.

Presently, there is a huge demand and supply gap of electricity in GB resulting in load shedding along with low voltage issues. Locals have no option for commercial and industrial demand to be partly fulfilled from diesel generators. Apart from the high cost of fuel, the use of these diesel generators is affecting the environment as well as tourism in the area.

WAPDA hired services of a joint venture of Attabad Hydropower Management Consultants (AHMC) with M/s National Engineering Services Pakistan (NESPAK) as its lead firm for the Review / Validation of the Feasibility Study, Procurement of the EPC Contractor, and Contract Management & Administration of ALHPP. As per the Consultancy Services Agreement, review of the Environmental Impact Assessment (EIA) Study (prepared by WAPDA in 2021) was not included in the scope of work. This EIA study has been updated based on the available information at this stage of the Project as an additional scope of work. The proposed project will be implemented in EPC mode therefore; Detailed Engineering Design including Basic Design will be prepared by the EPC Contractor after its selection.

As per Gilgit Baltistan Environmental Protection Act, 2014 the project Proponent should acquire NOC / Environmental Approval from EPA, GB before the start of the construction of any Project. As per Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000. The proposed Project falls under Schedule II (Category A "Energy": Hydroelectric Power Generation over Fifty (50) Mega Watt), which requires an EIA to initiate the process of NOC from Gilgit Baltistan Environmental Protection Agency (GB EPA). Thus, to fulfil the legal requirements, an EIA Study has been carried out for the proposed Project.

This EIA Report has been prepared to address the requirements detailed in the Gilgit Baltistan Environmental Protection Act, 2014 addressing environmental and social aspects and considerations. In addition, the EIA Study also addresses the requirements defined in the applicable national and local regulations.

The main components of the Project are Flexible/Rigid Overflow Structure, Sediment Flushing Tunnel, Headrace Tunnel, Surge Tank, Penstock, Powerhouse, Tailrace Channel and Switchyard. Reservoir has already been created as a result of a natural disaster. Total land

¹ The term ALHPP in this report is referred as Proposed Project.

to be acquired for Project structures is approximately 183 acres, which includes both Private and Government land. The estimated total land to be acquired is 777.5 acres due to the impounding of reservoir up to maximum conservation level (including free board) i.e. El. 2424 m.a.s.l, including river bed. The proposed Project site is accessible through Motorway from Islamabad to Thakot (M-15) and afterwards by Karakorum Highway (KKH) from Thakot to Project Area.

Salient features of the proposed project are given below in **Table ES-1**:

Table ES-1: Salient Features of the Proposed Project

Sr. No.	Items	Description
1	Location	27 km from Aliabad Town
2	River	Hunza River
3	Catchment Area	8901 km ²
4	River Mean Annual Flow	209 m ³ /s
5	Purpose	Power Generation
6	Type of Development	High Head Run of River with Peaking
7	Type of Flexible/Rigid Overflow Structure	Overflow
8	Flexible/Rigid Overflow Structure Crest Elevation	2414 m.a.s.l
9	Flexible/Rigid Overflow Structure Crest Length	60 m
10	Flexible/Rigid Overflow Structure Height	4 m
11	Design Flood	3250 m ³ /s
12	Maximum Conservation Level including free Board	2424 m.a.s.l
13	Maximum Flood Level	2421 m.a.s.l
14	Minimum Operating Level	2412 m.a.s.l
15	Gross Head	112.0 m
16	Net Head	106.0 m
17	Installed Capacity	54 MW
18	Headrace Tunnel Length	2320 m
19	Headrace Tunnel Diameter	5.5 m
20	Penstock Length	480 m
21	Penstock Diameter	3.6 m
22	Type of Turbine	Francis (Vertical)
23	No. of Units	03
24	Design Discharge	60.00 m ³ /s (20 m ³ /s to each unit)
25	Type of Powerhouse	External/ Surface
26	Annual Energy	374 GWh
27	Plant Factor	76.5 %

The proposed project will be implemented by the EPC Contract including Detailed Engineering Design.

The proposed project construction schedule spans over a period of 55 months, which include 36 months for construction activities, 07 months for pre-construction activities and 12 months for post construction liability period. The estimated cost of the proposed Project is 100 million USD.

The various alternatives which have been considered during the conduct of the study are No Project Option (NPO), Project Layout Alternatives, Flushing Tunnel Alternatives, Penstock Alternatives, Powerhouse Alternatives, and Tailrace Channel Alternatives.

For the collection of baseline information checklists / proformas, Satellite Imagery (Google Earth), and General Topographic (GT) sheets were used. The Study Area / Area of Influence (AOI) was delineated based on field surveys (primary data), the Consultant's experience, the study of available maps and data collected through secondary sources, and the results of the consultation with the relevant departments. In this report, the Study Area / AOI is considered as the area where the Project impacts on the Environment due to the proposed Project activities are assessed.

The segment of Hunza valley wherein the various components of the proposed project are situated reflects very high relief conditions marked by extensive steep mountain slopes along the right side of the valley as compared to the left bank mountain slopes. The mountains are mostly marked by erratic slopes instabilities along with relatively less extensive segments of casuistic slopes. The Project Area lies in Karakorum Block, where rocks of meta-igneous provenance are exposed. The rock units represent acidic igneous rocks including Granodiorite and Granitic Gneiss. Many local as well as regional faults are present in Project Area.

According to Seismic Provisions in the Pakistan Building Code 2007, the Project area falls in Seismic Zone 2B (moderate), which represents Peak ground acceleration from 0.16g to 0.24g, where g represents acceleration due to gravity.

The climate of Hunza valley is characterized by mild summer and cold winters. Wide spread snowfall occurs in winter. During winter the northern winds blow constantly bringing the temperature down considerably. According to the temperature data available from 2010-2020, the hottest month is July with a mean temperature of 21.20°C and the coldest month is January with a mean temperature of -0.42°C. Hunza receives maximum rainfall in spring i.e., in April.

In the Study Area, no proper solid waste management system exists. These areas lack proper sewerage system with only some open drains constructed in the vicinity for the discharge of wastewater.

The major Land Use of the proposed project is barren hilly land and some built-up area at the site of the powerhouse, while agricultural land is also present in the reservoir considering maximum conservation level of 2424 m.a.s.l.

Five distinct zones of flora in the Study Area can be identified including Dry Alpine Scrub, Moist Alpine Pastures, Dry Alpine Plateau Pastures, Sub Alpine Scrub and Birch Forests. A large number of medicinal plants grow in the natural forests of Hunza Valley. There are no endangered species of Fauna, Community Controlled Hunting, Protected Areas, Game

Reserve, Wildlife Sanctuaries and National Park found in the Project Area. Agriculture and livestock grazing area are also important aspects and present in the Project Area.

According to socio-economic survey in the Study Area, Fifty Eight (58) respondents were selected from villages / settlements (Sarat, Ganish, Attabad, Ayeenabad, Shishkat, Gulmit, Gulkin, and Passu) of Hunza district. The respondents of the study area included local residents, farmers, shop keepers, pedestrians, drivers, and Government employees etc. The survey findings revealed that there is no group of people that can be termed as “Indigenous Community”.

The stakeholder consultations were held with relevant departments such as EPA GB, Revenue Department, Water & Power Department GB, District Health Department Hunza, District Agriculture Department Hunza, District Education Department, Wildlife Department Hunza, Forest Department Hunza, and Fisheries Department Hunza etc. Moreover, Four (04) community consultative meetings were held with more than Forty Two (42) participants in the Study Area. The major categories participated in these meetings were local population, community groups, landowners, and Project Affected Persons (PAPs).

Impact assessment has been conducted for various phases of the proposed Project and the project envisages following potential positive impacts:

- The Project not only reduces or replaces equivalent electricity generation sources with all the associated environmental benefits but it will also help to avoid all associated pollution caused through extraction, processing, storage and transportation of conventional fuels required for fossil fuel power generation plants.
- The sustainable power supply with the development of the proposed Project is likely to attract more tourists in the Project area and will increase the local business and recreational activities.
- The proposed Project will also provide skilled and unskilled jobs during the implementation phase and a limited number of jobs during operation and maintenance.
- Hunza and Nagar valleys have precious mineral resources which have remained unexploited. The availability of electricity will certainly develop a set up on large scale to preserve fruits and for exploration of minerals.
- The requirements of electricity have increased in homes, both public and private offices, education institutions, hospitals, and health care centers in towns and habitats in the remote rural areas of valleys in Gilgit-Baltistan region. The electricity shortfall can be decreased with implementation of this Project.
- Access roads will be built as part of the Project and will facilitate the people for goods and services accessibility. After completion of the Project, these facilities and infrastructure will be available to the general public. Moreover, health facilities created during the construction phase will be available to local communities.

Following potential adverse impacts have been anticipated during different especially the construction phase of the proposed Project:

- Permanent Land acquisition;
- Temporary Land on rental / lease basis;

- Cutting of trees / bushes falling within the proposed Project Boundary;
- Landslide Hazards;
- Temporary Impact on aquatic fauna;
- Disturbance to infrastructure and public utilities;
- Disturbance to the public movement during construction;
- Noise and air pollution due to the working of construction machinery during construction and traffic during the O&M phase of the Project;
- Solid waste and wastewater generation during construction;
- Oil spillages from construction machinery, resulting in soil and water contamination;
- Occupational and community health and safety issues; and
- Social and Cultural Conflicts.

Sedimentation, Environmental flow, dam safety and emergencies etc. are the anticipated environmental impacts during the operation and maintenance phase of the proposed Project.

The impact assessment revealed that with the help of appropriate mitigation and control measures provided in this EIA Study, most of these potential impacts will either be avoided altogether, or their likelihood of occurrence and severity will be reduced, thus making this project environmentally and socially feasible.

WAPDA will establish a Grievance Redress Committee (GRC) to facilitate the resolution of complaints by Project Affected People (PAPs) and grievances about the project's environmental and social performance. The GRC will be coordinated by the Chief Resident Engineer and Environment Head. The GRC will address affected people's concerns and complaints promptly, using an understandable and transparent process.

The Environmental constraints will have to be monitored by concerned agencies, including Environment Specialist of Proponent and GB EPA. An EMP has been developed as part of this report which provides a detailed mitigation matrix that covers impacts, mitigation measures, roles, responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the Project.

The EIA, EMP, mitigation and monitoring programs, contained herewith are recommended to include within the bidding documents for project works for all project components. The Bidding documents shall clearly state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP through his own Site Specific Environmental Management Plan (SSEMP) and Site Specific Health and Safety Management Plan (SSHSM), based on the guidelines provided in the EIA report, which will adopt all of the conditions of the EMP and add site specific elements as per advice of Environmental Specialist. This will ensure that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

The tentative cost estimates to implement EMP is estimated as **PKR. 126.5 Million**. This tentative cost will be included in the overall project cost. This cost will be reviewed and firmed up periodically to ensure realism.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Water and Power Development Authority (WAPDA) intends to develop 54 MW Attabad Lake Hydropower Project (ALHPP²) on Attabad Lake situated in the Hunza Valley of GB, Pakistan. ALHPP (36°18'28.87"N and 74°49'19.44"E) has been identified on Hunza River on Attabad Lake. Attabad Lake was formed on January 4, 2010, when a huge mass from the right bank of Hunza River slid down near Attabad Village and blocked Hunza River. The inflow filled upstream valley and created a reservoir 14 km long till the end of May 2010. Attabad Lake is about 15 km upstream of Ganish Bridge and about 115 km upstream from Gilgit. Therefore, ALHPP will utilize the Attabad Lake water and head for the generation of the Hydel Electricity. The location of the Project is shown in **Figure 1-1**.

Presently, there is a huge demand and supply gap of electricity in GB resulting in load shedding along with low voltage issues. Locals have no option for commercial and industrial demand to be partly fulfilled from diesel generators. Apart from the high cost of fuel, the use of these diesel generators is affecting the environment as well as tourism in the area.

Gilgit-Baltistan of Pakistan is blessed with abundant renewable hydropower resources. More than 95% of Pakistan hydel potential is located in mountainous areas of Gilgit-Baltistan (Gilgit-Baltistan), Khyber Pakhtunkhwa (KPK) and Azad Jammu and Kashmir (AJK). The reconnaissance study of hydel potential for whole Gilgit-Baltistan is almost complete, and identified potential sites are still to be optimized in terms of capacity, cost and need of power for growing load centres

On November, 2015 Prime Minister, Government of Pakistan announced the construction of Attabad Lake Hydropower Project (ALHPP), Accordingly Government of Gilgit-Baltistan undertook its Feasibility Study through Annual Development Programme (ADP) for Financial Year 2016-17. In the beginning, Feasibility Study of ALHPP with installed capacity of 32.5 MW was carried out by local consultant of Gilgit-Baltistan. On July 2019, a meeting was held between Chairman WAPDA and Chief Secretary Gilgit-Baltistan. It was agreed that Feasibility Study would be again carried out by Hydro Planning Organization (HPO), WAPDA because of its expertise in the field of Hydro Power Planning. WAPDA prepared a feasibility report for the proposed project in June, 2021. The proposed Project is scheduled to be implemented in EPC mode.

WAPDA hired a joint venture of Attabad Hydropower Management Consultants (AHMC) with M/s National Engineering Services Pakistan (NESPAC) as its lead firm for the Review / Validation of the Feasibility Study, Procurement of the EPC Contractor, and Contract Management & Administration of ALHPP. As a part of this Contract, review of the Environmental Impact Assessment (EIA) Study (prepared by WAPDA in 2021) was not included in the scope of work. This EIA study has been updated based on the available information at this stage of the Project as an additional scope of work. The proposed project

² The term ALHPP in this report is referred as Proposed Project.

will be implemented in EPC mode therefore, Detailed Engineering Design including Basic Design will be available after the selection of EPC Contractor.

1.2 OBJECTIVES OF THE PROJECT

Following are the main objectives of the Project:

- The prime objective of the implementation of the Project is to develop the Power Potential available in GB on sustainable basis by providing cheaper, renewable, and environmental friendly power, keeping in view the present and future requirements of Pakistan, especially rural and remote areas for the development of the country; and
- Transmit energy to Hunza and adjoining suburbs for meeting the power requirements of the region. To reduce reliance on and consumption of diesel, timber, and other fuels by ensuring the availability of power. This will reduce overall Greenhouse Gases (GHGs).

1.3 NEED FOR EIA STUDY

The proposed Project is located in GB therefore, GB Environmental Protection Act 2014³ is the core environmental law for the proposed Project. Hence, GB EPA is the concerned authority with respect to environmental approvals.

According to the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations 2000, the proposed Project falls under category A of schedule II (Energy: Hydroelectric Power Generation over Fifty (50) Megawatts), which requires EIA before commencement of construction.

Thus, to fulfil legal requirements, an EIA study has been conducted for the proposed Project to initiate the process of NOC / environmental approval from the GB EPA.

1.4 THE PROPONENT AND CONSULTANT

The proponent of the Project is Water and Power Development Authority (WAPDA), Government of Pakistan while the Consultant is Attabad Hydropower Management Consultants (AHMC). The details are given as under:

a) Proponent Contact Address

Office of the Project Director
Attabad Lake Hydropower Project
Aliabad, Hunza, GB
Phone: +92-042-99204981, +92-058-13920813
Email: pdalhpp@gmail.com

³ Section 16 (1) of the Act states that: "No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof."

b) Consultant Contact Address

Attabad Hydropower Management Consultants (AHMC)

37-B, Block-N, Model Town Extension, Lahore-54700

Phone: +92 42 35194885

Email: alhpp.nespak@gmail.com

1.5 NATURE, MAGNITUDE AND LOCATION OF THE PROJECT

The proposed Project is a hydroelectric power generation having 54 MW capacity. The proposed Project comprises various components of linear and non-linear nature. The main components are the Flexible/Rigid Overflow Structure and its associated structures, Sediment Flushing Tunnel, Headrace Tunnel, Surge Tank, Penstock, Powerhouse, 132kV Switchyard and Tailrace Channel.

The proposed Project is located at about 115 km from Gilgit city and 27 km from Aliabad town in Hunza Valley. The Powerhouse location is on the left bank of river and is easily accessible from Karakoram Highway. The Flexible/Rigid Overflow Structure site is selected at the current overflow point of Attabad Lake.

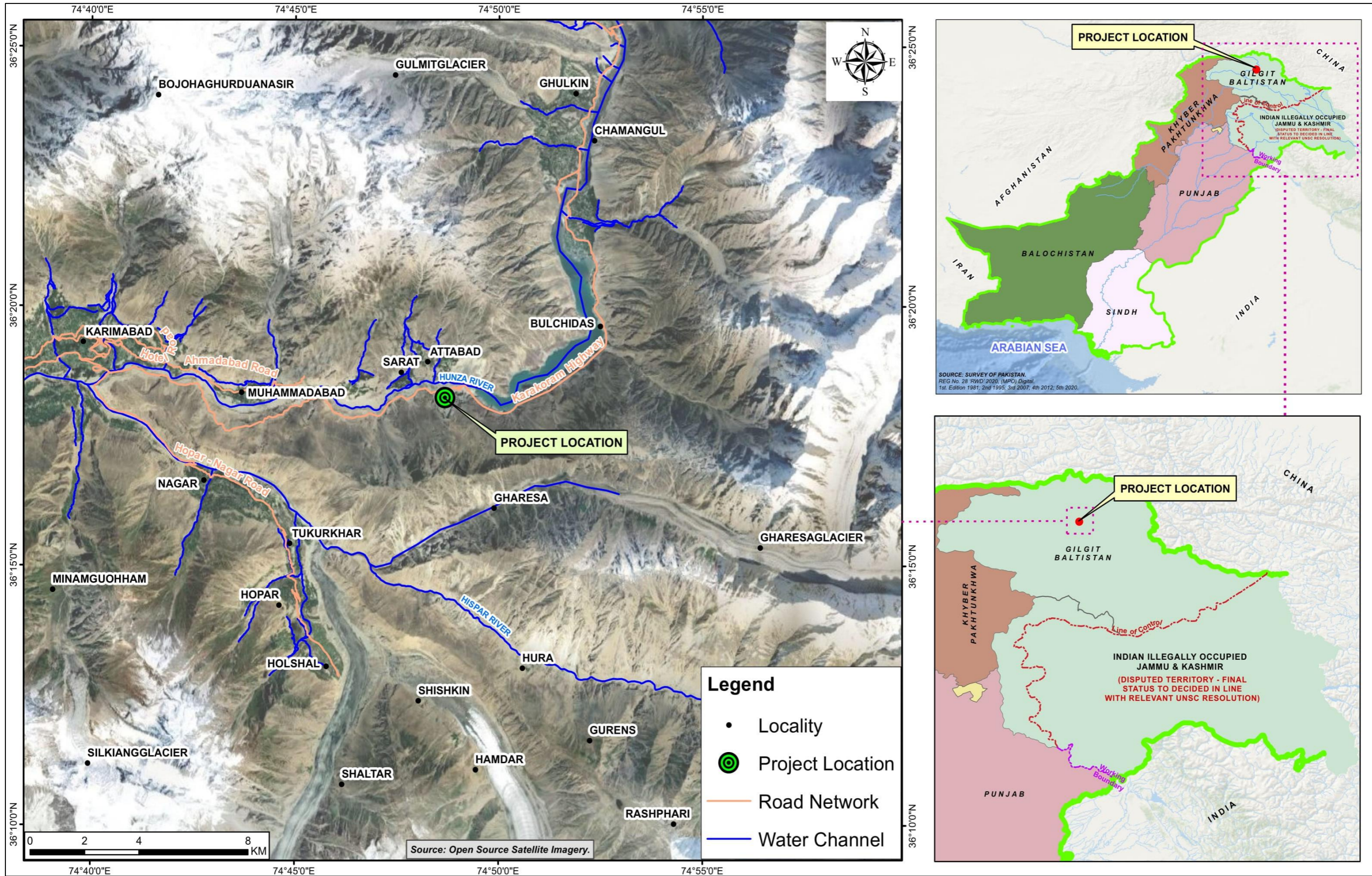


Figure 1-1: Project Location Map

1.6 OBJECTIVES OF EIA

The prime objective of the EIA study is to fully meet the statutory requirements set forth by the GB Environmental Protection Act - 2014 and to facilitate decision making by the GB EPA regarding grant of NOC / Environmental approval for the proposed Project.

The overall objective of this EIA is to elucidate the anticipated aspects of the proposed intervention and to propose necessary mitigation measures to prevent or minimize adverse impacts on surrounding environment and community. To achieve this, an assessment of the existing environmental conditions of the project area is a prerequisite and therefore, included after collecting the baseline data of major environmental attributes acquired from primary and secondary sources. This EIA has been prepared to ensure adequate environmental and social management during construction and implementation stages of the proposed project. It provides mechanisms to ensure that potentially significant environmental and social impacts of the proposed project are identified, assessed and mitigated as appropriate.

More specific objectives of this EIA report are to:

- Facilitate proponents of the project in ensuring environmental and social sustainability of the project;
- Establish a baseline of existing social and environmental conditions prior to project initiation by collecting secondary and primary data/information on physical, biological and socio-economic environment of the project area;
- Identify potentially significant environmental and social impacts (both positive and negative) during all stages of the project;
- Avoid, minimize, and suggest mitigation and compensation measures for significant adverse impacts;
- Conduct, record, report and ensure public consultation, participation with major stakeholders; and
- Provide EMP for all stages of the project as a tool for the implementation of the suggested measures along with monitoring and evaluation mechanism with adequate resources including implementing agencies capacity building.

1.7 DELINEATION OF THE STUDY AREA/AREA OF INFLUENCE (AOI)

For an EIA Study, a clear delineation of the Study Area / Area of Influence (AOI)⁴ is required. The Study Area / AOI is the area within which the potentially significant impacts of the proposed Project activities (direct or indirect) are envisaged. In this report, the Study Area / AOI is the area where the Project impacts on the environment due to the proposed Project activities are assessed. The proposed Project comprises various components of linear and non-linear nature.

Based on the available Google Earth Imagery and ArcGIS software, Project components were overlaid on the existing Project Area Imagery. Utilizing the information collected through the study of previous documents including the Feasibility Study, Reconnaissance Visit, consultations with the locals and concerned departments, and foreseen impacts of the

⁴ Term Study Area/Area of Influence (AOI) interchangeable in this document. Moreover, the Study Area/AOI also includes actual project area.

hydropower project, a tentative Study Area was delineated which will be firmed up during the detailed design stage. The Map of the Study Area is shown in **Figure 1-2**.

Based on the proposed Project components, geographical location and nature of the Project following is the description of the Study Area of the Project:

The catchment area of Hunza River upstream of the Project Site is about 8,900 km² which mostly consists of glaciers and snow deposits. Hunza River cuts through the Karakoram Range and flows approx. 250 km with an average slope of 0.90% from north to south before it merges into the Gilgit River. The discharge of the Hunza River has its peak in months from May to September due to the melting of snow/glaciers. Based on the hydrology, the proposed Project activities have no potentially significant impacts on the catchment area. Component wise description of the Study Area is as below:

- a) **Flexible/Rigid Overflow Structure:** The proposed Flexible/Rigid Overflow Structure is a Gabion Mattress Section (60m wide) with grout curtains to control seepage. The Flexible/Rigid Overflow Structure would be founded on overburden/slided mass with the crest elevation of 2414 m.a.s.l.
- b) **Sediment Flushing Tunnel:** The sediment flushing tunnel will be constructed at the left bank side near the Headrace Tunnel intake structure with a gated arrangement. The invert level of the sediment flushing tunnel section is planned at El. 2380 m.a.s.l. The sediment flushing tunnel would be founded mostly on hard rock with minor outlet length in slided mass.
- c) **Headrace Tunnel:** Approximately 2,320m long low-pressure headrace tunnel (horseshoe shape), having 5.5m diameter would run along the left bank of Hunza River starting from the power intake structure leading to the surge tank.
- d) **Surge Tank:** A circular surge tank having 10m diameter and 45 m high will be constructed at the intersection of the headrace tunnel and penstock.
- e) **Penstock:** A Penstock of 3.6m diameter will be laid under the left bank slopes for conveying water from headrace tunnel to Powerhouse.
- f) **Powerhouse:** The Powerhouse is proposed 52m long, 25m wide and 22.5m high with four (04) floors at different levels. The main hall would accommodate three (03) vertical Francis Turbine units, each of 19.3 MW, along with three (03) Generators, switchgear cabinets, trifurcation of penstock pipes, and an erection bay.
- g) **Tailrace Channel:** The draft tube of each turbine unit will drain water in an open tailrace channel which will discharge back the water into the Hunza River.
- h) **Switchyard:** A surface AIS 132 kV switchyard will be located near Powerhouse.
- i) **Residential Colony:** A colony containing offices, residential blocks for O&M Staff including Engineers, supervisory and lower staff, rest house, mosque, basic health unit (BHU), shops and other allied services including roads, water supply system, sewage disposal system and the electricity arrangement etc. will be developed near Powerhouse Site.
- j) **Contractor's Camp Area:** The contractor's construction camp and construction of operation and maintenance staff building are proposed to be established near the

Powerhouse Site. The exact location of the contractor's construction camp will be finalized by the EPC Contractor at detailed design stage.

- k) **Quarry Area:** The details of the identified material sites are discussed in the Chapter 3 of this report. The final source of material will be finalized by the EPC Contractor at detailed design stage.
- l) **Access Roads** (Temporary and Permanent): The project will also include the construction of both temporary and permanent access roads.
- m) **Reservoir Area:** The reservoir area of the lake extends upstream to Gulkin Village. The total length of the reservoir is approximately 14 km based on 2424 m.a.s.l.

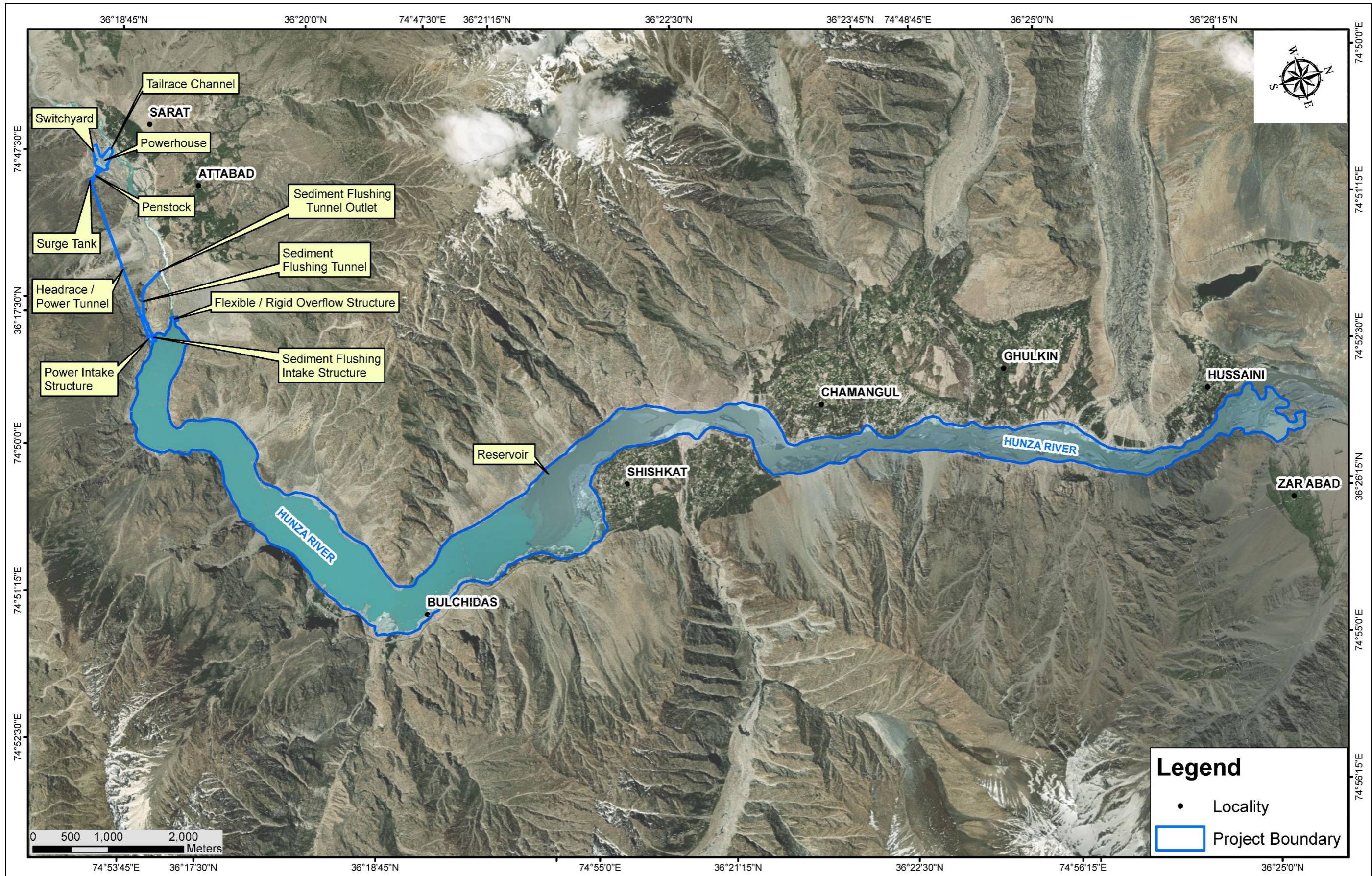


Figure 1-2: Study Area Map

1.8 EIA TEAM

A multidisciplinary team was formulated to conduct the study. The team comprises the following professionals (refer **Table 1-1**):

Table 1-1: EIA Study Team

Sr. No.	Name of Expert	Designation
1.	Mr. Muhammad Shariq Ahmed	Head ERSD
2.	Mr. Muhammad Farooq	Biodiversity Expert
3.	Ms. Uzma Iqbal	Senior Environmental Scientist
4.	Mr. Hafiz Muhammad Abid Saleem	Senior Environmental Engineer
5.	Mr. Shoaib Aziz	Senior Engineer
6.	Mr. Kamran Ahmed	Senior Sociologist
7.	Mr. Waleed Farooq	HSE Engineer
8.	Mr. Muneeb Yousaf	GIS Expert

1.9 APPROACH AND METHODOLOGY ADOPTED

This EIA study has been updated based on the available information as an additional scope of work. The proposed project will be implemented by the EPC Contractor including Detailed Engineering Design. Following is the approach and methodology adopted to update the EIA study:

a) Orientation

Meetings and discussions were held among the members of the EIA and design team. This activity was aimed at achieving a common ground of understanding of various issues related to the proposed Project. Subsequent to the concept clarification and understanding, a detailed data acquisition plan was developed for the internal use of the EIA consulting team. The plan identified specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and facilitation needs for the execution of the data acquisition plan.

b) Desktop Studies

After the award of the contract, the EIA team acquired various Project specific studies, relevant studies to the regions, available maps, Google Earth Imagery of the Area, published reports, previous Feasibility Study Report, 2021 etc.

After the acquisition of data, reports, maps and relevant information, EIA team relevant experts started the desktop studies. The main objective of the desktop study was to conceptualize the Project, familiarize with the project layout, design, status of the Project, and identification of the issues related to the Project.

c) Analysis of Alternatives

It is a mandatory requirement for any EIA study to analyze each potential alternative available that could have been developed to meet the objectives and recommend the option which is environmentally and economically feasible.

In order to select the most viable route keeping in view the technical, environmental, economic and social constraints, the analysis of different alternatives was carried out for the selection of the most feasible option. Moreover, the NPO was also considered. This exercise confirmed the justification for the need of the proposed Project.

d) Environmental and Social Baseline Information

After the selection of the most feasible project option, based on satellite images and the delineation of Study Area / AOI, detailed environmental survey was carried out within the Study Area. Detailed investigations/surveys were carried out for environmental parameters on which any adverse or positive impacts were envisaged by the implementation of the proposed project. Prior to the start of field activities, comprehensive checklists, proformas and maps were developed covering the main parameters for physical, biological and socio-economic environment. Primary and secondary data has been compiled and analyzed to update baseline conditions in the Study Area.

e) Stakeholder Consultations

The EIA team identified project stakeholders during inception stage, and held meetings and e-communications with them during the surveys, to receive feedback on the expected environmental issues related to the project impacts and suggested mitigation measures. Meetings were carried out with the project affectees, relevant departments to discuss the issues / constraints and get their views and feedback to mitigate the potential environmental impacts associated with the implementation and operation of the proposed project.

f) Anticipated Impacts Assessment and Mitigation Measures

A logical and systematic approach was adopted for impact identification and assessment. The process began with the screening and continued through scoping which identified the key issues and classified them into different categories. The tools, which were used for impact assessment, are:

- Checklists;
- Matrices; and
- Overlays.

Identification of potential environmental and social impacts in terms of their nature, magnitude, extent, location, timing and duration were carried out. The impacts were correlated to the project location, design stage, construction as well as operation stage. Based on the impact prediction methods and public/stakeholder consultations, the EIA team screened the adverse environmental impacts for inclusion in the mitigation measures and environmental management plan. The same process was followed for the identification of social impacts.

Public consultations (which provided feedback of the impacts from the stakeholder's viewpoint) were used to screen out the insignificant impacts. Matrices and overlays were used for the evaluation of temporal and spatial impacts respectively.

The EIA team proposed practicable, economically feasible and socially acceptable mitigation measures for the significant adverse environmental and social impacts. These measures were based on exploring the alternative ways to achieve the project objectives causing least disturbance to the existing environment, and proposing changes in the project design through improved monitoring and management practices.

g) Environmental Management Plan

An EMP has been prepared to ensure the adequacy and effectiveness of the proposed protocol by clearly identifying the roles and responsibilities of the agencies responsible for implementation, monitoring and auditing of EMP activities, existing and suggested framework, necessary approvals, training needs and required further studies. The EMP also includes organizational setup, a monitoring mechanism, monitoring plan, environmental and social parameters to be monitored with their frequency. Similarly, costs for environmental monitoring, ecological and social component/social mitigation measures were also included as part of the EMP. Environmental monitoring, evaluation, auditing and reporting mechanism were also proposed in the EMP.

1.10 ORGANIZATION OF REPORT

This report contains ten (10) chapters. The contents of chapters are described as follows:

- **Chapter 1** - "Introduction" describes introduction, location of project, objective and purpose of the EIA report, approach and methodology;
- **Chapter 2** - "Policy, Legal And Administrative Frameworks" elucidates the current legal framework including national, local laws, policies, guidelines which is applicable to the proposed project in the context of environment and sustainable development;
- **Chapter 3** - "Project Description" furnishes an overall description of the project, including its features and key components, construction planning, timeframe and cost etc.
- **Chapter 4** - "Project Alternatives" presents the Analysis of Alternatives such as No Project Option, Project Layout, Headrace, Penstock and Powerhouse Location Alternatives;
- **Chapter 5** - "Description of the Environment" comprises a detailed narrative of the existing (baseline) conditions of the project area, with respect to its physical, biological and socio-economic environment;
- **Chapter 6** - "Public Consultation" provides summary of consultative sessions with the local community as well as with other stakeholders including local politicians, local government officials for their opinions and suggestions on the project;
- **Chapter 7** - "Grievance Redress Mechanism" provides the mechanism to address the complaint of workers and locals;

- **Chapter 8** - “Anticipated Environmental Impacts & Mitigation Measures” elaborates the likely impacts of the project on the physical, biological and socio-economic environment during the pre-construction, construction and operation stages and lays down the proposed measures to mitigate the adverse impacts of the project;
- **Chapter 9** - “Environmental Management Plan” provides the mechanism to be adopted for the implementation of measures and monitoring the environment during all stages; and
- **Chapter 10** - “Conclusions and Recommendations” gives the conclusion of the impact assessment study and recommendations for the construction and operational stages.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

2.1 GENERAL

This chapter provides an overview of the policy framework and legislation that applies to control the environmental consequences as a result of proposed Project implementation and operation. The proposed Project needs to comply with all the applicable environmental policies, laws, guidelines, acts and legislations of Government of Pakistan (GoP) and the Government of GB.

2.2 SUMMARY OF RELEVANT STRATEGIES, POLICIES, ACTS AND LEGISLATION

The summary of major relevant strategies, policies, acts and legislation from environmental perspective are briefly described in **Tables 2-1 & 2-2** below:

Table 2-1: Main Strategies/Policies Related to Environment and Relevance to the Project

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
1.	National Conservation Strategy, 1992	Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the Country. The NCS outlines the Country's primary approach towards encouraging sustainable development, conserving natural resources and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.	The core areas that are relevant in the context of the proposed Project are pollution prevention during construction and conserving biodiversity and forestry.
2.	National Environmental Policy, 2005	In March 2005, GoP 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 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.	Clause (b) of sub-section 5.1 states that EIA related provisions in Environmental Protection Act, 1997, will be diligently enforced for all developmental projects.
3.	National Forest Policy, 2015	The goal of this policy is to foster the sustainable development of Renewable Natural Resources (RNR) in Pakistan, through maintenance and rehabilitation of these essential resources and	Proposed project involves tree cutting so the relevant clauses of preservation of the policy will be applicable, however, no

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		<p>enhancement of sustainable livelihoods of rural masses, particularly women, children and other deserving groups.</p> <p>The various components of the policy include:</p> <ul style="list-style-type: none"> • Reducing poverty, powerlessness and unemployment; • Population planning in critical ecosystems; • Reducing the impact of socio-economic factors; • Providing substitutes to firewood in the mountain-woods; • Reducing political interferences in Forestry and Wildlife Departments; • Renovating and invigorating the institutions of RNR; • Supporting Local Governments in the sustainable development of their RNR; • Policies for fragile ecosystems; • Riverside forests; • Irrigated plantations; • Preservation of sensitive and unique forests; • Wildlife conservation; • Rangelands and desert ecosystems; and • Planting trees and fodder on farmlands. 	<p>forest area falling within the project boundary.</p>
4.	Pakistan Labor Policy, 2010	<p>The main objective of the Labor Policy, 2010 is the social and economic well-being of the labor of Pakistan. The Labor Policy, 2010 has following 4 parts:</p> <ul style="list-style-type: none"> • Legal Framework; • Advocacy: rights of workers and employers; • Skill development and employment; and • Manpower export. 	<p>The labor will be employed for construction of the proposed Project. The provision of policy will apply to all the labor employed during the execution of the project.</p>
5.	National Climate Change Policy, 2012 (Updated in 2021)	<p>The National Climate Change Policy provides a framework for addressing the issues that Pakistan faces or will face in future due to the changing climate. In view of Pakistan's high vulnerability to the adverse impacts of climate change, in particular extreme events, adaptation effort is the focus of this policy document. The vulnerabilities of various sectors to climate change have been highlighted and appropriate adaptation measures spelled out. The policy cover measures to address issues in various sectors such as water, agriculture, forestry, coastal areas,</p>	<p>The proposed project involves the renewable energy resource development which will have positive impacts on the regional as well as global climate change issues. The analysis shows that 373.69 GWh of electricity will be generated annually by this project which will displace about 149,476 ton of CO₂ at 0.40 kg/kWh. One ton of CO₂</p>

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		<p>biodiversity and other vulnerable ecosystems.</p> <p>Notwithstanding the fact that Pakistan's contribution to global Greenhouse Gas (GHG) emissions is very small, its role as a responsible member of the global community in combating climate change has been highlighted by giving due importance to mitigation efforts in sectors such as energy, forestry, agriculture and livestock.</p> <p>Furthermore, appropriate measures relating to disaster preparedness, capacity building, institutional strengthening; technology transfer; introduction of the climate change issue in higher education curricula; ensuring environmental compliance through IEE and EIA in the development process; addressing the issue of deforestation and illegal trade in timber; promoting Clean Development Mechanisms (CDM); and raising Pakistan's stance regarding climate change at various international forums, have also been incorporated as important components of the policy.</p> <p>The policy thus provides a comprehensive framework for the development of Action Plans for national efforts on adaptation and mitigation.</p>	<p>corresponds to CER which is currently valued about 1.5 US\$. Therefore, the CDM benefits worth will be 29.921 million PKR per annum.</p>
6.	National Sustainable Development Strategy, 2012	<p>The National Sustainable Development Strategy is an attempt to define sustainable development and the pathway to a "green economy" in Pakistan's context. It lays out an adaptive system and approach that can be continuously improved, through regular updates, to respond to evolving challenges. The focus has been on integrating not only across the three overall dimensions of economic, social and environment but also integrating the goals with the existing development paradigm with the aim of shifting it on to a more sustainable pathway.</p>	<p>This strategy is applicable as the project involves the construction of hydroelectric power to improve the power availability with least environmental burden.</p>
7.	National Electricity Policy, 2021	<p>The Ministry of Water and Power of the Government of Pakistan has developed an ambitious power policy to support the current and future energy needs of the country. This bold strategy will set Pakistan on a trajectory of rapid economic growth and social development. Simultaneously, it will address the key challenges of the power sector in order to provide much needed</p>	<p>The proposed project is a renewable energy production facility, and it will reduce the gaps between energy availability and demand.</p>

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		relief to the citizens of Pakistan. This document will frame the broad contours of the energy policy articulating the vision for the power sector, highlighting its key challenges, setting major goals, summarizing policy principles, and highlighting the strategy devised to achieve Pakistan's aspirations	
8.	National Disaster Risk Reduction Policy, 2013	National Disaster Management Authority (NDMA), being the lead focal agency for disaster preparedness and management, has therefore, embarked upon formulation of a comprehensive National Disaster Risk Reduction Policy through wider consultations with all stakeholders including all provinces, state of AJ&K and regions. This policy covers disasters risk reduction in a more holistic way and introduces a proactive and anticipatory approach by laying special emphasis on risk assessment and prevention.	This policy will be elicited if any unforeseen natural and manmade disaster occurs during the construction and operation phase.
9.	National Action Plan for COVID-19 Pakistan	GoP has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf . The GoP has launched the real-time data portal for COVID-19 http://covid.gov.pk/ . These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf .	This Action Plan for COVID-19 is applicable to the proposed project as it is being launched during this pandemic.

Table 2-2: Main Legislation/Acts Related to Environment and Their Relevance to the Project

Sr. No.	Act	Brief Coverage	Relevance to Project
1.	Gilgit-Baltistan Environmental Protection Act, 2014	The GB Environmental Protection Act 2014 was enacted by Govt. of GB on May 06, 2016. The act has Eleven (11) Parts out of which part VI is related to environmental examination and assessments. This act is applicable to almost all environmental parameters such as air, water, soil, and noise pollution, as well as to the handling of hazardous wastes. The Act provides the framework for protection and conservation of species, wildlife habitats and biodiversity, conservation of renewable resources, establishment of	The provision of the act is applicable to proposed Project for conducting an EIA according to section 16 and to obtain environmental approval/NOC from the GB EPA. The proposed Project will also ensure the compliance with all other relevant sections of this Act.

Sr. No.	Act	Brief Coverage	Relevance to Project
		standards for the quality of the ambient air, water and land, establishment of Environmental Tribunals, appointment of Environmental Magistrates, IEE and EIA approval. Penalties have been prescribed for those contravene the Act. The key features of the Act have a direct bearing on the requirement for an Initial Environmental Examination and Environmental Impact Assessment for development projects.	
2.	Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000	<p>These regulations set out:</p> <ul style="list-style-type: none"> • Key policy and procedural requirements for filing an EIA; • The purpose of environmental assessment; • The goals of sustainable development; • The requirement that environmental assessment be integrated with feasibility studies; • The jurisdiction of the Provincial EPA and Planning & Development (P&D) Departments; • The responsibilities of proponents; • Duties of responsible authorities; • Provides schedules of proposals that the project requires either IEE or an EIA; • The environmental screening process of the projects under schedule I, II and III; and • The procedure for the environmental approval for filing the case with the concerned EPA for the granting of the NOC. 	The provisions of these regulations are applicable for environmental screening of the project, which implies that an EIA is required for the proposed project. After submission of EIA to GB EPA, the process for environmental approval/NOC will be initiated.
3.	National Environmental Quality Standards, 2000	The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and have been amended in 1995 and 2000 which includes standards for liquid effluent, industrial gaseous emissions, ambient air, drinking water quality, noise levels and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles.	All projects to be implemented in GB must comply with NEQS during all the phases i.e. construction and operation.
4.	Guidelines for Environmental Assessment	EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of	These guidelines are applicable to the proposed project and have been considered during the preparation of the EIA.

Sr. No.	Act	Brief Coverage	Relevance to Project
		<p>development Projects. The guidelines that are relevant to the proposed project are listed below.</p> <ul style="list-style-type: none"> • Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997; • Guidelines for Sensitive and Critical Areas, 1997; • Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and • Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997. 	
5.	Forest Act, 1927	The Act reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty leviable on timber and other forest produce. It also defines the procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest or a Village Forest.	Proposed project involves tree cutting so the relevant clauses of preservation of this act will be applicable, however, no forest area falling within the project boundary.
6.	Northern Areas Wildlife Preservation Act, 1975	This Act provides for the establishment of national parks, wildlife reserves and wildlife sanctuaries and the issuing of hunting licenses and certificates of lawful possession. It regulates hunting, prohibits the use of in humane methods and imposes certain other limitations, such as time of day, season and area in which hunting is permitted. The First Schedule to the Act contains a list of animals divided according to the categories of "small game" and "big game".	All activities at the Project site will be carried out keeping in view the provisions of this act. Moreover, there is no notified protected site in and near the project area.
7.	Northern Areas Fisheries Act, 1975	This act is related to the fisheries in the GB. The act mainly describes the prohibition of destruction of fish by explosive and destruction of fish by poisoning water. The act also describes the fish size not to be kill and capture specified in the second column of the First Schedule. Moreover, the action also describes the separate penalties for the violation of section 4, 5 or 9 and section 6, 7, 8 or 10.	The Act is directly applicable to the proposed project since it is planned on a potential fish habitat.

Sr. No.	Act	Brief Coverage	Relevance to Project
8.	Land Acquisition Act (LAA), 1894 Including Later Amendments	The Land Acquisition Act, 1894, is a “law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition”. The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the lawgiver to compensate those who have been deprived of property, adequately. The land needed for the construction of development projects will be acquired under normal conditions based on prevailing market prices or negotiated prices between client and the owners of land. Section 17(4) of the LAA will not be used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached.	This act is applicable as the proposed project involves the permanent acquisition of land.
9.	Factories Act, 1934	The Factories Act provides regulations for health, safety and welfare of workers, disposal of solid wastes and effluents, and damage to private and public property, handling and disposal of toxic and hazardous materials.	This act will be applicable during the construction phase of the proposed Project. The EPC Contractor will respect the provision of this act during the execution of the proposed Project.
10.	Pakistan Antiquities Act, 1975	<p>The Antiquities Act, 1975 (amended in 1990) states the following:</p> <ul style="list-style-type: none"> • “Ancient” is any object that is at least 75 years old; • All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology; • The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise; • All new construction within a distance of 200 feet from protected antiquities is forbidden; • No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and 	No notified archaeological site has been identified within the proposed Study Area. However, the law will be applicable to the project mainly due to its two provisions: <ul style="list-style-type: none"> ▪ According to the law, any construction activity within 61 m or 200 ft. of protected antiquities, are prohibited. ▪ The provisions of this act would also be applicable, if any accidental archaeological discoveries may occur during the excavation works for the construction of proposed Project.

Sr. No.	Act	Brief Coverage	Relevance to Project
		<ul style="list-style-type: none"> The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage. 	
11.	Explosives Act, 1884	It provides regulations for handling, transportation and use of explosives.	Under the Explosives Act, the EPC Contractor is bound by regulations on handling, transportation and using explosives during quarrying, blasting and other purposes.
12.	The Protection against Harassment of Women at the Workplace (Amendment) Act, 2022	The Protection Against Harassment of Women at the Workplace Act refers to sexual harassment at the workplace.	This Act will be applicable to the project if women are employed for the construction of the proposed Project.
13.	Employment of Children Act, 1991	Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any construction, or any other hazardous employment. In accordance with this Article, the Employment of Child Act 1991 prohibits child labor (a child is under 14 years old).	The relevance of this act to the project will be to prohibit child employment for construction of the proposed project.
14.	National Disaster Management Act, 2010	National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.	For the proposed Project, GB Disaster Management Authority (GBDMA) is responsible. The EPC Contractor will follow the guidelines of updated Contingency Plan prepared by the GBDMA.
15.	Hazardous Substances Rules, 2003	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules.	This rule is applicable to the proposed Project due to involvement of hazardous waste handling, use and disposal during different construction activities at the construction stage.
16.	Building Code of Pakistan, 2007	The provision of BCP shall apply for engineering design of building like structure and related components. The construction in violation of the Building code shall be deemed as violation of professional engineering work. Moreover, a certificate for the proposed action will be obtained from concerned Control Authority.	These codes shall be used in structural design of building area components constructed under this proposed project.

2.3 COMPLIANCE PROCEDURE FOR OBTAINING NOC FROM GB EPA

Review of IEE and EIA Regulations, 2000 provide the necessary details on the preparation, submission, and review of the IEE and the EIA reports. Categorization of projects for IEE and EIA is one of the main components of these regulations. Projects have been classified on the basis of expected degree of adverse environmental impact.

The proposed project falls under Schedule II (category A Energy: Hydroelectric power generation over fifty megawatts), which requires an EIA to initiate the process of NOC from GB EPA.

The regulations stipulate that within ten working days of the IEE or EIA study having been submitted, GB EPA will confirm that the document submitted is complete for the purpose of review. During this time, should the agency require the proponent to submit additional information, it will return the IEE or EIA to the proponent for revision, clearly listing those aspects that need further discussion. Subsequently, GB EPA would make every effort to complete an IEE review within forty-five days and an EIA review within ninety days of filing (refer **Figure 2-1**).

The prescribed procedure for review of EIA by the GB EPA is described in Review of IEE and EIA Regulations, 2000. The agency will communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the EIA is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the EIA shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations.

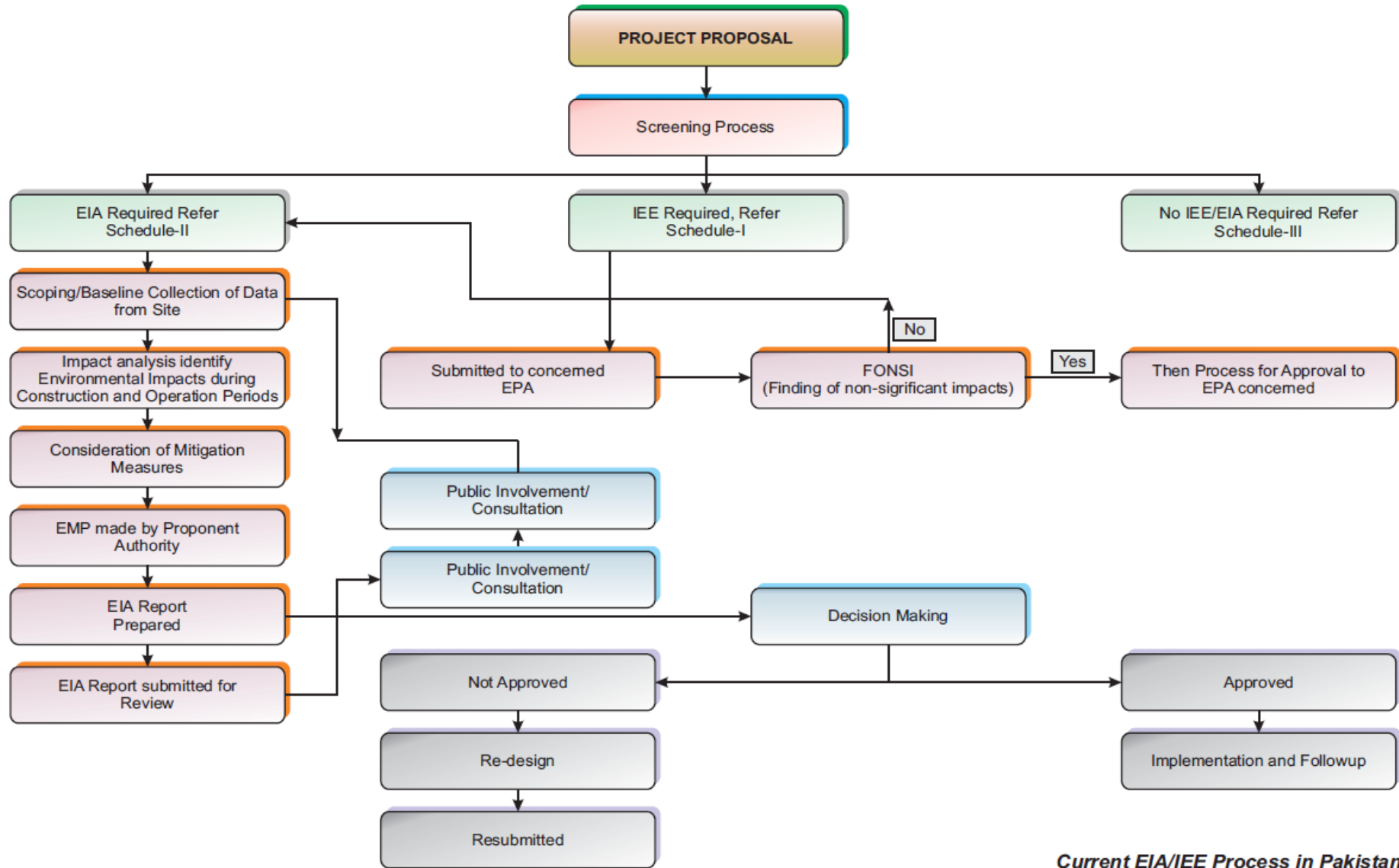


Figure 2-1: EIA and IEE Procedure in Pakistan

Current EIA/IEE Process in Pakistan

2.4 INTERNATIONAL PROTOCOL/CONVENTIONS

As Pakistan is a member of a number of international organizations such as United Nations Organization (UNO), Organization of the Islamic Cooperation (OIC), South Asian Association for Regional Cooperation (SAARC), and Economic Cooperation Organization (ECO) etc., so it has to follow the international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed project are provided in the **Table 2-3**.

Table 2-3: International Agreements/Conventions Relevant to the Project

Sr. No.	Agreement/Convention	Ratification	Description/Relevance
1	Convention on Biological Diversity, 1994 Web Link: https://www.cbd.int/	Signed in 1992 and ratified in 1994.	The Convention on Biological Diversity (CBD) has three main goals: conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources. This is applicable to the Project for conservation of biological diversity during the Project life.
2	The Rio Declaration, 1992 Web Link: http://www.unep.org/documents.multilingual/default.asp?documented=78&articled=1163	Signed on 13 th June 1992, and ratified on 1 st June 1994	The Rio Declaration comprises 27 principles which address important issues such as; sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption. The provision of the declaration is applicable for environmental protection during the Project life.
3	Kyoto Protocol, 1992 Web Link: http://unfccc.int/kyoto_protocol/items/2830.php	Ratified in 2005	The Kyoto Protocol is a protocol to reduce greenhouse gases that cause climate change. It was agreed on 11 th December, 1997 at the 3 rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16 th February, 2005. As of November 2007, 175 countries have ratified the protocol. One hundred and thirty seven (137) developing countries have ratified the protocol, including Brazil, China, India and Pakistan but have no obligation beyond monitoring and reporting emissions.

Sr. No.	Agreement/Convention	Ratification	Description/Relevance
			The protocol is applicable to reduce the emissions from Project construction activities.
4	<p>The Basel Convention, 1989.</p> <p>Web Link: http://www.basel.int/theconvention/overview/tabid/1271/default.aspx</p>	Ratified 26 th July 1994	<p>Basel Convention on the control of trans-boundary movements of hazardous wastes and their disposal is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to Less Developed Countries (LDCs). It does not, however, address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated, for environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.</p> <p>The provisions of this convention implies to minimize the amount of waste generated and its management during the construction and O&M phases.</p>
5	<p>Convention on the International Trade of Endangered Species (CITES), 1975</p> <p>Web Link: https://www.cites.org/</p>	Pakistan signed the Convention in 1973 and ratified it in April 1976.	<p>The convention entered in to force on 1st July 1975. The principal obligations of contracting parties to the CITES are to safeguard the trade in rare or endangered species and it established a permit system to control imports and exports of wild fauna and flora. According to this convention species threatened with extinction whose movement between countries is prohibited except for conservation purposes such as captive breeding, species whose commercial trade is permitted but export permits are needed. The National Council for Conservation of Wildlife (NCCW) is the CITES Scientific and Management Authority in Pakistan.</p> <p>The provision of this convention will be respected during the project implementation.</p>
6	<p>UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972</p> <p>Web Link: http://whc.unesco.org/en/convention-text/</p>	Pakistan ratified this convention on 23 rd July 1976.	Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to

Sr. No.	Agreement/Convention	Ratification	Description/Relevance
			<p>foster training and education for such protection.</p> <p>The provision of this convention will be respected during the project implementation. However, there is no notified archaeological site within the Project Boundary.</p>
7	<p>The Rotterdam Convention on Chemicals, 1998</p> <p>Web Link: http://www.pic.int/</p>	<p>Pakistan signed this convention on 9th September, 1999 and ratified on 14th July, 2005</p>	<p>The convention promotes shared responsibilities in relation to importation of hazardous chemicals. The convention promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labeling, include directions on safe handling, and inform purchasers of any unknown restrictions or bans. Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged to make sure that procedures within their jurisdiction are complied.</p> <p>The convention is applicable with reference to proper labeling and safe handling of hazardous chemical if used during the Project implementation.</p>

3 PROJECT DESCRIPTION

3.1 GENERAL

This Chapter presents the technical details of proposed project including location, accessibility, components (such as Flexible/Rigid Overflow Structure, Sediment Flushing Tunnel, Headrace Tunnel, Surge Tank, Penstock, Powerhouse, Tailrace Channel and Switchyard etc.), construction aspects, implementation schedule and project cost etc.

3.2 OBJECTIVES OF THE PROJECT

Following are the main objectives of the Project:

- The prime objective of the implementation of the Project is to develop the Power Potential available in GB on sustainable basis by providing cheaper, renewable, and environmental friendly power, keeping in view the present and future requirements of Region, especially rural and remote areas; and
- Transmit energy to Hunza Valley and adjoining suburbs for meeting the power and energy requirements of the region; and
- To reduce reliance on and consumption of diesel, timber, and other fuels by ensuring the availability of power. This will reduce overall Greenhouse Gases (GHGs).

3.3 PROJECT LOCATION

ALHPP has been identified on the Hunza River on Attabad Lake situated in Hunza-Nagar District, GB. Attabad Lake was formed on January 04, 2010, when a huge mass from the right bank of Hunza River slid down near Attabad Village and blocked the Hunza River. The inflow filled upstream valley and created a reservoir 14 km long till the end of May 2010.

The proposed project Site is located about 115 km from Gilgit Town and 27 km from Aliabad town in Hunza Valley. Project Location Map is shown in **Figure 1-1**.

3.4 PROJECT ACCESSIBILITY

The proposed Project site is accessible through Motorway from Islamabad to Thakot (M-15) and afterwards by Karakorum Highway (KKH) from Thakot to Project Area. Power house site is located on the left bank of Hunza River near Salmanabad Village. Access to the Project Site, along the Attabad Lake is quite convenient with steep slopes and moderate bends. No problems are expected to occur during the transportation of heavy construction and permanent equipment for the Project as well as the heavy construction materials. However, the road towards Power House Site needs improvement and widening of the track to cater for the transportation of the heavy construction material and machinery. The accessibility map of the proposed Project is shown in **Figure 3-1**.

3.5 CATCHMENT AREA

The catchment area of Hunza River upstream of the Project Site is about 8,900 km² which mostly consists of glaciers and snow deposits accumulated in the mountainous region usually during winter. Hunza River cuts through the Karakoram Range and flows approx. 250 km with an average slope of 0.90% from north to south before it merges into the Gilgit River. Many large size glaciers like Batura, Passu, Ghulkin, Gulmit, Bliglong, Minapin, Hasanabad and Muchlobel Glaciers drain in Hunza River. The water from main streams including Chaprot, Hasanabad and Molma Nullahs from large as well as small valleys also drains into the Hunza River. The discharge of Hunza River has its peak in months from May to September due to melting of snow/glaciers due to rise in temperature.

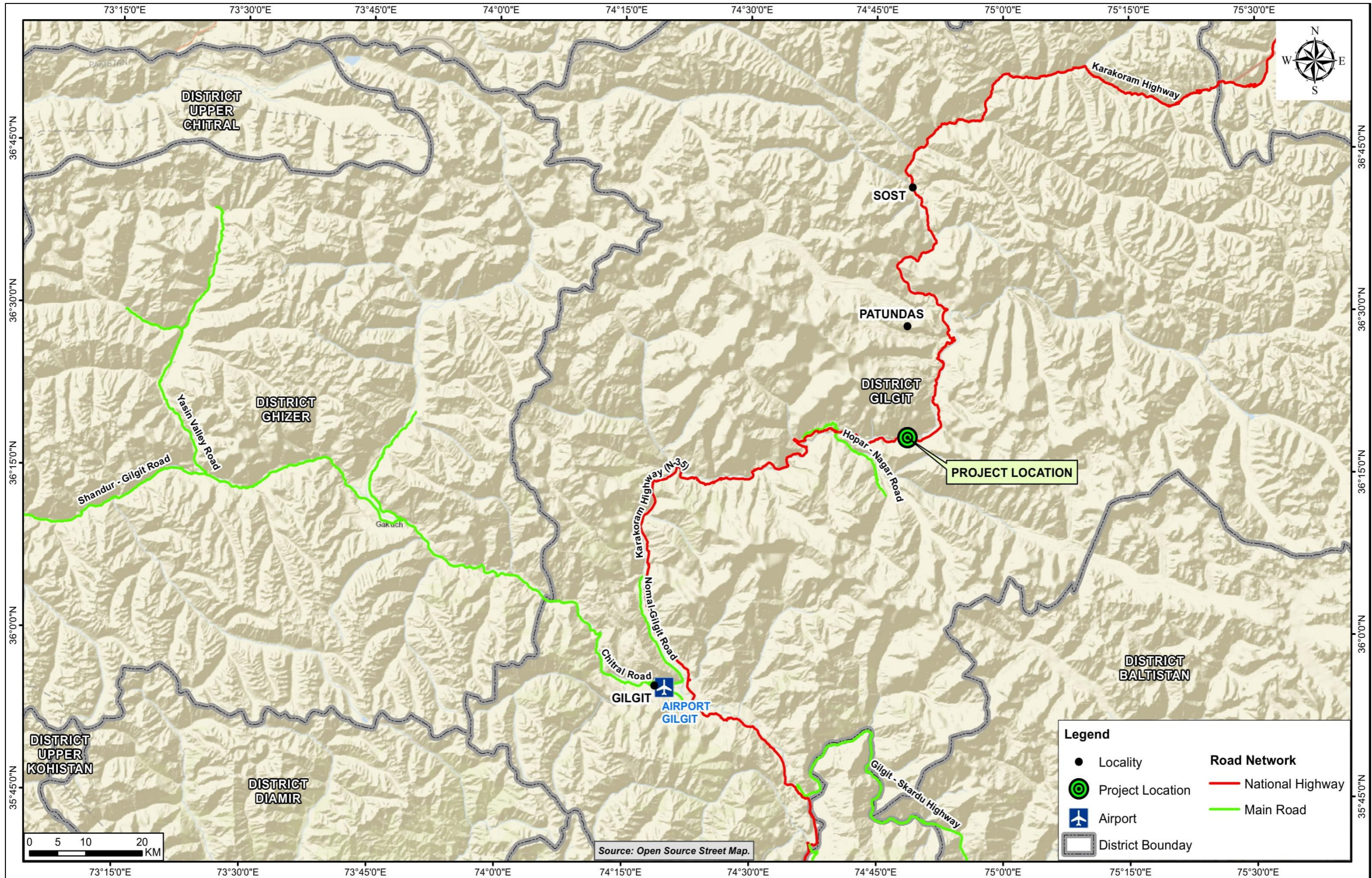


Figure 3-1: Site Accessibility Map

3.6 PROJECT COMPONENTS

Following are the main components of the proposed Project and the salient features are provided in **Table 3-1**:

- Flexible/Rigid Overflow Structure;
- Sediment Flushing Tunnel;
- Headrace Tunnel;
- Surge Tank;
- Penstock;
- Powerhouse;
- Tailrace Channel; and
- Switchyard.

Table 3-1: Salient Features of the Proposed Project

Sr. No.	Items	Description
1	Location	27 km from Aliabad Town
2	River	Hunza River
3	Catchment Area	8901 km ²
4	River Mean Annual Flow	209 m ³ /s
5	Purpose	Power Generation
6	Type of Development	High Head Run of River with Peaking
7	Type of Flexible/Rigid Overflow Structure	Overflow
8	Flexible/Rigid Overflow Structure Crest Elevation	2414 m.a.s.l
9	Flexible/Rigid Overflow Structure Crest Length	60 m
10	Flexible/Rigid Overflow Structure Height	4 m
11	Design Flood	3250 m ³ /s
12	Maximum Conservation Level including free Board	2424 m.a.s.l
13	Maximum Flood Level	2421 m.a.s.l
14	Minimum Operating Level	2412 m.a.s.l
15	Gross Head	112.0 m
16	Net Head	106.0 m
17	Installed Capacity	54 MW
18	Headrace Tunnel Length	2320 m
19	Headrace Tunnel Diameter	5.5 m
20	Penstock Length	480 m
21	Penstock Diameter	3.6 m
22	Type of Turbine	Francis (Vertical)
23	No. of Units	03
24	Design Discharge	60.00 m ³ /s (20 m ³ /s to each unit)
25	Type of Powerhouse	External / Surface
26	Annual Energy	374 GWh
27	Plant Factor	76.5 %

3.7 PROJECT DESIGN

An overflow structure will be constructed to divert the flow of Attabad Lake at Hunza River into the power intake structure. Before the construction of overflow structure, a deep sediment flushing tunnel will be constructed, which will act as a diversion tunnel during the construction of overflow structure. At the operational stage of the proposed Project, the diversion tunnel will act as sediment flushing tunnel. The diverted water will enter into a 2320 m long headrace tunnel. The headrace tunnel is followed by surge shaft after which water will enter into a 480m long penstock pipe branching into three (03) units at the end through the manifold. These high-pressure penstock pipes will feed three (03) turbines, 19.3 MW each. The proposed Project with a design discharge of 60 m³/s will generate the power round the year. The detailed components and their cross sections are shown in **Figure 3-2** to **Figure 3-6**. A brief detail of each component is provided in the following sections:

3.7.1 Cofferdams

Two temporary coffer dams will be constructed for the proposed Project if required i.e., Stage-I coffer dam and Stage-II coffer dam. The construction of Stage-I coffer dam at upstream of sediment flushing tunnel/under sluice with crest level at 2422 m.a.s.l, will be initiated as soon as possible after the improvement / upgrading the access path to the Flexible / Rigid Overflow Structure Site. On the completion of the Stage-I coffer dam, the excavation of sediment flushing tunnel / under sluice will be commenced and the Hunza River / Attabad Lake water will continue flowing through the existing spillway.

The construction of Stage-II coffer dam at upstream of the Flexible / Rigid Overflow Structure with crest level at 2422 m.a.s.l, will be initiated after the completion of sediment flushing tunnel / under sluice. On the completion of Stage-II coffer dam, the Hunza River / Attabad Lake water will be diverted through sediment flushing tunnel. The Stage-II coffer dam is envisaged to prevent entry of water into the working area for construction of Flexible / Rigid Overflow Structure in dry portion.

3.7.2 Sediment Flushing Tunnel

The suspended sediments transported by Hunza River and entering the power intake will unavoidably result in a certain wear and tear resulting in need for overhaul and replacement of runners. For this purpose, the sediment flushing tunnel will be constructed at the left side near the Power/Headrace Tunnel Intake Structure, consisting of low level outlets. It will also be used as a diversion tunnel during the construction of overflow structure. The invert level of sediment flushing tunnel is planned at El. 2380 m.a.s.l. The sediment flushing tunnel would be founded mostly on hard rock and with minor outlet on overburden / slided mass.

3.7.3 Power Intake Structure

A two (02) bay power intake structure shall be constructed on left bank of Attabad Lake upstream of main Flexible/Rigid Overflow Structure for passing the design discharge. The Intake level will be 22m above the invert level of sediment flushing tunnel section to keep the area upstream of the intake sediment free. It shall be equipped with a trash rack to prevent intrusion of debris (like timber, leaves, trees etc.) into the waterways and with a hydraulically

operated gate for emergency closure and for isolating the waterways for inspection and maintenance.

3.7.4 Flexible/Rigid Overflow Structure

The proposed Flexible/Rigid Overflow Structure is a Gabion Mattress Section (60m wide) with grout curtains to control seepage. The Flexible/Rigid Overflow Structure would be founded on overburden/slided mass with the crest elevation of 2414 m.a.s.l.

3.7.5 Headrace Tunnel

Approximately 2,320 m long low-pressure headrace tunnel (horseshoe shape), having 5.5m diameter would run along the left bank of Hunza River starting from the power intake structure leading to the surge tank.

3.7.6 Surge Tank

A circular surge tank having 10m diameter and 45m high will be constructed at the intersection of the headrace tunnel and penstock to prevent the adverse effect of water hammer pressure or flow variation due to turbine load fluctuation on the headrace and other structures.

3.7.7 Penstock

A Penstock of 3.6m diameter will be laid under the left bank slopes for conveying water from headrace tunnel to three (03) Vertical Shaft Francis Turbines to be housed in the Powerhouse. At the end, the penstock shall be trifurcated into penstock manifolds with reduced dia. In the first section up to 80 m, the penstock will cross horizontally the rock starting from the bottom of surge tank. This section can be considered as an extension of headrace tunnel, lined with an embedded steel lining. The second section, 400 m long will be the embedded penstock descending towards the Powerhouse.

3.7.8 Powerhouse

The Powerhouse is proposed 52m long, 25m wide and 22.5m high with four floors at different levels. The main hall would accommodate three (03) vertical Francis Turbine units, each of 19.3 MW, along with three (03) Generators, switchgear cabinets, trifurcation of penstock pipes, and an erection bay.

3.7.9 Tailrace Channel

The draft tube of each turbine unit will drain water in an open tailrace channel which will discharge back the water into the Hunza River.

3.7.10 Switchyard

A surface AIS 132kV switchyard will be located near the Powerhouse. The civil works of the switchyard area will be started after the construction of powerhouse superstructure. The switchyard equipment will be transported to its location through access road to the

Powerhouse. The erection of switchyard equipment will be done using the 5 ton mobile crane. Cabling for instrumentation, monitoring and controls along with cable terminations will be completed before the start of unit testing.

3.7.11 Residential Colony

An area of 2.5 Acres will be required for the construction of office, residential block for O&M Staff including Engineers, supervisory and lower staff, rest house, mosque, basic health unit, shops and other allied services including roads, water supply system, sewage disposal system and the electricity arrangement etc. near Powerhouse Site. The Colony once completed will be utilized for the management personnel of the Employer and Consultant till the project construction completes, to facilitate the communication and management. After the completion of the project the colony will be utilized by Operation & Maintenance (O&M) staff.

3.7.12 Contractor Camp

The EPC Contractor will be responsible for the construction of adequate accommodation and temporary facilities for the workforce prior to start of main works. All utilities including electricity, water supply, sewerage system and approach roads will be provided by the EPC Contractor at construction camps & offices and in residential area. The EPC Contractor will ensure that all these facilities fulfill the requirements for residential camps, site offices, yards, and construction sites etc.

Camp site will be selected keeping in view the availability of adequate area for establishing camp site, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. The EPC Contractor will identify the construction camp sites before the start of the construction activities keeping in view the following criteria guidelines:

- There should be no resettlement issue for the location of the camps;
- Camp site should be away from the residential areas and sensitive receptors;
- Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding; and
- There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, and forest areas, etc. near to the construction camp site.

The Contractor Camp is planned near Powerhouse Site.

3.7.13 Other Site Facilities

Other site facilities that will be required by the EPC Contractor for the construction of Project are described below. Most of these facilities are planned near the proposed Powerhouse site, where suitable land is available.

- **Materials Laboratory** equipped with the equipment for testing of soil, rock, concrete, aggregates, bricks, embankment materials and filter materials;
- **Temporary Facilities / Buildings** such as steelwork and carpenter's workshops, mechanical equipment repairing workshop, fabrication workshop, and storage yards for storing equipment, machinery, aggregate, sand, cement, steel reinforcement, scaffolding, bricks, chemicals, and explosives to be used during blasting operations and fuel tanks etc.;
- **Temporary Roads** connecting camp & other temporary facilities with the sites of main structures in the project area, other than the access roads;
- **Religious Facilities** within the camp areas for performing religious activities;
- **Health Facilities** including portable First Aid Station equipped to provide primary care for emergencies relating to injuries, burns, broken bones etc. Arrangements shall be made with the closest major hospital to cater for accident and hospitalization cases;
- **Emergency Fire Protection Facilities** in all offices and buildings to cater for any fire hazard including hose, fire extinguishers, pails and shovels etc.;
- **Wireless Communication System** for communication between site personnel, site offices and the working areas;
- **Security Facilities** including security check posts at main entrance of camp/site. All the work areas, storage areas and such other area where construction activity is proceeding shall be guarded by the security guards and watchmen for security; and
- **Spares and Standby Equipment** to ensure continuity and proper completion of operations, including diesel power generating sets, earthwork plant, concrete mixing and transportation plant, grouting equipment, dewatering plant and other key plant and equipment required to ensure work progress.

3.7.14 Detailed Engineering Design

The proposed project will be implemented in EPC mode therefore, the EPC Contractor will be responsible for the Detailed Engineering Design which will be approved by Project Consultants engaged for Management Consulting Services. The EPC Contractor will design all Permanent works and all necessary Temporary works.

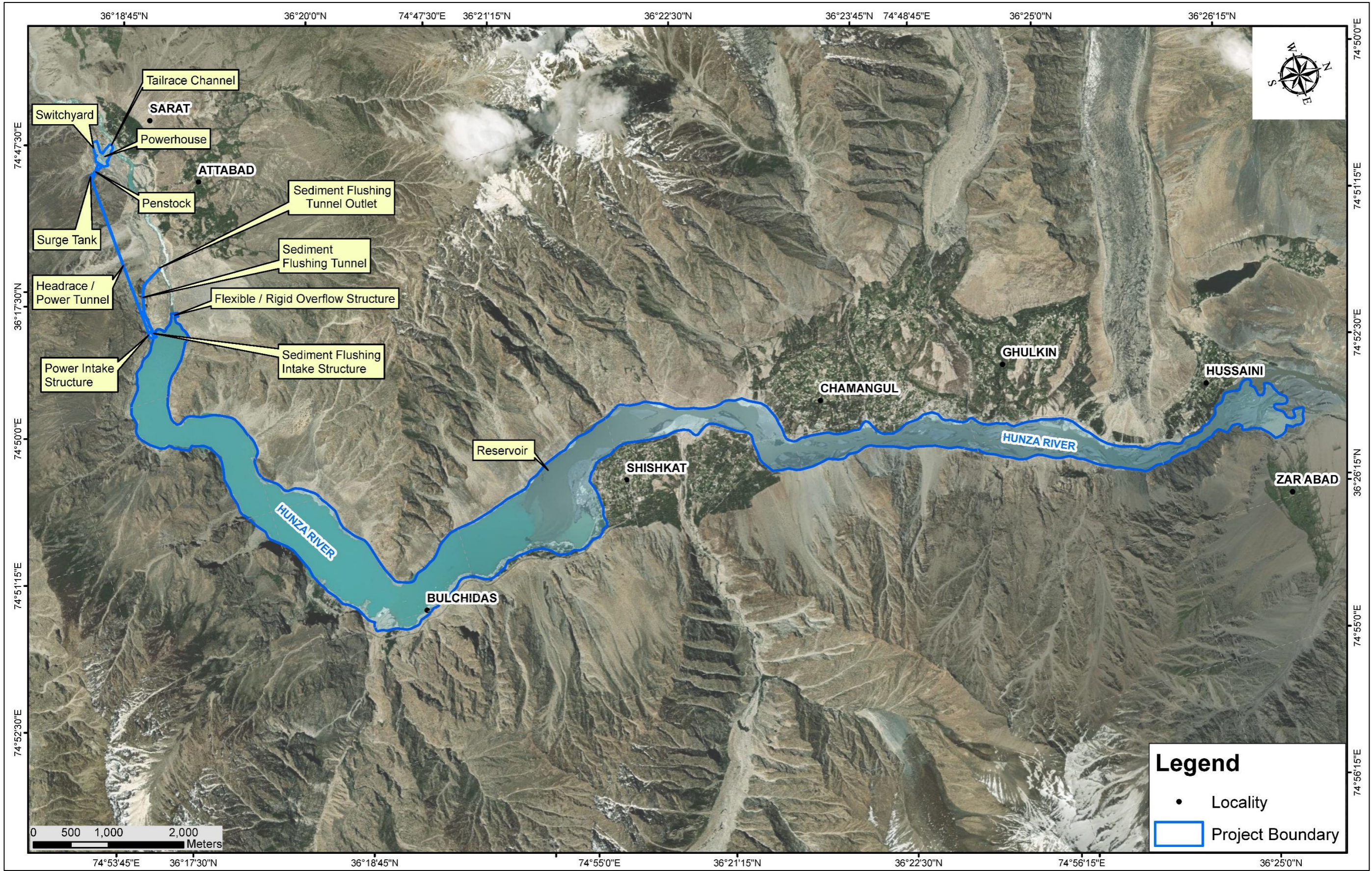


Figure 3-2: Project Component Map

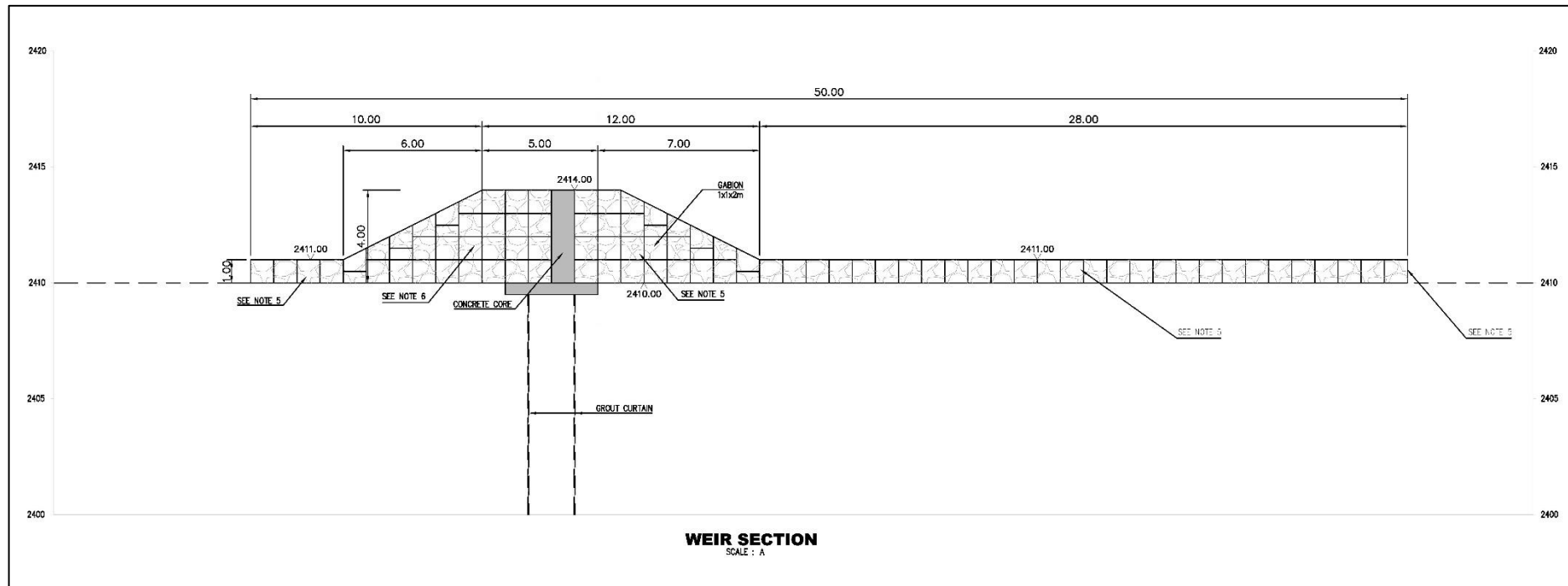


Figure 3-3: Proposed Flexible/Rigid Overflow Structure Longitudinal Section

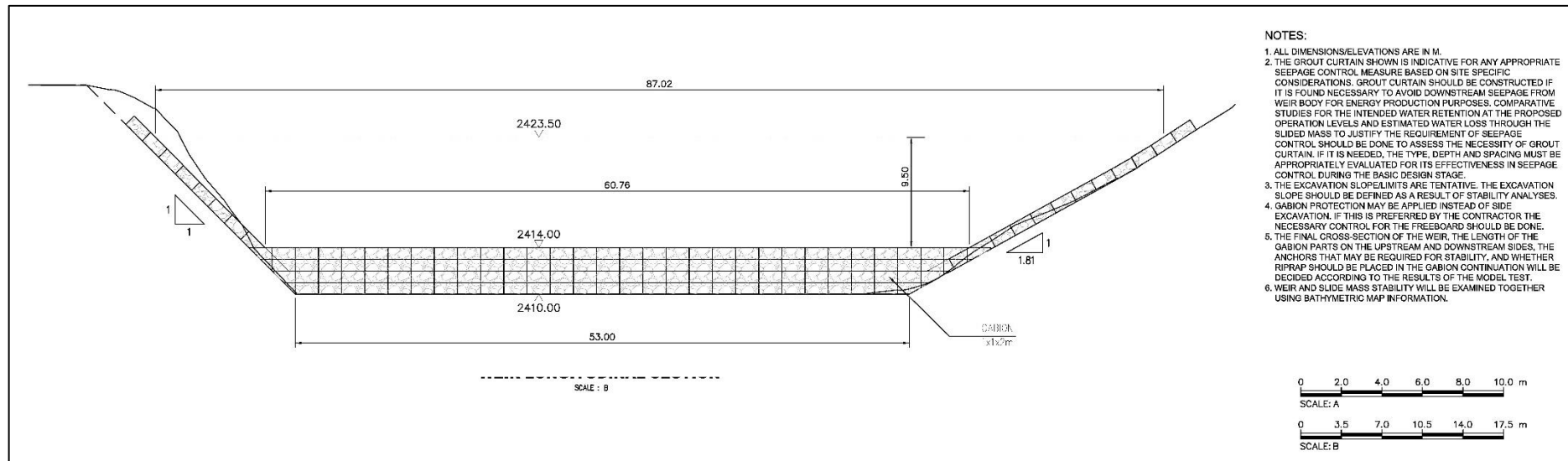


Figure 3-4: Proposed Flexible/Rigid Overflow Structure Cross Section

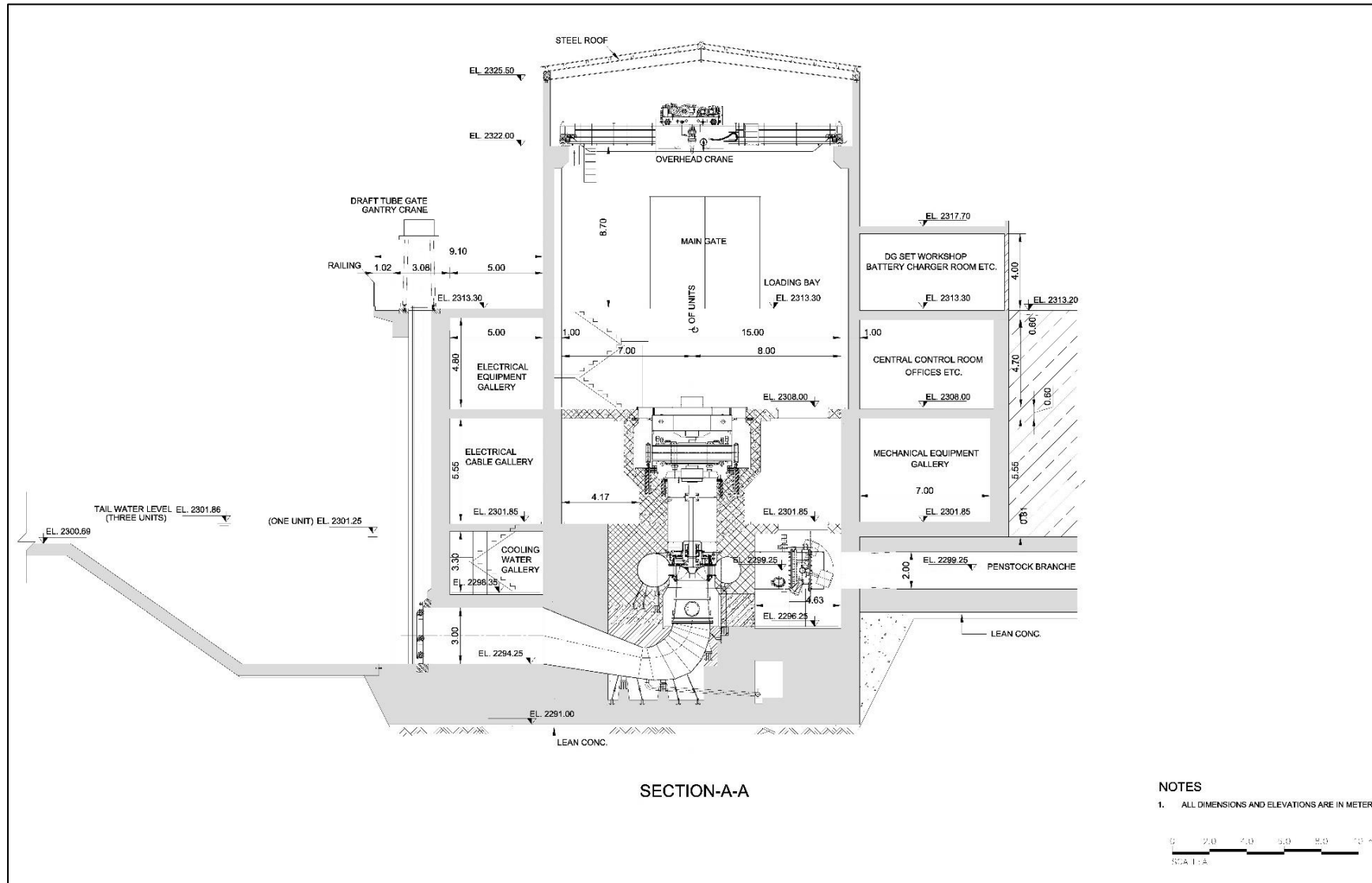


Figure 3-5: Powerhouse Longitudinal Section

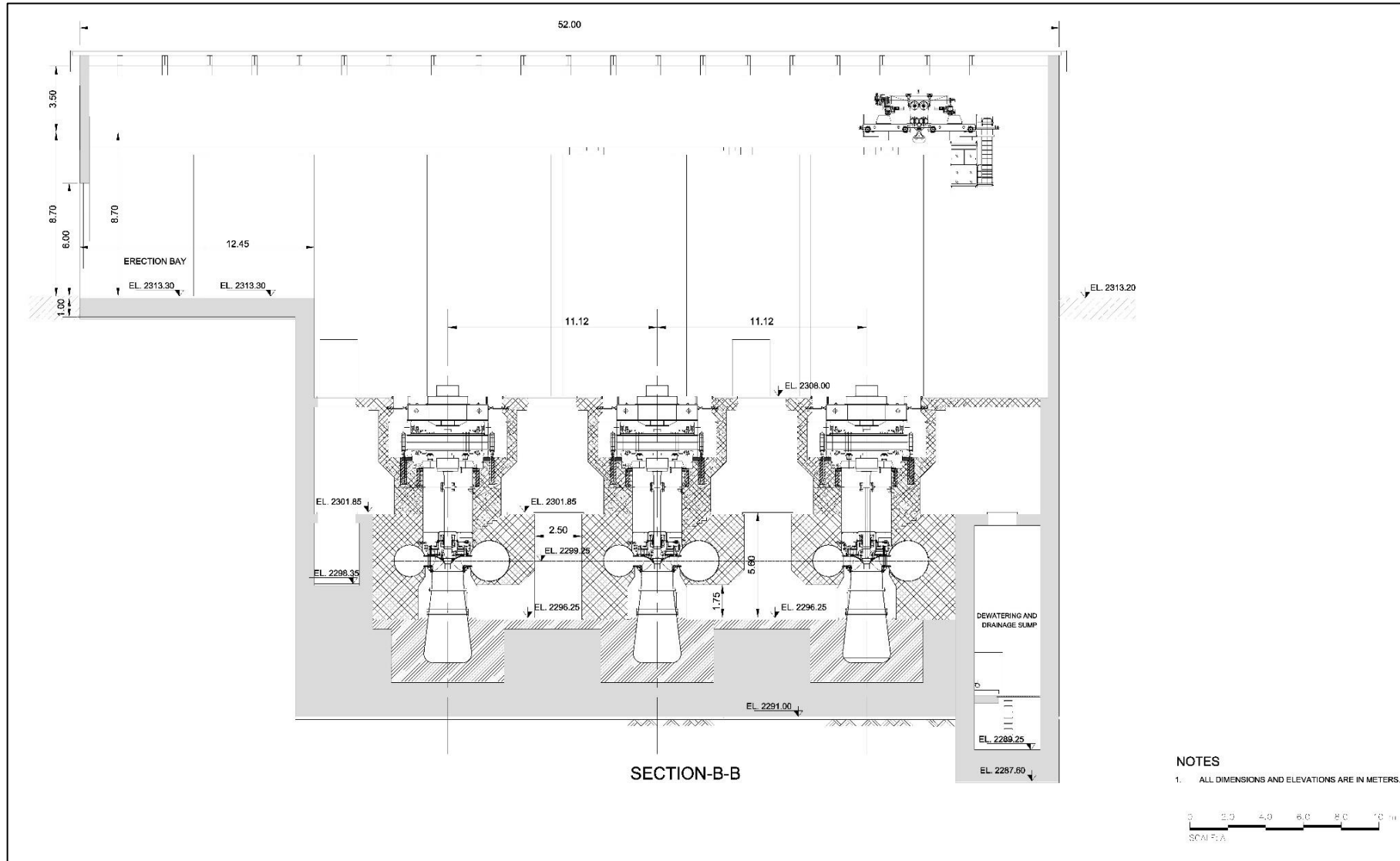


Figure 3-6: Powerhouse Cross Section

3.8 LAND ACQUISITION

The land will be acquired for the Project components such as powerhouse, Flexible/Rigid Overflow Structure and its associated structures, access roads and project colony etc. Total land to be acquired is approximately 183 acres (05 acres for Contractor's Camp, 60 acres for Project Colony and Powerhouse Area, 103 acres for Intake Area and Access Corridor, and 15 acres for Spoil Area) for the proposed Project which includes both private and government land. The estimated total land to be acquired is 777.5 acres due to the impounding of reservoir up to maximum conservation level including free board, including river bed. Private land will be acquired by the Client as per Land Acquisition Act 1894 including later amendments.

The land required for the establishment of contractor camps, stores and workshops will be acquired on temporary basis by direct negotiation and agreement with the owners. Temporary acquisition will principally be the responsibility of the EPC Contractor.

3.9 PROJECT ADMINISTRATIVE JURISDICTION

The proposed project falls under administrative jurisdiction of Hunza Nagar District, GB.

3.10 CONSTRUCTION ASPECTS

3.10.1 Construction Materials

The materials used for construction purpose would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, and cement etc. Water of required quality is available in the project area. Coarse and fine aggregates for concrete meeting ASTM gradation requirements can be obtained locally. Asphalt, reinforcement and cement material can be transported from nearby factories.

The bulk of construction material can be gained by quarrying.

3.10.2 Procurement of Construction Materials

a) Cement

It has been estimated that about 31,485 tons cement (Ordinary Portland Cement) would be required to meet the project construction activities. The nearest cement factories to the Project site are Bestway Cement (Farooqia, 675 km), Askari Cement (Wah, 685 km), Fauji Cement (Fateh Jhang, 710 km), Askari Cement (Nizampur, 755 km) and Cherat Cement (Nowshera, 790).

b) Coarse Aggregate

The rock quarries have been identified at Passu and Powerhouse area. The marble present in Passu area and Rounded Boulder Gravel Silt (RBGM) at Powerhouse Area can be used as coarse aggregate by certain amount of processing.

c) Sand

High quality of large sand deposits are available in the tail end area of Attabad Lake near Shishkat Bridge for use in the proposed Project.

d) Reinforcing Steel

The quantity of reinforcing steel required for the Project will be about 3,300 tons, with a monthly average consumption of about 155 tons. The nearest location from where the reinforcing steel bars of the desired specification are available is Islamabad (735 km from the Project Site).

e) Explosive Materials

Flushing tunnel outlet and tailrace channel might have extensive volume of excavation of slided materials having large size boulders, which may require blasting. There are certain areas, where rock excavation would also be involved like power intake, headrace tunnel and surge tank etc. The Wah - Bofors factory in Wah (near Rawalpindi) is capable of supplying all the explosives and blasting consumables required for the Project.

f) Steel Plates and Steel Formwork

Steel sheets of various thicknesses are produced at the Steel Mills at Karachi, which can be used to fabricate steel formwork. Alternatively, steel items can be imported from abroad. Most likely source of steel plate could be nearby countries such as China and Iran.

g) Petroleum Products

Petroleum products will be mainly diesel with comparatively minor quantity of gasoline and lubricants, which can be procured directly from the source i.e. the oil refineries, spread in the country, for the operation of machinery and vehicles. The storage tanks would be established at the Project site with total capacity of around 40,000 liters, sufficient for around one month of operation, to cope with extraordinary conditions like land sliding on the KKH or fuel shortages, etc.

h) Water and Stone for Riprap and Fill Material

The Hunza River water will be used in the making of concrete. The results of water samples taken from Hunza River indicate that water is suitable for mixing & curing of concrete. The large boulders with sufficient quantity present in the slided mass can be used as riprap material to control the erosion by water. Silty sand, sandy silt and gravelly sand available in the river bed and in slided mass (in ample quantities) can be used as fill material for the protection of slopes and construction of coffer dam etc.

3.10.3 Work Force

The construction of the proposed Project shall be carried out by WAPDA through EPC Contractor. Total workforce required for the proposed project including supervisory staff, skilled and unskilled labour is approximately 300-350 numbers during the construction phase. The workforce will be originated from GB, different regions of Pakistan and from oversees.

3.10.4 Construction Activities and Required Machinery

Construction activities involve the following:

- Earth work (clearing of vegetation/trees and top soil);
- Access Road work;
- Structure works; and
- E&M Works

The list of the machinery and the equipment required for the proposed Project is provided in **Table 3-2**.

Table 3-2: Machinery and Equipment Requirement

Sr. No.	Type of Machinery/Equipment	Sr. No.	Type of Machinery/Equipment
1	Dump Truck	12	Self-Propelled Pneumatic Roller
2	Front End Loader	13	Asphalt Distributor
3	Dozer	14	Batching Plant
4	Grader	15	Concrete Transit Truck
5	Vibratory Roller	16	Concrete Pump
6	Water Tankers	17	Excavator
7	Aggregate Spreader	18	Water Pumps
8	Three Wheel Rollers	19	Cranes
9	Tandem Roller	20	Vibrators
10	Asphalt Plant	21	Generators
11	Paver		

3.10.5 Water Requirement

Water requirement during the construction phase will be met from Hunza River. The water can be uplifted from the Hunza River through pumps to meet the domestic demand and requirement of project construction activities like concrete preparation and wet drilling during excavation for water carrying channel. The water consumption is estimated to be 35,000 liters/day⁵ for 350 construction workers of the proposed Project.

⁵ Tentative Work Force Requirements Including the Client and the EPC Contractor Staff
 = (350) x (100) = 35,000 liters/day

3.10.6 Wastewater Generation

The wastewater generation is estimated to be 28,000 liters/day for 350 construction workers for the proposed Project⁶. The estimated wastewater generation will vary during the operational stage of the project.

3.10.7 Solid Waste Estimation

Due to construction activities waste will be generated at the construction site and contractors' camp. The EPC Contractor will provide the estimated quantity of disposable solid waste encountered in excavation of material during the construction phase. The useable excavated material will be utilized at site where applicable during the construction phase. Solid waste generated during construction and at camp sites shall be safely disposed in demarcated waste disposal sites.

The solid waste generation is estimated to be 157.5 kg/day (as per 0.45 kg/capita/day waste generation)⁷ for 350 construction workers.

3.10.8 Power Requirement/Power Source

The main source of electricity/electric power during the construction phase will be arranged by the EPC Contractor for construction camps and construction machinery. The main sources of energy required at the project are diesel, petrol, natural gas and electricity.

3.11 PROJECT IMPLEMENTATION SCHEDULE

The proposed project construction schedule spans over a period of 55 months, which include 36 months for construction activities, 07 months for pre-construction activities and 12 months for post construction liability period.

3.12 COST OF THE PROJECT

The estimated cost of the proposed Project is 100 million USD⁸.

⁶ Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)

⁷ The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day

⁸ Source: Feasibility Report, 2021

4 PROJECT ALTERNATIVES

4.1 GENERAL

This Chapter presents the Analysis of Alternatives such as No Project Option, Project Layout Alternatives, Headrace Alternatives, Penstock Alternatives and Powerhouse Location Alternatives. The details are provided in the following sections:

4.2 NO PROJECT OPTION

Electricity has become a basic need of human beings and is one of the most important ingredients of economic development. There exists a strong correlation between energy utilization and rate of economic expansion of any country. In Pakistan per capita energy consumption is very low. With the ever-increasing gap in the demand and supply in the national grid the short fall reached to an extent that an electricity crisis arises in the country which resulted in long hours of load shedding even in the main cities of the Pakistan as well as cities and towns of GB.

The Central Hunza is located on the right bank of Hunza River, extending from Murtazabad up to Attabad Village. Central Hunza is the hub of tourism in Gilgit-Baltistan. National and international tourists flow remain at peak during summer season. As a result, hotel industry is booming, whereby, other small-scale businesses i.e. transport sector, cottage industry, local markets and automobile workshops are most likely to flourish in the near future. The increase in tourism industry has significantly enhanced the energy demand of the area. Furthermore, the area is having multiple business opportunities due to its location on the China Pakistan Economic Corridor (CPEC), which will result in fast growth of economic activities, thus increase in the energy demand being interlinked with each other.

The supply from the existing hydropower projects is currently not sufficient to meet the existing demand, therefore, it is supplemented through standby diesel generators during peak hours, mostly in winter season. Due to abrupt surge of Shishper Glacier situated in the catchment of Hasanabad Nullah, the powerhouses on Hassanabad Nullah are under the threat of Glacier Lakes Outburst Flood (GLOF). The Government has limited resources to address the issue of sustainable electricity supply in the area. The private sector is reluctant to invest in Gilgit-Baltistan's energy sector, which is due to absence of a Power Policy and non-connectivity of the area with the National Grid. Therefore, it is necessary to develop projects on other water resources to facilitate central Hunza.

Presently, there is high supply and demand gap; therefore, load shedding is common in summer, while it becomes very acute in winter. The commercial and industrial demand is partly fulfilled from privately owned diesel generators. The diesel generators are mainly used by the hotels, small businesses, banks and other consumers which can afford the high running cost. Apart from the cost the use of these diesel generators is creating environmental pollution (i.e. noise and air), which is also affecting the tourism in the area.

Thermal power generation is more expensive, being dependent on the imported oil, and is less environmental friendly due to high emission rate of Green House Gases (GHGs). The power shortfall situation is being tackled through load management by shedding and supplying the power to various areas and sectors alternatively.

Hydropower generation is very attractive for sustainable development of the country as it reduces the need for imports and can abate substantial amount of GHG emission by substituting for largely gas and oil based power generation. The no project option would, therefore, require the installation of more thermal units which will further aggravate the economy and will become a major source of environmental degradation.

Attabad Lake was formed on January 4, 2010, when a huge mass from the right bank of Hunza River slid down near Attabad Village and blocked Hunza River. The inflow filled upstream valley and created a reservoir 14 km long till the end of May 2010. Attabad Lake is about 15 km upstream of Ganish Bridge and about 115 km upstream from Gilgit. Therefore, ALHPP will utilize the Attabad Lake water and head for the generation of the Hydel Electricity. Therefore, due to the implementation of ALHPP project, no major adverse impacts are anticipated.

Based on above, it is concluded that the Project of 54 MW is technically, economically and environmentally feasible. Therefore, NPO is not a feasible option.

4.3 PROJECT LAYOUT ALTERNATIVES

In order to optimize the location of the Project in terms of benefits and potential impacts on the environment, following project location alternatives were discussed:

4.3.1 Alternative-I: Project Layout on the Left Bank

The left bank has been examined in detail to propose Project Layout with power intake, 2.3 km low pressure headrace tunnel, surge tank, embedded penstock and surface powerhouse near Hunza river, 2.5 km downstream of Attabad Lake.

The main access road to Project Area from down country is KKH passes on the left bank in Project Area leading to Chinese Boarder through Khunjerab Pass. After landslide, about 7 km highways tunnel has been constructed on the left bank because about 19 km was submerged in the lake. The access to the area and for construction activities, the left bank is the suitable bank to propose the Project Layout. Since the slide did not initiate from left bank the slopes are more stable. The geological conditions favour intake structures, headrace tunnel and surface powerhouse. The slided area of about 500 m is to be stabilized by excavating material on the left bank.

The following observation have been made:

- An overflow structure is to be constructed to pass the 10,000-year flood. The river diversion during construction is to be managed through a tunnel on the left bank. Later on, the same tunnel is to be used for sediment flushing;

- For power intake structure, there is sound rock formation on the left bank just upstream of Flexible / Rigid Overflow Structure site. The access to the area can be made through adit and headrace tunnel. Steep slopes and weak geology have been observed for the headrace, penstock and powerhouse area;
- Headrace tunnel can be constructed at lower elevation of highways tunnel in same geological formation upto surge tank. The access to surge tank and headrace tunnel is available through old KKH;
- From surge tank to powerhouse area, embedded penstock can be laid down over mild slope terraces. The anchor block can be placed over rock/boulders; and
- At the proposed site, surface powerhouse can be constructed. Surface powerhouse, tailrace channel and bifurcated penstock can be placed at required elevation by excavating the alluvium.

4.3.2 Alternative-II: Project Layout on the Right Bank

A Project Layout on the right bank have been studied with intake 1.6 km upstream and powerhouse 2.0 km downstream of overflow structure. A low pressure tunnel about 2.3 km length is to be constructed to utilize the available head at ALHPP.

The Project Layout on the right bank has geologically disturbed area and Attabad slide originated from the right bank and slided material fallen on the left bank. On the right bank of the River, there is excessive loose material present and it is considered susceptible to rock fall and minor slides due to its being fragmented. The accessibility to the right side is difficult and construction and operation of scheme on the right bank is technically unfeasible.

The right bank of the river is where the slide basically initiated from, therefore, there is excessive loose material present and the mountain side is quite fragmented. Clearing the overburden to reach the rock face will not only require a lot of excavation but also the site will remain susceptible to rock fall and minor slides. The operability of Project components on this bank will remain a challenge.

Considering the Project construction, operation and maintenance, environmental issues, stability of structures, the left bank layout has been preferred over the right bank and is selected for further studies.

For Feasibility Study, field investigations like topographic survey, geological mapping, borehole drilling, test pits, environmental survey, flows and sediment observations have been carried out. For the identified dam or Flexible/Rigid Overflow Structure and the powerhouse site on the left bank of Hunza River near Attabad, topographic survey has been carried out, which is duly connected with Survey of Pakistan (SOP) Grid. The long term flow data of Hunza at Danyor Station has been used to estimate the daily flows and flow duration curves at the Flexible/Rigid Overflow Structure site. All the field data helped to finalize the structure locations and sizes for a technically feasible and economical layout. Similarly, environmental and social constraints have been studied.

Considering topographic, geological and environmental conditions at the Flexible/Rigid Overflow Structure and upstream valley, an overflow structure at 2414 m.a.s.l has been proposed with normal operating pond level as 2414 m.a.s.l. The tailrace outlet of ALHPP has been planned at 2300 m.a.s.l.

Based on the above analysis, Project Layout on the Left Bank Option has been selected for the proposed Project.

4.4 HEADRACE ALTERNATIVES

Two (02) options have been studied on the left bank of Hunza River at Feasibility Stage i.e.:

- Alternative-IA: Headrace Tunnel Option; and
- Alternative-IB: Headrace with Embedded Pressure Pipe

4.4.1 Alternative-IA: Headrace Tunnel Option

The proposed Project has been envisaged with a 14 m high Flexible/Rigid Overflow Structure on Hunza River identified 4 km downstream of Attabad Lake confluence with Hunza River and the powerhouse near Batakundi Village. The Project Layout includes power intake, sand trap, headrace tunnel, surge shaft, in addition to Flexible/Rigid Overflow Structure and surface powerhouse on the right bank.

For the water ways from intake to surge shaft, two (02) options have been considered; either headrace tunnel or pressure pipe. These two options have been studied with respect to powerhouse and preliminary cost estimates.

The salient features with this option are as under:

Overflow Height	4.0 m
Normal Reservoir Level	2414.0 m.a.s.l
Minimum Operating Level	2412.0 m.a.s.l
Live Storage	3.0 million m ³
Mean Annual Flow	209.0 m ³ /s
Design Discharge	60.0 m ³ /s
Turbine Level	2300.0 m.a.s.l
Maximum Net-Gross Head	112.0 m
Minimum Net-Gross Head	108.0 m
Headrace Tunnel Length	2320 m
Penstock Length	480 m
Type of Turbine	Francis
Installed Capacity	54.0 MW
Annual Energy Generated	374.0 GWh
Plant Factor	76.5 %

4.4.2 Alternative-IB: Headrace with Embedded Pressure Pipe

The salient features of ALHPP layout for Alternative-IB are same except the following:

Maximum Net-Head	102.1 m
Minimum Net-Head	99.6 m
Headrace pipe length	2.8 km
Penstock Length	550 m
Installed Capacity	51.7 MW
Annual Energy Generated	357.8 GWh
Plant Factor	79.0 %

Based on the above features and keeping in view the environmental and social constraints, Alternative-IA Headrace Tunnel Option has been selected for the proposed Project.

4.5 PENSTOCK ALTERNATIVES

Both the embedded penstock and tunnel options are considered for the conveyance of lake water for power generation along the left bank of the Attabad Lake. On the basis of field observations, topographic survey, geological & geotechnical investigations, the embedded penstock route passes through overburden and its construction / installation will be quite hazardous as observed during geotechnical investigation. The cost comparison of tunnel and embedded penstock has also been carried out to check the suitability of conveyance of lake water. Cost comparison also shows that power tunnel option is more appropriate in view of least cost with less operation and maintenance issues that may encounter in case of embedded penstock alternative. Necessary geological studies, mapping and geotechnical studies including topographic surveys of cross drains along tunnel route and embedded penstock have also been carried out.

4.6 POWERHOUSE LOCATION ALTERNATIVES

Powerhouse location is affected by factors primarily associated with availability of head, favorable geology, availability of land and accessibility besides impact of powerhouse construction on habitants in the area (locality). Issues relating to protection against land sliding and flooding have also been taken into account. Keeping the above in view, only one location has been considered for powerhouse for both the alternates.

A surface power house is being considered on the left bank of Hunza River about 300 m upstream of Sarat Bridge. The terrace is large enough space for powerhouse, switchyard, offices and/or staff residences in the close vicinity of the powerhouse. The river bed level at the site is 2306 m.a.s.l.

5 DESCRIPTION OF THE ENVIRONMENT

5.1 GENERAL

An environmental baseline study is intended to establish a database against which potential project impacts can be predicted and managed later. This section covers a comprehensive description of the environment of project area, including the resources which are expected to be affected directly by the project, as well as, those indirectly affected by the construction and operation of the project. The existing environmental conditions of the proposed project have been considered with respect to physical, biological and socio-economic aspects within Study Area i.e. (Area of Influence) from boundary of the proposed Project, as shown in **Figure 1-2**.

The existing information to establish a database for the proposed project was collected from review of published literature and through the site visits/surveys carried out in the project area. To comprehend the existing environmental conditions, site survey was conducted and salient observations were duly noted. Situation of prevailing air quality, noise level, water and wastewater quality were also monitored through laboratory testing. The socio-economic baseline survey of the proposed project area was conducted through consultation with the community. People of the project area were interviewed to get their opinions and feedback regarding the construction of the proposed apartment buildings.

5.2 PHYSICAL ENVIRONMENT

The following section provides an overview of the information on physical environment of the proposed Project study area collected from primary as well as secondary sources. The major parameters covered include topography, land use, soils, geology, seismicity, climate, water resources and other parameters as described in the following sub-sections.

5.2.1 Topography and Geomorphology

The Project Area is located on Hunza River at Attabad Lake which was formed in the year 2010 due to a huge slide from right bank mountain. The project site is about 15 km upstream from Ganish Bridge of Hunza. Its distance is about 20 km from Hunza and 115 km from Gilgit. The project area is located in district Hunza. Topographically, Hunza valley has a varying relief.

The segment of Hunza valley wherein the various components of the proposed project are situated reflects very high relief conditions marked by extensive steep mountain slopes along right side of the valley as compared to the left bank mountain slopes. The mountains are mostly marked by erratic slopes instabilities along with relatively less extensive segments of casuistic slopes. The mass wasting regimes active in the project area are drastically influenced by a broad spectra of variables such as geo-mechanical conditions, moisture distribution and dynamic loading. Most abundant slope hazards include but not limited to rock fall/debris flows, rolling slopes in unconsolidated loose overburden and mud/debris flows in sub-parallel rectilinear secondary drainage.

Tupopdan Peaks 6,106 meters (20,033 ft.) lies near the Project Area also known as 'Passu Cones' is the most photographed peak of the region. The other nearby high peaks are Pasu Sar, Shispare Sar, and Batura.

The powerhouse location is on the left bank of river and easily accessible from Karakoram Highway. The Flexible/Rigid Overflow Structure site is selected at current overflow point of Attabad Lake.

The topography map of the project area is shown in **Figure 5-1**.

5.2.2 Regional Geology

Tectonically, project area lies in the Karakoram Block towards the north of the Main Karakoram Thrust (MKT) and Main Mantle Thrust (MMT) which are considered to be the manifestation of the tectonic collision between Indian Plate (Continent) with the Kohistan Island Arc and then with the Eurasian plate (Continent). The Himalaya, Karakorum and Hindokush are considered to be the highest mountainous ranges in the world.

Site Geology

The Project Area lies in Karakorum Block, where rocks of meta-igneous provenance are exposed. The rock units represent acidic igneous rocks including Granodiorite and Granitic Gneiss. Many local as well as regional faults are present in Project Area.

Soil units present in the Project Area are:

- Angular Boulder Gravels with Sand and Appreciable Amount of Fines (ABGM): Most of the slopes are covered by material comprising of ABGM. This is colluvium material broken from the rock units, rolled down slope and settled at the foothill or along the slopes. ABGM material is present in the sediment flushing tunnel, surficial deposits in power tunnel alignment and in part of tailrace channel.
- Rounded Boulder Gravels with Sand and Appreciable Amount of Fines (RBGM).
- Terrace Deposits which consist mainly of unconsolidated mixtures of clay, silt, sand and gravels with occasional boulder sand. Terrace deposits are present at a relatively higher elevations in the project area.
- Morainic Deposits consists mainly of material ranging in size from large boulders to clay size particles, angular to sub-angular, poorly sorted, elongated and have flat surface, powerhouse area is covered by moraine deposits with clayey silt to silty clay.

Both fine and coarse aggregates for construction of Flexible / Rigid Overflow Structure and its associated structures are present in the vicinity of Project Area in ample quantities. Clayey silt for blanketing / impervious material, coarse aggregate and rip rap have been investigated and proposed as barrow area while sand and fill materials are proposed to be excavated from river bed.

Figure 5-2 provides map for the location of the proposed Project in regional geological prospective.

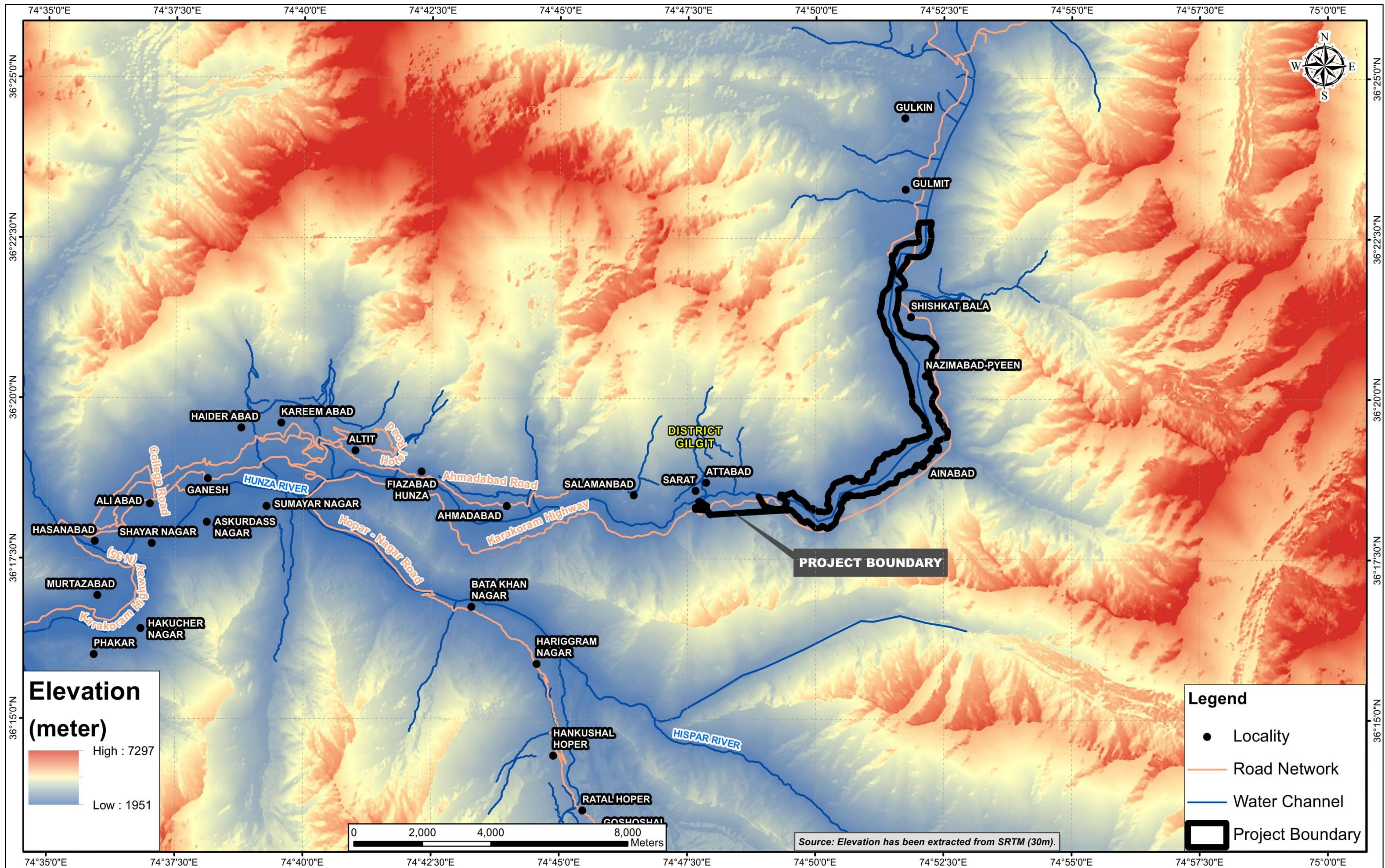


Figure 5-1: Topography Map

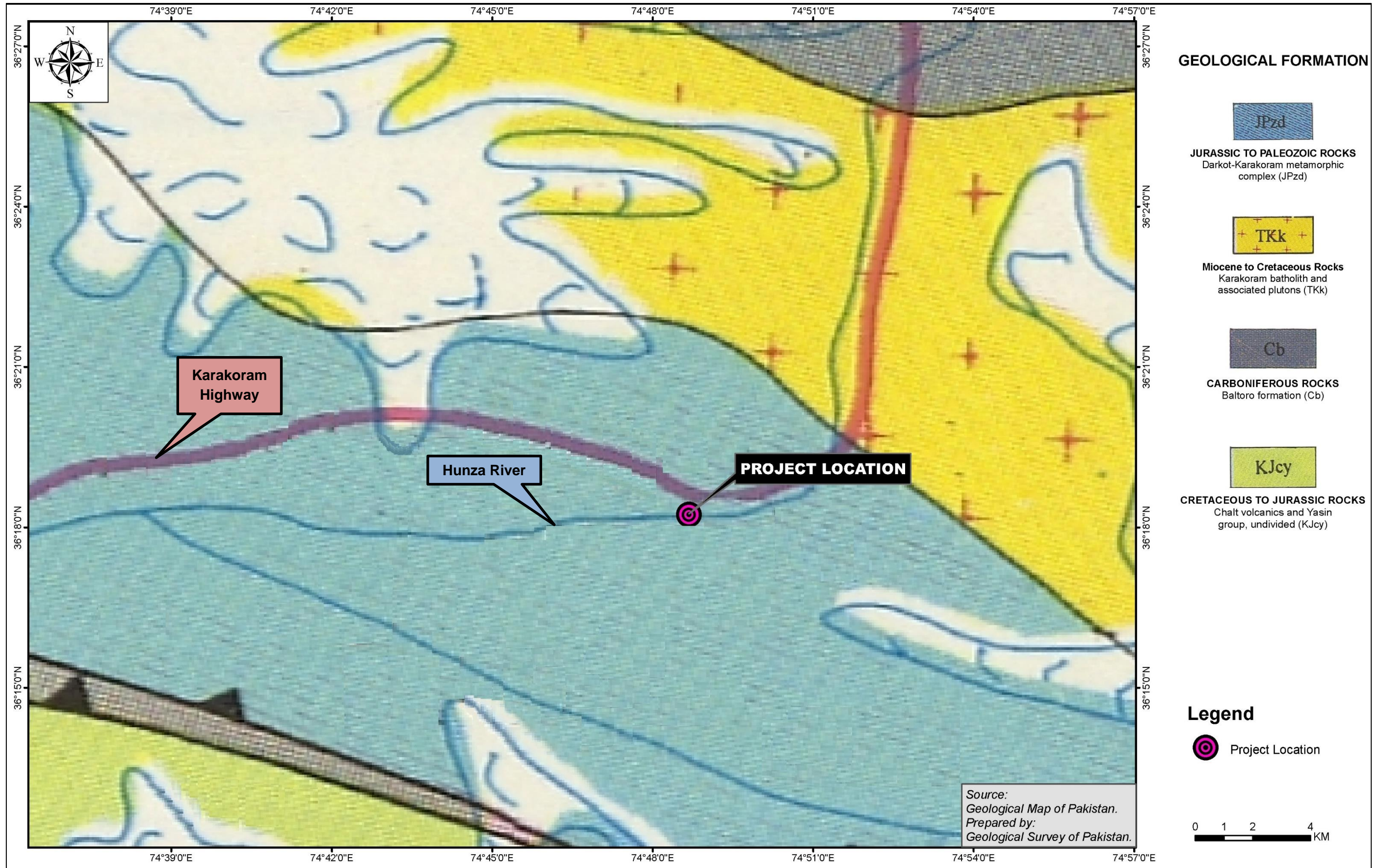


Figure 5-2: Regional Geological Map

5.2.3 Seismicity

The project area lies in the region of Northern Pakistan which has high frequency of earthquakes especially in the Himalayan orogenic belt. This belt represents the contact between Indo-Pak and Eurasian plates, which has always been the source of moderate to large earthquakes including Kangra (1905), Bihar-Nepal (1934), Assam (1897) and 2005 Kashmir earthquakes with significance consequences. The presence of some of the active faults like Main Karakorum Thrust (MKT), Main Mantle Thrust (MMT), Raikot Fault, Riwat Fault, Panjal Khairabad Fault, Jhelum Fault and Main Boundary Thrust (MBT) etc. make the GB region tectonically very active.

According to Seismic Provisions in the Pakistan Building Code 2007, the Project area falls in Seismic Zone 2B (moderate), which represents Peak ground acceleration from 0.16g to 0.24g, where g represents acceleration due to gravity. Seismic zoning map of the Project area is given in **Figure 5-3**.

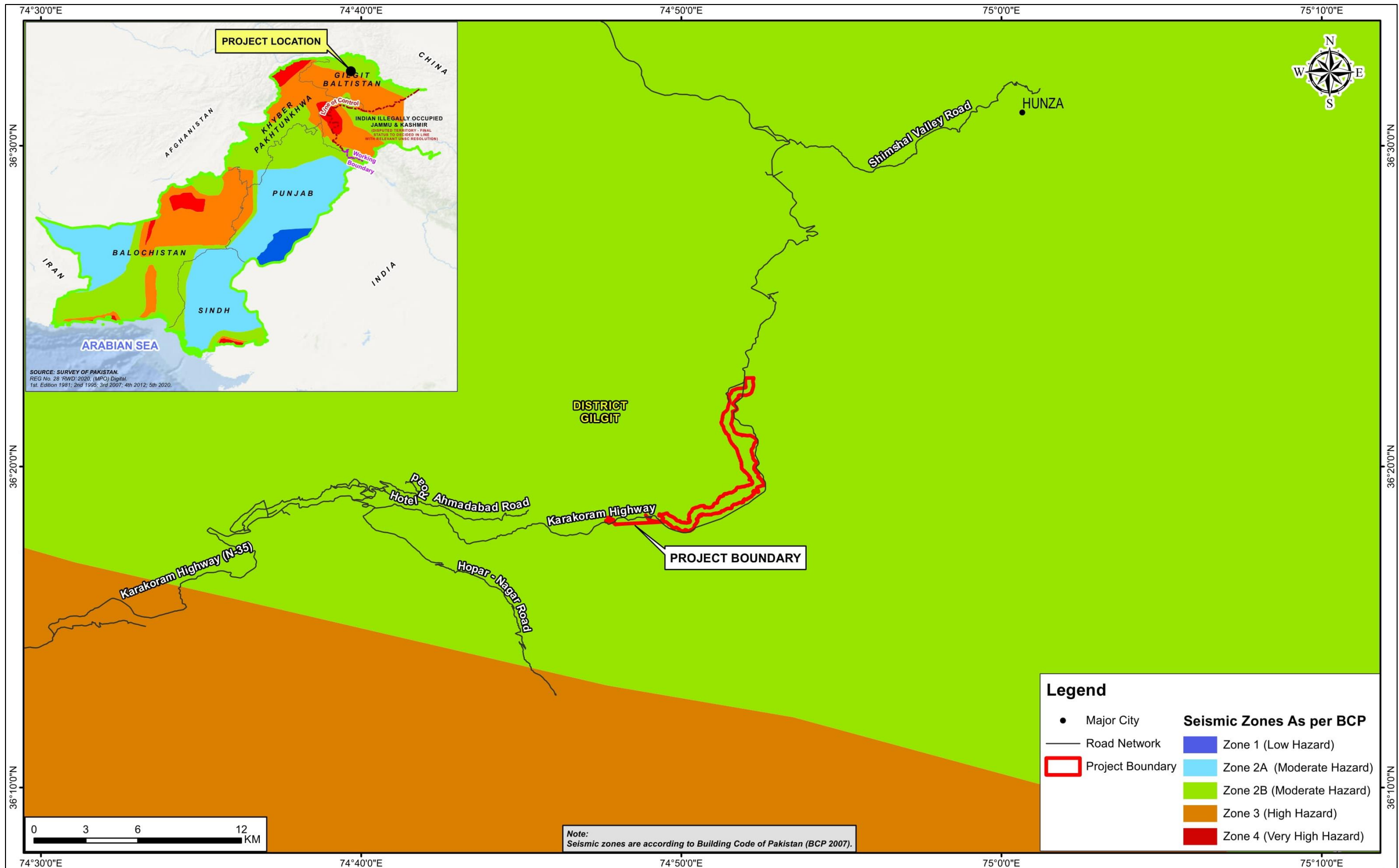


Figure 5-3: Seismic Zoning Map of the Project Area

5.2.4 Land Erosion

The glaciers of the GB and KPK have very high “activity indices”, an index for the total amount of water passing through the glacier system per annum. As a result, they have high flow rates in terms of the glacier melt, ranging between 100 and 1,000 meters/year. As a result of these high rates of flow, these glaciers aggressively erode their beds and transport the eroded materials to the headwaters of rivers, which causes the transport of sediments into the major rivers of the region. The exact proportion of sediment due to glacial erosion is still not measured; however, it could be stated that these account for the huge load of the sediments passing through the upper Indus system especially Hunza River, Shyok River and Shiger River.

Landslides are very common features in the project area because of the high steep terrain. Erosion and sediment input to the river is a function of landslides and riparian erosion processes. There are frequent talus accumulations along the side slopes of the river. These are typically in a state of stable equilibrium at their current slope angle and environment but become unstable when the equilibrium is disturbed. Excess water and earthquakes often trigger landslides.

5.2.5 Hydrogeology

Glaciers and snow are the principal water source in Gilgit-Baltistan, located in the extreme north of the country, home to some of world’s highest mountain ranges and to three (03) of the world’s largest glaciers, Biafo, Baltoro and Batura. The province, which has a population of two million, is also the place from where the country sources much of its water through its lifeline, the Indus River. The melted water from snow fields and glaciers enters streams, which feed manmade channels that take water to settlements for agriculture, livestock and domestic requirements, including drinking.

The water supply systems in GB are primarily based on the use of surface waters which include rivers, springs and streams. This means that people face moderate to acute water scarcity during the winter months when glacier melt is reduced. The use of ground water is uncommon, except for a few riverside villages, where people draw water from shallow wells. There are many sources of surface water in GB, some of the surface water sources situated near project area are mentioned as follows:

- Hunza River is the principal river of Hunza in Gilgit-Baltistan, Pakistan. It is formed by the confluence of the Shimshal River including Chapursan, and Khunjerab River which are fed by glaciers. It is joined by the Gilgit River and the Naltar River, before it flows into the Indus River. The river cuts through the Karakoram Range, flowing from north to south.
- Borith Lake lies approximately 2 km to the north of Gulmit, a saline body of water occupying a small hollow at an elevation of 2,500 meters (8,200 feet). The lake can be reached via a 2 km unpaved jeep route from Husseini village, which lies adjacent to Gulmit village. It is also accessible by a 2-3 hour trekking route directly from Gulmit, across the end of the Ghulkin glacier.

- Attabad Lake a part of the project area, is a lake located in the Gojal region of Hunza Valley in Gilgit-Baltistan, Pakistan. It was created in January 2010 as the result of a major landslide in Hunza River at Attabad. The Lake has become one of the biggest tourist attractions in Hunza, offering activities like boating, jet-skiing, fishing and other recreational activities.
- Shimshal River is located very close to the Project Area. It is formed from three main sources such as Khurdopin Glacier, Shimshal Pass and Zardgorban. The river also receives water from other sources before flowing into the Khunjab River and finally ending in Hunza River near the Project Area.
- Shiskat Nullah Gojal and Shishkat Spring Gojal are main streams present near the Project Area, which are being used for the drinking purpose by the people of Hunza. As per the study conducted by GB EPA in 2019, the water quality of both the streams is fit for drinking purposes as the water is free from heavy metals. The main surface water sources in the Study Area are shown in **Figure 4-9**.

5.2.6 Flooding

Flooding of the Hunza River at the Flexible / Rigid Overflow Structure site is not a common feature although some floods of high intensity have been recorded in the past at upstream site e.g. the Glacial Lake Outburst Floods (GLOF) at Shimshal River.

Flood at the proposed Project site has been estimated from the available record using different methods. Instantaneous peak flows for the period 1966 to 2015 have been presented in the **Figure 5-4**.⁹

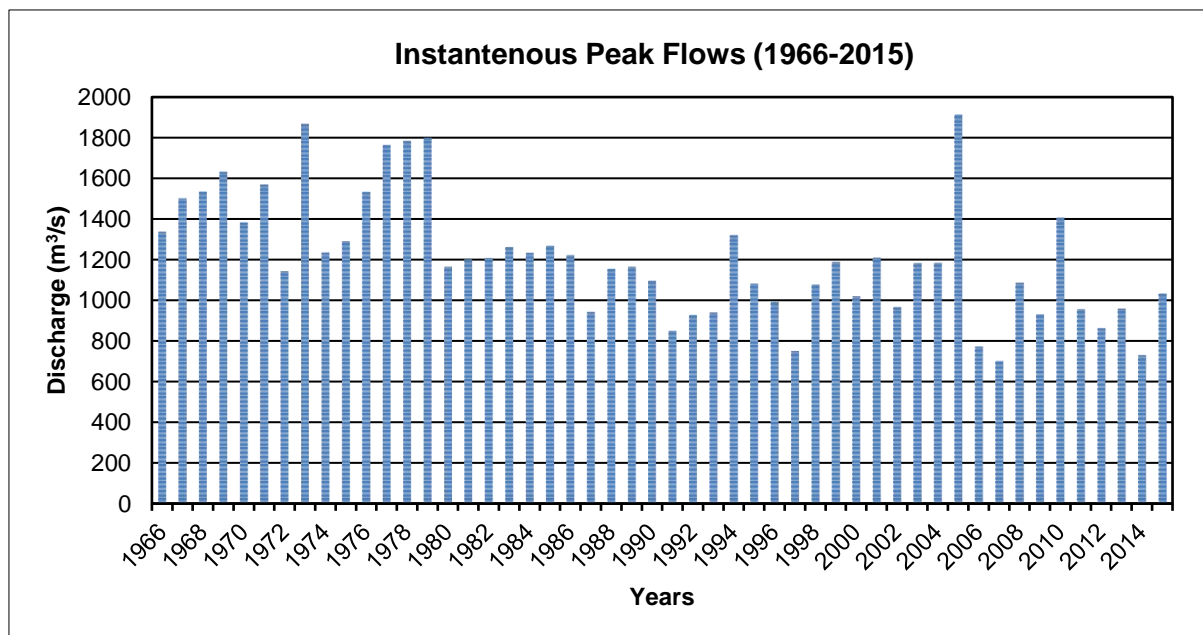


Figure 5-4: Instantaneous Peak Flows at Attabad Lake HPP Site

⁹ Source Feasibility Report, 2021

Confidence intervals of 5% and 95% have been used for the calculations of flood. As per the model, flood for 1000-year return period from computed curve has been calculated as 2,559 m³/s and from expected probability curve it is 2,695 m³/s. Flood for 10,000-year return period, it is 3,016 m³/s from computed curve and 3,292 m³/s from expected probability curve. With the confidence interval of 5% and 95%, maximum flood values are 3,682 m³/s and 2,606 m³/s. ¹⁰

The flow in Hunza River varies greatly at different times of the year, the discharge is at a minimum during the colder months when Attabad Lake is frozen, and there is a rise of water in spring and early summer season when glaciers melt.

Recently a massive GLOF occurred in Hunza district's Hassanabad village sweeping away the Hassanabad Bridge on the Karakoram Highway. The Shisper Glacier started discharging 5,000 cusecs of water owing to premature melting, leaving Hunza, Gilgit disconnected.

5.2.7 Climate

The climate of Hunza valley is characterized by mild summer and cold winters. Wide spread snow fall occurs in winter. During winter the northern winds blow constantly bringing the temperature down considerably. According to the temperature data available from 2010-2020, the hottest month is July with a mean temperature of 21.20°C and the coldest month is January with a mean temperature of -0.42°C. The mean maximum temperature is 26.34 °C in July and mean minimum temperature are -3.8 °C in January respectively. Hunza receives maximum rainfall in spring i.e. in April. **Table 5-1** to **Table 5-3** provides climatic condition in project area. Graphical representation is given in **Figure 5-5** to **Figure 5-7**.¹¹

Table 5-1: Average Minimum and Maximum Temperature in Hunza from 2010-20

Sr. No.	Month	Minimum Temperature °C	Maximum Temperature °C	Mean Temperature °C
1	January	-3.8	2.96	-0.42
2	February	-0.7	5.5	2.4
3	March	2.73	10.18	6.45
4	April	6.89	15.97	11.43
5	May	10.23	19.627	14.93
6	June	14.11	23.97	19.04
7	July	15.87	26.34	21.10
8	August	16.33	26.01	21.17
9	September	10.74	20.08	15.41
10	October	6.9	17.2	12.05
11	November	1.25	10.2	5.725
12	December	-1.99	4.4	1.205

¹⁰ Using Hydrologic Engineering Center's (HEC) Statistical Software Package (HEC-SSP) Software.

¹¹ Source: Karimabad Meteorological Station

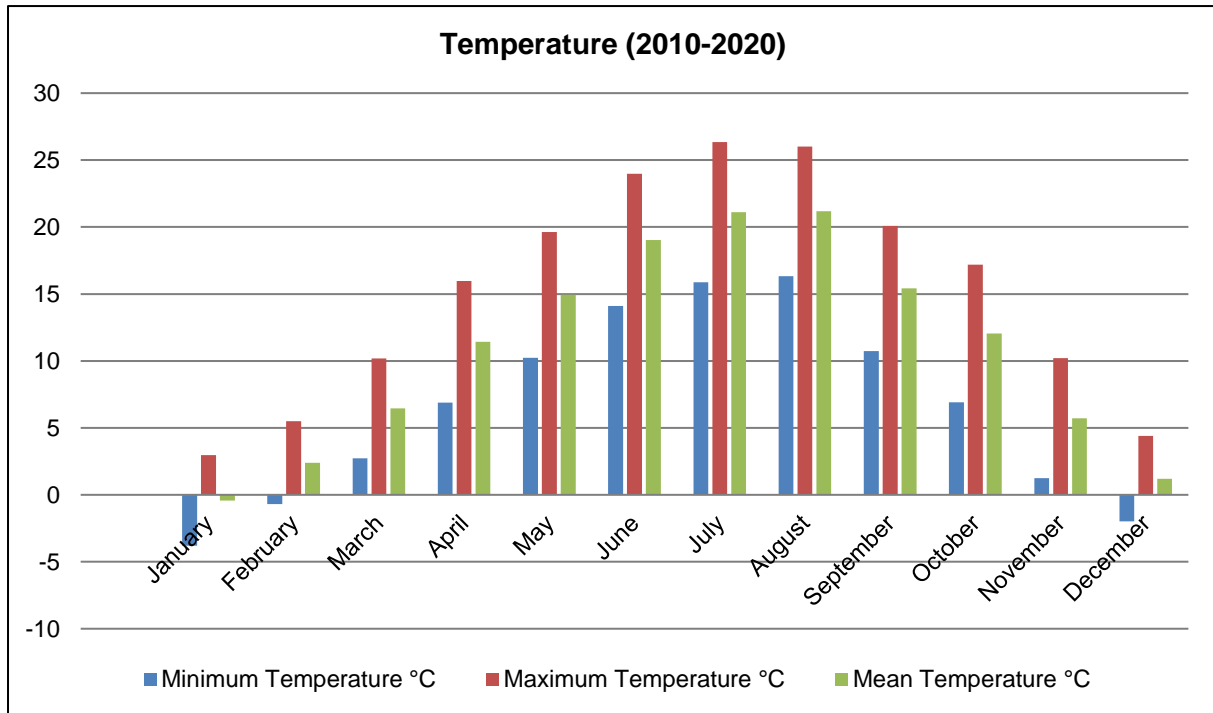


Figure 5-5: Average Minimum and Maximum Temperature in Hunza from 2010-20

Table 5-2: Mean Monthly Precipitation (mm) 2010-2020

Month	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
January	0	4.8	0	6.6	3	0	3.8	0	0	13.5	13.2	4.1
February	0	1.8	0	8.1	0	2.5	0	6.6	1.8	10.4	0	2.8
March	2.8	0	0	0	11.4	11.7	8.9	3	14	6.9	0	5.3
April	25.4	3.8	19.8	12.7	8.1	13.5	70.6	36.8	13.2	2.5	3.6	19.1
May	28.7	5.3	17.3	16.3	4.6	10.9	21.8	7.6	22.4	17	8.6	14.6
June	10.2	7.9	11.7	1.8	1.3	19.1	4.8	11.4	3	30	2.8	9.5
July	52.1	15	5.1	9.7	31.8	0	37.4	6.6	8.9	10.2	15.7	17.5
August	13.2	16	19.6	24.1	17.3	6.6	12.6	20.3	0	4.3	20.1	14.0
September	14.5	35.1	42.3	19.1	36.3	1.3	4.1	2	1	0	8.6	14.9
October	2.5	16	3	0	16	0	0	0	0	3	1	3.8
November	0	0	0	0	0	8.9	0	0	9.7	0	1	1.8
December	0	0	4.6	0	0	0	0	1.5	0	0	0.5	0.6

Source: Karimabad Meteorological Station

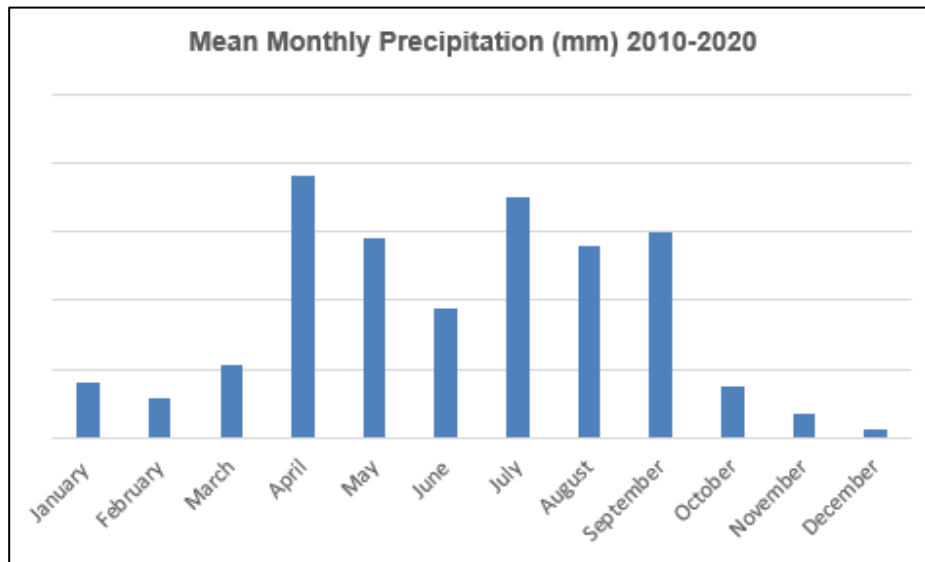


Figure 5-6: Mean Monthly Precipitation (mm) 2010-2020

Table 5-3: Mean Monthly Relative Humidity (%) 2010-2020

Month	Average Relative Humidity %
January	37.1
February	41.5
March	35.75
April	34.65
May	39.5
June	42.25
July	43.75
August	48
September	50.35
October	42.5
November	41.6
December	45.5

Source: Karimabad Meteorological Station

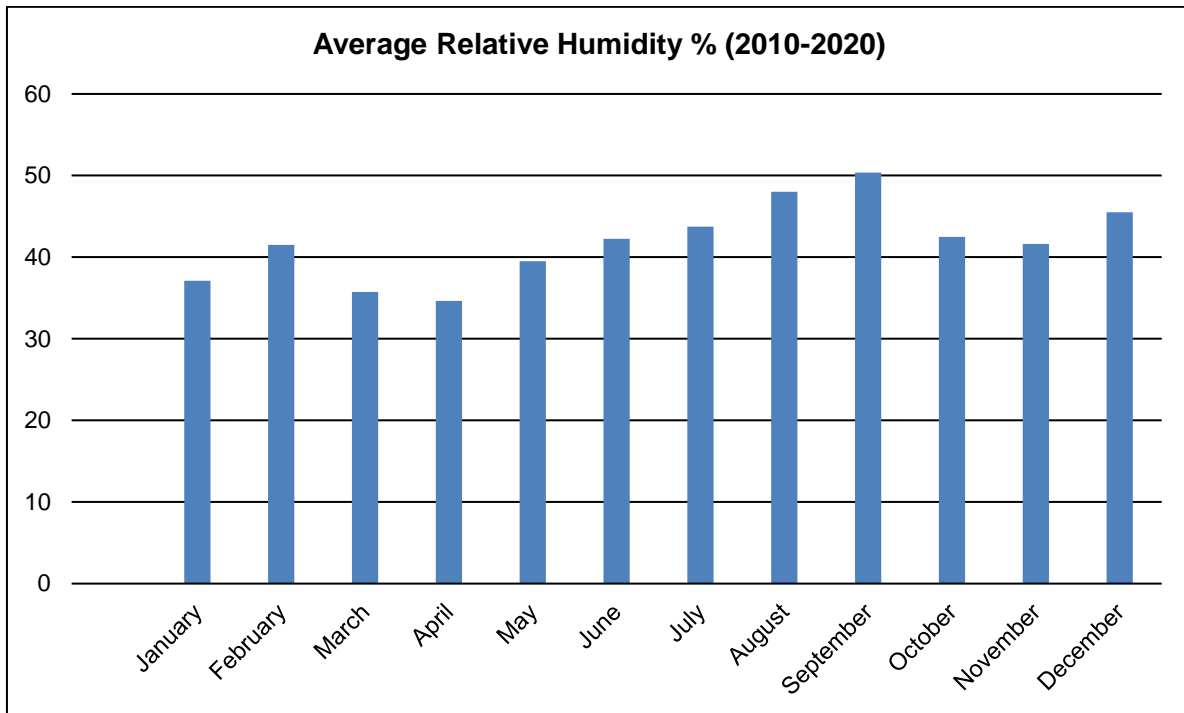


Figure 5-7: Average Relative Humidity

5.2.8 Solid Waste and Sewerage System

In the Study Area, no proper solid waste management system exists. Most of the solid waste is found to be stored in the form of small heaps at various locations near the villages and people use their solid waste in the vegetable field as fertilizer. Animal waste especially cow dung is used for farm manure or used for burning after drying (though rarely). Few waste bins have been observed along the Karakoram Highway and at popular tourist locations in Hunza to encourage waste management. The major constituents of solid waste in the area are paper, plastic, and organic waste (food waste, garden waste, animal waste). GB Waste Management Company (GBWMC) and Karakoram Area Development Organization (KADO) are the waste management companies in the Hunza district which focuses on waste management and recycling system by encouraging waste management practices.

The study area lacks proper sewerage system, only some open drains constructed in the vicinity for the discharge of wastewater. More than 50 percent of the houses have improvised pour flush pit latrines. The remaining 50 percent of the household use locally made toilets, dry pits or defecate in the fields. Wastewater (sludge) from kitchen, bathing and washing is discharged into small drains/ water courses leading to the nala or directly to small fields outside the houses.

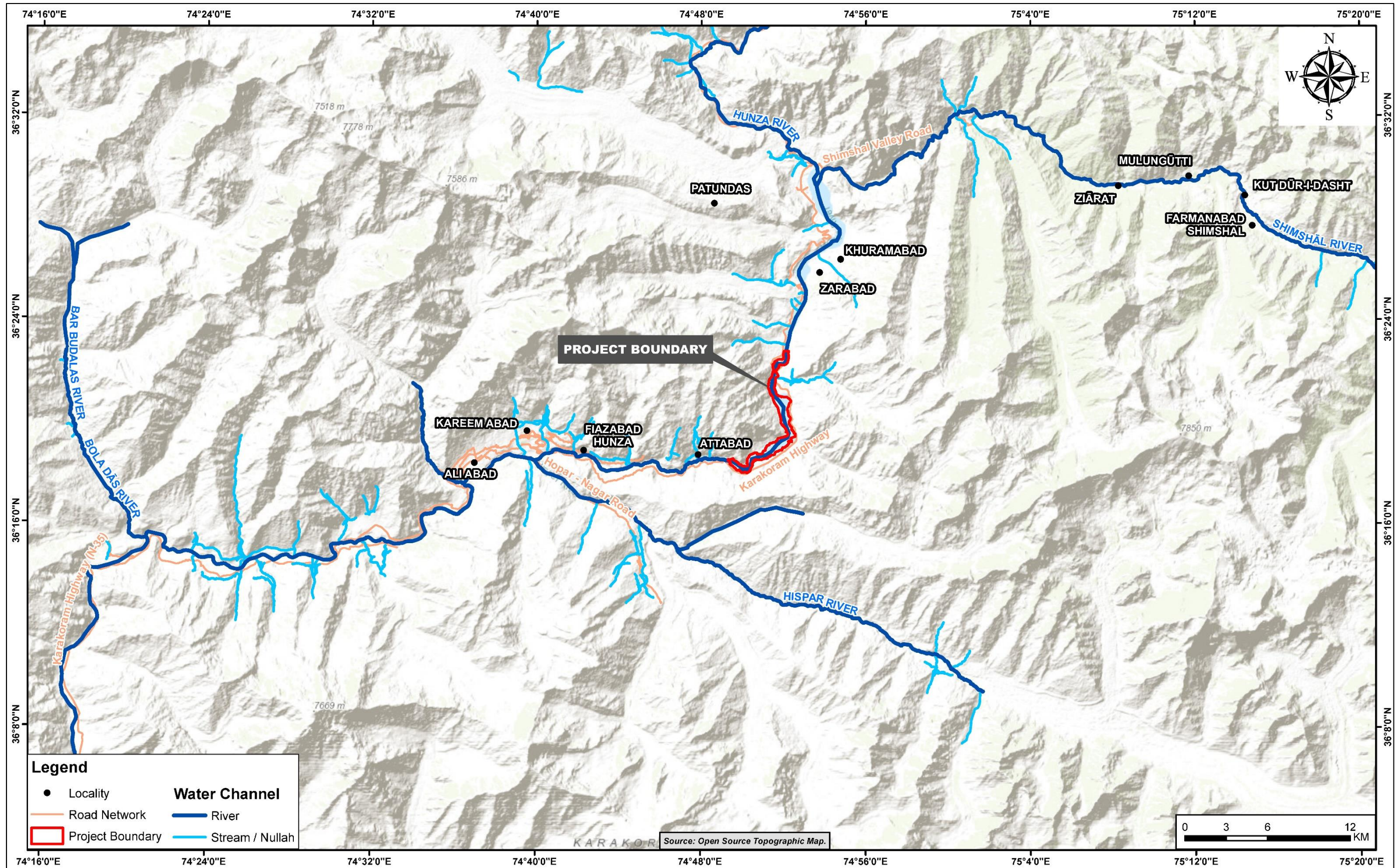


Figure 5-8: Hydrological Map

5.2.9 Land Use

The Project Area including reservoir comprises mostly of the barren/open area and cultivated area. However, graveyard and some built-up areas are also present in the Project Area. The land use of the proposed project boundary and reservoir are provided in the **Tables 5-4**. The land use of the Project Area is shown in the **Figure 5-9**.

Table 5-4: Summary of Land Use within Study Area of Project

Sr. No.	Land use Type	Project Components		Reservoir
		Area (Acres)	Percentage	Area (Acres)
1	Agricultural Land	---	---	14.276
2	Built-up	0.446	2.35%	8.460
3	Culvert	---	---	0.008
4	Distributary Channel	---	---	0.640
5	Drain	---	---	0.162
6	Graveyard	---	---	0.334
7	Landside Debris	---	---	0.188
8	Open/Barren	11.593	61.14%	124.320
9	Parapet Wall	---	---	0.095
10	Road	0.024	0.13%	5.320
11	Track	0.345	1.82%	1.258
12	River	0.265	1.40%	---
13	Slope	6.176	32.57%	---
14	Water Pond	0.114	0.60%	---
Total		18.96	100%	---

5.2.10 Environmental Sensitive Receptors

Sensitive receptors are mainly people or other organisms that may have a significantly increased sensitivity and exposure to the pollutants and social disturbance, due to the developmental projects. Thus, sensitive receptors are necessary to be identified, to evaluate the potential impacts of the proposed project on public health and the environment. The project area is situated in base of the mountain which is a barren land. There are no sensitive environmental receptors present in the Area of Influence of the project. However, the lake itself is a sensitive receptor. One graveyard is also present in the Reservoir Area.

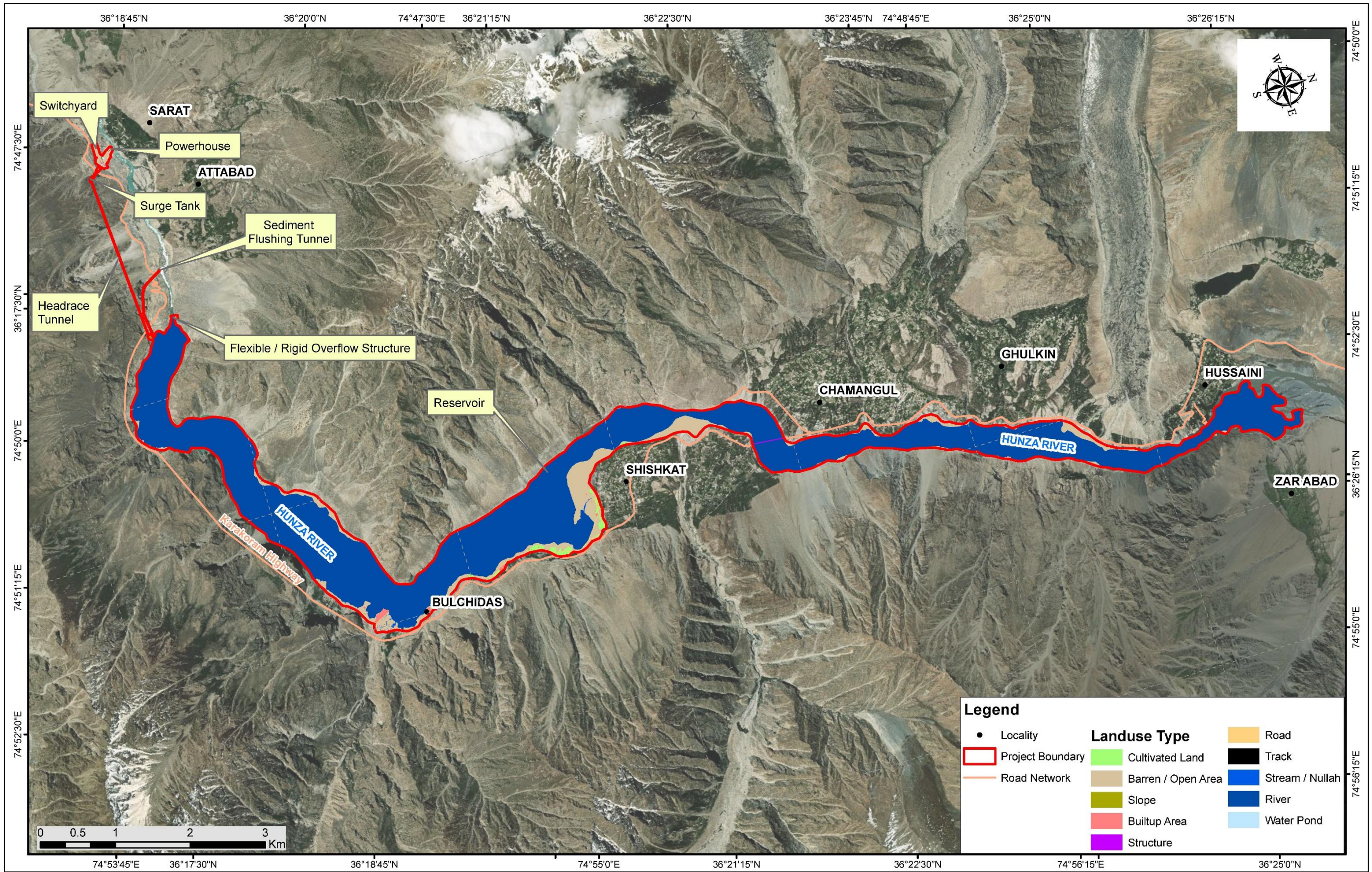


Figure 5-9: Land use Map of the Study Area

5.2.11 Environmental Parameters for Monitoring

The environmental monitoring of parameters like ambient air quality, noise level, surface water and groundwater help us to analyze the prevailing environment conditions in and around the study area, and to protect it from any adverse activities due to the proposed Project implementation.

The environmental parameters for ambient air, noise level, surface water and groundwater monitored during preparation of EIA of ALHPP in 2021 has been taken for the current EIA.

5.2.12 Air Quality and Noise Level

The ambient air quality monitoring for Carbon Monoxide (CO), Sulfur Dioxide (SO₂), Nitrogen Oxides (NO_x) and Suspended Particulate Matter (SPM) was carried at near the proposed Project Site. Noise level was also measured near the project area. Based on the environmental monitoring, the following range of concentration of gaseous pollutants is estimated on the roadside at Gulmit (**Table 5-5**):¹²

Table 5-5: Range of Gaseous Pollutant Concentration & Noise Emission Level

Range of Variation	CO (ppm)	SO ₂ (ppb)	NO _x (ppb)	SPM (g/m ³)	Noise dB(A)
Minimum	0.65	05	05	45	40
Maximum	0.9	10	12	90	70
Average	0.7	07	07	70	55

- g/m³: grams per cubic meter

The noise level near the river is fairly high and range between 50 to 65 dB without traffic, mainly due to the flowing water colliding against rocks and boulders.

5.2.13 Surface/Wastewater Quality

In the project area, the Hunza River carries water of various streams (nallahs) of snowmelt, and rainwater fall. The people use the water of these nallahs for drinking, household and agriculture purposes. Generally, there is no shortage of clean potable water in the project area as it is very difficult to fetch the water of river and nallahs due to the very steep slopes. People mostly use water from nallahs for drinking, washing and other domestic purposes. As these waters flow over land they pick up sediments, salts, toxic elements, pulverized organic matter and bacteria from the surface. Water samples were taken covering the complete affected area within the project area. The laboratory results of these samples summarized in **Table 5-6 and 5-7** reveal that all the parameters are within the permissible limits when compared with drinking water quality standards of WHO, except the presence of Escherichia coli pathogenic bacteria which causes gastroenteritis in human beings.¹³

¹² Feasibility Study Report of Attabad Lake Hydropower Project-Volume-VI

¹³ Feasibility Study Report of Attabad Lake Hydropower Project-Volume-VI

Table 5-6: Chemical Parameters Results of the Samples (Surface Water)

National Standards for Drinking Water Quality of Pakistan (mg/l)									
Nitrate	Nitrite	Cu	Al	Fe	Mn	Cr6	Zn	Ni	B
≤50	≤3	2.0	≤0.2	---	≤0.5	≤0.05	5.0	≤0.02	0.3

Sr.	Location from Sample Collected	Test Results (mg/l)									
		Nitrate	Nitrite	Cu	Al	Fe	Mn	Cr6	Zn	Ni	B
1	Hunza River Side before Confluence of Shamshal Nullah	ND	ND	0.4	ND	ND	ND	0.03	ND	0.01	ND
2	Shamshal Nullah before entering Hunza River	ND	ND	0.07	ND	0.04	ND	0.02	ND	0.02	ND
3	Hunza River Side Near Power House	ND	ND	0.2	ND	0.3	ND	ND	ND	0.01	ND
4	Attabad Lake Boating Area	1.3	ND	ND	ND	ND	ND	0.03	ND	0.02	ND
5	Gulmit Tap Water	ND	ND	0.02	ND	ND	ND	ND	ND	0.01	ND
6	Gulmit Glacier Near Hunza River	ND	ND	ND	ND	ND	ND	0.14	ND	0.2	ND
Conclusion		The concentrations of nitrate, copper, iron, Chromium 6 and nickel are within National Standards for Drinking Water Quality of Pakistan for first four areas.									

Table 5-7: Bacteriological and Physical Parameters Results of the Samples (Surface Water)

Bacteriological Parameter	National Standards for Drinking Water Quality of Pakistan (Physical Parameters)						
	E.coli	pH	Turbidity	Total Dissolved Solids	Electrical Conductivity	Color	Odor
0/100 ml	6.5-8.5	<5 NTU	<1000 ppm	2000 μ s	Unobjectionable	Unobjectionable	Unobjectionable

Sr. No	Location from Sample Collected	Test Results								
		Bacteriological	Physical Parameters							
		E.coli	pH	Turbidity	Total Dissolved	Electrical Conductivity	Temp.	Color	Odor	Taste
1	Hunza River Side before Confluence of Shamshal	0 col/100ml	8.4	<5 NTU	67.8 ppm	130.4 μ s	7°C	Clear	Odorless	Tasteless
2	Shamshal Nullah by entering Hunza	0 col/100ml	8.4	15 NTU	98.1 ppm	186.8 μ s	7°C	Clear	Odorless	Tasteless
3	Hunza River Side Near Power House	0 col/100ml	8.0	<5 NTU	62.7 ppm	125.4 μ s	7°C	Clear	Odorless	Tasteless
4	Attabad Lake Boating Area	0 col/100ml	8.5	<5 NTU	65.4 ppm	129.7 μ s	7°C	Clear	Odorless	Tasteless
5	Gulmit Tap Water	0 col/100ml	7.4	<5 NTU	23.5 ppm	47.2 μ s	7°C	Clear	Odorless	Tasteless
6	Gulmit Glacier Near Hunza River	0 col/100ml	8.0	<5 NTU	29.7 ppm	59.4 μ s	7°C	Clear	Odorless	Tasteless
Conclusion		Results show that the turbidity in Shamshal Nullah by entering Hunza water sample exceed the National Standards for Drinking Water Quality of Pakistan.								

The laboratory results of these samples reveal that all the parameters are within the permissible limits when compared with drinking water quality standards of WHO, except the presence of *Escherichia coli* pathogenic bacteria which causes gastroenteritis in human beings.

5.2.14 Mining

Mining is one of the common professions in small parts in Hunza. Locals have developed mining at their own level with their own resources. People use to explore the Mines by their own resources without any support of Government. However, in project area, no mining activity was observed.

5.2.15 Natural Disaster

The project area and its surrounding valleys are highly susceptible to natural disasters such as landslides, flash floods and avalanches, which affect civic life of areas within project vicinity. Attabad Lake, itself is an example of a massive landslide in 2010 and dammed the Hunza River. Attabad village was completely devastated and six small villages and 25km of KKH was completely submerged in Attabad Lake. GLOF events are becoming common in the project area as the areas is surrounded by some very large glaciers which can

5.2.16 Tourism

Attabad Lake has now become a spot of tourist attraction. A large number of tourist visits the area every year. The local communities get employment as tourist guides and transporters.

5.3 ECOLOGICAL ENVIRONMENT

5.3.1 Methodology

The available literature was thoroughly reviewed to have a better understanding of the project area and its surroundings including habitat, flora and fauna. The route alignment was thoroughly examined based on the primary and secondary data (Flora of Pakistan - MI Sheikh, Birds of Pakistan - ZB Mirza, Mammals of Pakistan - TJ Roberts, previous EIAs of the proposed area, Manual of silviculture for Pakistan [1965] Champion, Sir HG, Pakistan Forest Institute, Peshawar, Seth, SK Khattak, GM). The data from primary and secondary sources was collected and adopted as such giving reference to the source. The stakeholder Forest, Wildlife, Agriculture, Fisheries and EPA departments were also consulted and relevant data was acquired from them. This survey broadly covers ecosystem sensitivities (if any), vegetation, other flora and fauna. Only the trees and vegetation in the vicinity of Powerhouse, around the Lake and Communities were also consulted during the process of EIA and their view point and suggestions were incorporated in the Plan. The Project area comprises of Hydropower Station and Transmission Lines from Attabad to Sost and Attabad to Karimabad which linearly stretch over major part of the District. However, the impacts of Transmission Line component of the project were not tangibly quantify at this stage. The Biological component of the Project area represents almost entire district in terms of flora, fauna, aquatic life and agriculture sectors. The specific information related to aquatic life in the Attabad Lake was collected along with the information of other parts of the Project area.

5.3.2 Introduction and General Information Related to Biological Components of Project Area

Biological Environment study includes the study of all those factors such as wild animals, plants, aquatic life or bacteria that affect human life as in a particular place or period. Biodiversity is the core component of Biological Environment. Habitat loss is considered as the leading cause of loss of world's biodiversity. Most species need undisturbed habitat to find food, water, shelter, and mates. But people are altering habitats all over the world. In such areas, the activities causing habitat loss include commercial logging (not based on technical and sustainable basis), land development, over-grazing, fuel wood collection, construction of roads, and building new settlements. All these actions change landscapes, natural water flows, and the species composition in the area. Moreover, changes in climate and land use patterns is also reducing the amount of snowfall and rain upon which the habitat depends.

As far as the Biological Environment of the project area is concerned, the high altitudes, rugged mountains and sweeping glaciers make much of the region of Gilgit-Baltistan uninhabitable. Only two percent (2%) of the Northern Areas (NAs) estimated to be suitable for agriculture through irrigation by diverting stream water. However, so far only one percent (1%) of the total area is being cropped. Approximately nine percent (9%) of the area is covered by natural forests and open scrub, twenty-two percent (22%) area constitutes alpine pasture, and remaining sixty-eight percent (68%) is mostly bare rock, under permanent snow and glaciers.

5.3.3 Flora

A study was carried out on the Biodiversity of Hunza District including Khunjerab National Park (KNP) to establish baseline information about existing plant wealth and wildlife including flora, reptiles, birds and mammals in order to make some vantage points for future monitoring of key wildlife species. Using different direct and indirect investigation techniques, 14) different valleys and Nullahs of Hunza and KNP were surveyed and observations on various habitats were recorded.

The wide variety of climatic conditions in the region, coupled with the extreme variations in altitude and aspect, has created a wide array of vegetation and ecological zones. Five distinct zones can be identified including Dry Alpine Scrub, Moist Alpine Pastures, Dry Alpine Plateau Pastures and Sub Alpine Scrub and Birch Forests. So far, 62 plant species belonging to 45 genera and 25 families were identified. Of them, 4 grasses and one species of Liliaceae were determined. This represent the Project area and finding of the study were verified during field visit of the Project area. The detail of ecological zones is as follow:

a. The Dry Alpine Zones and Permanent Snowfields

This ecological zone is characterized by vast glaciers, boulder fields and sheer cliffs. This zone predominates at high altitudes, around the major peaks of the Karakoram Mountains. It covers most of upper Hunza and the northern parts of Baltistan.

b. Alpine Meadows and Alpine Scrub

This zone covers the areas between the high valleys and the permanent snowfields, between

3,500 and 3,800 meters. It is characterized by lush, green and well-watered alpine meadows, located on valley bottoms or high plateau surrounding the main watercourses. Alpine meadows occur in almost all the higher regions of Gilgit, Baltistan, Ghizar and Diamir and Hunza particularly where mountains extend above the tree line. The meadows support a wide variety of wildflowers, grasses, sedges and other plants.

c. Sub-Alpine Scrub

The sub-alpine scrub zone occurs throughout the higher mountains of the Himalaya, Hindu Kush and Karakoram, and is found in Gilgit, Skardu, Ghizar, Astore and Hunza. However, it is often confined to small ravines on the upper slopes. The vegetation consists of small deciduous species such as *Betula Utilis*, and evergreens such as *Juniperus Communis* and *Rhododendron Hyphenanthemum*.

d. Dry Temperate Coniferous Forest

These forests are usually found on the inner or northerly slopes of the Himalaya, between 1,500 and 3,400 meters. They occur in parts of Gilgit, Diamir and Baltistan Districts, and are characterized by single species stands of conifers. Typical tree species include *Picea Smithiana*, *Cedrus Deodara* and *Pinus Wallichiana*, with an understory of *Quercus Ilex* and *Junglus Regia* and scattered shrubs of *Artemisia Maritima* and other species.

e. Dry Temperate Evergreen Oak Scrub

This is an intermediate zone, lying between 1,500 and 2,500 meters. The vegetation is dominated by dry oak forest (*Quercus Ilex*). Occasionally individual stands of evergreen species are also found, including *Pinus Gerardiana*, *Pinus Wallichiana*, *Cedrus Deodara* and *Juniperus Spp.*

f. Medicinal Plants

A large number of medicinal plants grow in the natural forests of Gilgit-Baltistan, especially Astore Valley and Hunza Valley. The following is a list of important medicinal plants found in the project area (**Table 5-8**).

Table 5-8: Important medicinal plants report in GB Forests

Sr. No.	Botanical Name	Local Name	Sr. No.	Botanical Name	Local Name
1	<i>Aconitum Chasmanthum</i>	Mohri	12	<i>Onasin Echioides</i>	Laljari
2	<i>Aconitum Hetrophyllum</i>	Partis	13	<i>Orchus-Latifolia</i>	Salib Misri
3	<i>Aconitum Lavae</i>		14	<i>Picrohiza-Kurrva</i>	Karoo
4	<i>Angelioa Glauca</i>	Chora	15	<i>Podophyllum Emodi</i>	Ban Kakri
5	<i>Arterrisia Bravifolia</i>	Rund	16	<i>Rheun Emodi</i>	Rhewand Chini
6	<i>Carum Spp.</i>	Kala Zeera	17	<i>Sausuria-Lappa</i>	Kuth

Sr. No.	Botanical Name	Local Name	Sr. No.	Botanical Name	Local Name
7	Ephedra Spp.	Oman (Asmani Booti)	18	Saxifraga Ciliate	Zakhmay Hayat
8	Ferula Feotida	Heeng	19	Shymus Serpillum	Bannanajwainu
9	Ferula Narthex	Heeng	20	Swertia Chiretha	Chiretta
10	Lavatria Kashmirianian	Resha Khatimi	21	Valeriana Wallichii	Mushak Bala
11	Macrotomia- Benthami	Gao Zaban	22	Viola Serpans	Banafsha

g. Forestry

Forests in GB cover an area of 281,600 hectares. Majority of these are found in the districts of Diamer, Baltistan, Gilgit and Ghizar. However, the Hunza District including the project area has 0.75% of the area under forest. The forests provide timber, firewood, torchwood, grazing land and medicinal plants e.g. Kuth (Sassuria, Lappa), Black Cumin, and other Non-Timber Forest Products (NTFP) including Pine Nuts (Chilgoza), Mushrooms, Honey, Berries of Sea Buckthorn, and animal products. The forests are important watersheds for the downstream population. Many species of wild animals and plants depend on these forests for survival. Fuel wood is the main resource harvested from the forests, followed by timber. The young branches of trees provide an important fodder source from March to May, when other fodder sources are scarce. Fuel wood is collected from low and high pastures, private land, fruit trees, and purchased from local markets. Generally, fuel wood is collected in spring and autumn and is stored for use during winters. Wood is also harvested to make agricultural and household tools and utensils while some types of bark, leaves, and berries are widely used for medicinal purposes.

Forestry is important for fuel, timber, in addition to control of the soil erosion and reduction in silt load in lakes and rivers. In the Gilgit-Baltistan only Diamer district is rich in forest while the other five districts including Hunza have nominal forest of Juniper. The forests consist of blue pine, spruce; willows and shrub consist of Rosa species.

A new program of planting trees over private land by AKRSP and 10 Billion Trees Tsunami Project (TBTP) in the valley is operational. The forest areas including uncultivated wasteland are State Forests owned by the government. Wood is used for timber, fire and fuel wood throughout the year. Firewood is used during winter season. Based on data used by AKRSP each house on average use 100 mounds of fire and fuel wood during a year. On the other hand, fire and fuel wood collected from common property is 63 mounds per annum. Forest trees are rich source of fodder. It was noted that 12 mounds of fodder are also collected by each household from the forest. The natural forest although has been extensively exploited. In the Hunza valley more forest plants are planted to reduce the pressure on existing forest. For this purpose, an average 130 trees of Poplar by each household and 90 plants of willow per household are planted under this Program.

In Ten Billion Trees Tsunami Project, 4.4 Million trees were planted in 2019-20 year through

Gilgit forest circle, Diamer Astore Forest Circle, Baltistan Forest Circle, Wildlife Divisions, AKRSP and through Agriculture Department in Gilgit Baltistan. The detail of planting in the year 2021 is given in **Table 5-9** as under.

Part of activities already has been undertaken in the Project Area.

Table 5-9: Plantation Plan in Hunza District for the year 2021¹⁴

Sr. No.	Activities	Sites	Area/km	Plants to be planted
1	Avenue Plantation	Nasirabad to Aliabad	45 km	30,000
2	Slope Plantation	Attabad Lake	700 Kanal	25,000 (First Phase)
3	Block Plantation	Hussaini	1680 Kanal	50,000 (First Phase)
4	Block Plantation	Gulkin Shahabad	948 Kanal	25,000 (First Phase)
5	Block Plantation	Khuramabad	1500 Kanal	50,000 (First Phase)
6	Free Distribution of Plants	Across Hunza District	-	150,000
7	Urban Plantation	District Head Quarter	-	15,000
Total			-	345,000

With action plan of TBTP, it will improve the production and procurement of forest and fruit plants, rehabilitation program of natural forest and awareness campaign for forestry will help in plantation of trees in the region.

5.3.4 Agriculture

The Hunza district spread over an area of 10,109 sq.km (1,010,900 ha) which is 14% of the total area of Gilgit-Baltistan. Hunza District is bounded on the south by the Nagar District and Shigar District and on the west by the Ghizar District. The district headquarter is the town of Karimabad. Administratively, Hunza district is composed of two tehsils namely Aliabad and Gojal. The number of villages are 46, the population in 2017 was 50,000, dwelling in about 6,494 households with average household size of 7.7 persons. With a growth rate of 2.74, the estimated population of the district is 57,236 persons in 2022. Overall literacy rate is 71% - male 80% and female 65%. According to Agriculture Department Gilgit-Baltistan, total agricultural land of the district is 6,453 ha out of which 2,114 ha is cultivated while 4,339 ha is cultivable waste. The land use statistics of district Hunza is given in **Table 5-10**.

Table 5-10: Land Use Statistics of District Hunza

Sr. No.	Type of Land	Area (Ha)	Percentage
1.	Agricultural Land	6,453	1%
2.	Forest Land	5,003	0.75%
3.	Range Land & Pastures	194,498	19%
4.	Rivers/Lakes	32,480	3%
5.	Settlements	46,016	5%
6.	Snow/Glaciers	313,896	31%
7.	Rocks/Barren Land	412,555	41%
Total		1,010,901	100%

¹⁴ Source: Forestry & Wildlife Department GB) Plantation site Khuramand & Zarabad, Hunza

a. Current Features of Agriculture in District Hunza

The crops grown and cropping pattern in Hunza is influenced by the elevation which ranges from about 8,000ft to above 10,000ft. From 8,000ft to 8,500ft, transitional double cropping system is practiced while above 8,500ft single cropping pattern is followed in the district. The major cereal crops of the districts are wheat, barley, maize and buckwheat. The vegetables grown are potato, tomato, peas, cabbage, cucumber, carrot, radish and beans. The fruits of the districts are apricot, apple, cherry, grapes, pear, peaches, pomegranate, mulberry, walnut and almond. Fodder is also produced in sufficient quantity. It is important to note that farmers grow mix of crops for subsistence. Therefore, the land is used for growing multiple crops in the same season. A typical cropping pattern followed in district Hunza is given in the **Table 5-11** below.

Table 5-11: Cropping Pattern of Hunza District

Elevation	Cropping Pattern
2,438 m (8,000ft) to below 2,591 m (8,500ft) Cropping Season Feb - Oct Transitional Double Cropping	Wheat followed by maize or peas, and vegetables and fodder. - OR Potato followed by peas, and vegetables and fodder. - OR Wheat followed by buck wheat, and vegetables and fodder. Fruits are grown.
2,591 m (8,500ft) to below 2,743 m (9,000ft) Cropping Season Mar - Oct Single Cropping	Potato, and vegetables and fodder. - OR Wheat, and vegetables and fodder. - OR Barley followed by buckwheat, and vegetables and fodder. - OR Maize, and vegetables and fodder. Fruits are grown.
Above 2,743 m (9,000ft) Cropping Season Late Apr - Sept Single Cropping	Potato, and vegetables and fodder. - OR Wheat, and vegetables and fodder. - OR Barley, and vegetables. Fruit in limited quantities in relatively lower altitudes and no fruits on higher altitudes.

b. Future agricultural potential in Hunza

The following potential has been identified after analysis of the consultations with Agriculture Department and farming community as well as assessing the market potential pertaining to various agro-ecological zones of the district including the Project area (refer **Table 5-12**).

Table 5-12: Potential of crops in various agro-ecological zones of Hunza

Type	Potential crops	Remarks
Potential in Warm & Cold Temperate zone		
Cereals	Wheat (winter sowing), Maize. Quinoa and buckwheat may be high potential.	Among cereals, wheat in winter and maize as a second cereal crop are priority. Quinoa has been proposed as a high potential super food crop in Nagar during summer at the peripheries. Buckwheat may also be a future potential. It used

Type	Potential crops	Remarks
		to be cultivated earlier and this trend may be regenerated.
Vegetables	Potato, Capsicum, Peas	Potato and Capsicum are in high demand from the market from this zone. This zone in Hunza also specializes in Peas, sown in February / March and harvested in May /June which is early harvest having advantage in the market. Tomato vertical cultivation is cultivated in May and fruits in July over a long stretch. Cucumber and bottle gourd are also suitable to be cultivated in vertical formation.

c. Fruit Culture in GB and Hunza District including Project area

The main strength of the economy of Gilgit-Baltistan (GB) depends largely on dry fruits and agriculture. This area is famous for its almond, apricot, cherry and other dry fruits production in the world, but the most popular fruit is almond; a huge variety of almond is found in all districts of GB. Each type has its own specific characteristics. Gilgit-Baltistan produces about 120,650 tons of almonds per year¹. Farmers of GB could earn billions of rupees through almonds export. The fresh and dried almonds in Gilgit-Baltistan are famous for its rich taste and organic nature. Pollution free environment and abundant water resources make it ideally suitable for natural growth of fruits and vegetables.

Gilgit-Baltistan faces problems with advantages in respect of fruit sector like long and difficult road journey, lack of storage facilities, non-availability of export quality packing material, quality control for grading and facilities for disinfection decrease the worth of fruits and cannot be dispatched to various markets of the country. Gilgit-Baltistan could be a business hub between Pakistan and China in the wake of China Pakistan Economic Corridor (CPEC) and Hunza District can be used as a gateway between both the countries. In this scenario people of GB could get huge benefits by exporting its finest quality of almonds and other dry fruits to china. The irony is the lack of infrastructural facilities and efficient road network to reach timely to market network.

People of GB have more opportunities in the agriculture sector and organic farming. Climate and abundant water resources make it ideally suitable for marvelous growth of this sector in Gilgit Baltistan, where immense potential is yet to be exploited. The nearest large city from GB is Rawalpindi/Islamabad. Under these conditions one of the options available is to process the fruits at location to increase its shelf life and to add to its value, so that it may be transported economically.

d. Fruit Crops

Gilgit-Baltistan including district Hunza (Project area) has a very favorable climate for producing diverse fruits, particularly apricots. For centuries, the farmers of the region have been practicing horticulture as part of their livelihoods management strategy. Horticulture contributes about 83 percent of the entire income generated from agriculture. Similarly, within the horticulture, fruits contribute 60 percent. There are about 5.749 million fruit trees (3.653 million fruit bearing and 2.096 million non-fruit bearing).production volume of 169,373 tons

produced over an area of 25,012 hectares. Major fruits produced in the area include apricot, apple, grapes, pears, peaches, pomegranate, cherry, mulberry, walnut and almond.

e. Livestock Rearing¹

Livestock in GB (including Hunza) plays a central role in the rural economy as rural farmers use livestock for both dairy and meat production. They also use the manure, skins, and hides for income generation. Livestock contributes 35-40 percent to the overall agriculture income¹⁵. The production potential of livestock is too low to meet the demand of meat and dairy products. This gap is filled from importing meat from other parts of the country. As a part of subsistence farming, every household rears some kind of livestock.

Many different breeds of sheep, goats and cattle are found in Gilgit-Baltistan. Sheep breeds include the Baltistani, Gojali and Kohai Ghizar varieties. Goat breeds include Baltistani, Pamiri, Gojali, Kohai-Ghizar, Jarakheil, Gaddi and Kaghani. Farmers also keep cattle, yaks and various cross breeds of the two known as zo/zomo. Yaks are typically kept in the high regions such as Gojal, Baltistan and parts of Ghizar and Hunza Districts. Preferred animals are yaks (*Bos grunniens*), Zo (cross infertile breeds of yaks and domestic cow), and Zomo (female fertile breed). Zo are used as source of meat or sold to meet domestic requirements. In addition, each household maintains local breeds of cows for subsistence milk production.

These are highly valued animals and very important to the local economy as they provide milk, wool, draught power and manure. Yaks are physically well-adapted to high altitudes. Their heavy wool and other thermo regulatory mechanisms enable them to tolerate extreme weather conditions.

f. Problem in Agriculture Sector

Gilgit-Baltistan is a remote mountainous region of smallholders with comparatively higher incidence of poverty. Agriculture productivity is generally low due to poor access to quality inputs, huge postharvest losses (45% for apricot and 10% for potato), lack of local processing and value addition and poor access to markets. Production is scattered and fragmented over large areas and of variable quality with difficult access and there are no aggregation platforms. Varietal selection is inappropriate and most farmers produce fruits and vegetables of multiple varieties; many of which are not in demand in the market or have poor shelf life. There is a poor connectivity among the actors and stake holders along the value chains of key products. Supportive policies and incentives are often weak or entirely missing. In view of these challenges, there is need to undertake research and studies on the following aspects of Agriculture sector:

1. To determine the potential of agriculture in areas of Gilgit-Baltistan;
2. To identify investment opportunities in Gilgit-Baltistan; and
3. To determine challenges of farming community in this area and to provide recommendations/suggestions.

¹ (Source: *Rangelands and their Interfaces in the Hindu Kush Himalayas, 2013, ICIMOD*)

5.3.5 Fauna

This diverse range of vegetation and ecological zones also supports a rich faunal diversity, including an estimated 54 species of mammals and 230 species of birds. About 23 species of reptiles and 6 of amphibians have been reported from GB. Among reptiles 9 species are of lizards and 14 of snakes, while among amphibians 2 species of frogs and 4 of toads. Very little information is available on insect diversity in GB; however, about 100 species of butterflies have been reported from GB.

The project area does not support any habitat of endangered wildlife species.

Occurrence of some rare species has been reported in Hunza District including KNP. These include species like Lammergeyer and Golden eagle. Few sightings of Lesser Kestrel have also been reported in lower Hunza near Hunza River. The main diverse group of birds is the Passeriformes species. These are mostly Warblers, Tits, Flycatchers, and Buntings. Some of the restricted range species like Snow Partridge and Himalayan Monal Pheasant are extremely rare and may be at the verge of extinction from many of their earlier strongholds. According to Birdlife International (2001) report, there are 27 species of Pakistan which are threatened internationally, out of which 7 species are found in GB.

Hunza has very scattered settlements with meager population. Considering its wildlife resources to be protected and preserved, shooting, trapping of wild animals is not allowed except with a special permit. The number of animals or birds killed or captured is also restricted and specified in the permit. Snow Leopard and Ibex are already declared as endangered and other species of mammal are also scarce. But trophy hunting is allowed which is beneficial to the local community as the 70% of the funds go to local community which is used for the development of the local area. The detail of fauna in the Project area is given in **Table 5-13**.

Table 5-13: Fauna available in Project area of Hunza District

English Name	Urdu Name	Scientific Name
Red Fox	Lombrei	Vulpesvulpes
Lynx	Seaa Gosh	Felis Lynx
Wolf	Bharia or Bahdia	Canis Lupus
Maramot	Barfani Choh Tershoon	Maramotacandata
Alpine Weasel	Gilhari	Mustelaaltacia
Musk Rat	Chachondar	Mustelaaltacia
Himalayan Snowcock	Ramchakur	Mustelaaltacia Tetraogallushimalayencis
Chukor	Chukor	Alectorischukor
Eagle	Shaheen	Aquila Chrysaetos
Hawk	Gid	-
Falcon	Ooqaabor Ooqabaa	-
Pie	Jample	Urocissaeryphrohyncha
Hopoe	Hodhodh	Upepaepaps
Pigeon	Kabutar	-

a. Insects

The Project Areas is rich in biodiversity of insects including butterflies found in the project area, particularly during the humid months of July and August. In addition, caterpillars, bugs, beetles, black bees, weevils, mosquitoes, ants, green aphids, codling moths, leaf miners, mites, fruit flies, woody aphids, stray grass hoppers, leaf hoppers, mealy and woolly bugs, peach leaf curling aphids, scale insects, walnut weevils, blister mites, and dusky veined aphids are all found in the NA including the project sites.

b. Endangered, Threatened or Vulnerable Species of Fauna

There are no endangered species of fauna found in the Project Area.

c. Community Controlled Hunting Areas

The concept of biodiversity conservation through community development was piloted in a few selected valleys by International Union for Conservation of Nature - IUCN under a Global Environment Facility (GEF) / United Nations Development Programme (UNDP) project in Gilgit-Baltistan and Chitral during the period 1995-1998. The success of the project resulted in expanding the concept to a larger canvass and today there are 53 communities-controlled hunting areas CCHAs. Out of which 12 CCHAs fall in Hunza District. The participating communities are required to write a management plan for conservation and sustainable use and monitor the population of species targeted for trophy hunt. The major species being managed for trophy hunt are Markhor, Ibex, and Urial. The communities are issued permits by government for the number of animals that can be safely hunted. Communities sell permits nationally and internationally through outfitters. Eighty percent of the income from successful hunt goes to local community while 20% goes to government to cover administrative costs.

There are no Community Controlled Hunting Areas falling in the Project Area.

d. Protected Area

In order to safeguard the biodiversity of key ecological systems, Government of Gilgit-Baltistan has declared 7 National Parks to protect and conserve bio-diversity of Gilgit Baltistan. These include Handarb National Park, Khunjerab National Park, Deosai National Park, Central Karakorum National Park, Qurumber National Park, Himalaya National Park and Nanga Parbat national Park. Out of these National Parks the Khunjerab National Park is situated in Hunza District. In the protected forest, the forest owned by Government as per Forest Act-1927, all activities are prohibited until and unless permitted by the government. Usually, removal of fallen, dying, and dead trees is not banned, however, grazing, sometimes, is regulated to ensure regeneration. In Gilgit Baltistan, designated protected forests cover an area of 445,712 ha and are mostly found in Ghizer, Astore, Skardu, Hunza and Gilgit Districts. Out of that 64,512 ha is conifer forests while 381,200 ha are scrub forests (IUCN, 2003).

Aga Khan Rural Support Programme (AKRSP), International Union for Conservation of Nature (IUCN), Wildlife Conservation Society (WCS) and World Wide Fund (WWF) are the main international organizations who over the last two decades have played a crucial role in creating awareness among communities for sustainable management of biodiversity resources. The

then Ministry of Environment also implemented a Program for Mountain Areas Conservation (PMAC) to promote biodiversity conservation in Gilgit Baltistan through community participation. This program was completed in 2011. As a result of these efforts the Gilgit Baltistan offers a model for community based management of forestry resources.

Despite of all these conservation initiatives and efforts by government and international organization, fast depletion of forest ecosystems has been observed in the last two decades. The following strategies and actions are being taken to achieve the objectives of conservation, sustainable use and equitable sharing of benefits.

There are no Protected Areas falling in the Project Area.

e. Game Reserves

The Game Reserves areas set aside for conservation of key game species, however, hunting and shooting is allowed except under a special permit. There are Eight (08) Game Reserves in GB out of which one (01) Game Reserve is located in District Hunza. The detail of these Game Reserves is given as follow (**Table 5-14**):

Table 5-14: Game Reserves Areas

Game Reserve	Area (km ²)	Key Species
Danyore (Gilgit)	443	Markhor, Ibex, Urial, Snow Leopard, Lynx, Wolf, Fox, etc. and Bird Species.
Kilikmintika (Hunza Gojal)	650	Ibex, Marco Polo Sheep, Snow Leopard, Brown Bear, Fox, Marmot, etc. and Bird Species.
Nazbar Nallah (Ghizer Yasin)	334	Ibex, Snow Leopard, Brown Bear, Wolf, Fox, etc. and Bird Species.
Chassi Bowster (Ghizer Phander)	370	Ibex, Snow Leopard, Wolf, Brown Bear, Fox, etc. and Bird Species.
Pakora (Ghizer Ishkoman)	75	Ibex, Snow Leopard, Wolf, Fox, etc. and Bird Species.
Askore Nullah Skardu	129	Ibex, Snow Leopard, Wolf, Fox, etc. and Bird Species.

There is no game reserve, wild sanctuaries and National Park present in the Project Area.

5.3.6 Aquatic Ecology

Gilgit-Baltistan is blessed with highest potential of cold and clean water resources in shape of lakes, canal, reservoirs, rivers, and water logged areas that offer ideal habitat for trout and other cold water fish species. There is dire need to get maximum benefit from these resources through technological advancement in production, processing and marketing. Both the public and private sector are fully involved in order to judicially exploit this potential both in natural waters as well as its development in culture conditions.

Hunza Valley is blessed with great water resources comprised of streams and alpine lakes

fed by the snowmelt and glacier waters. The fish fauna in Hunza Valley is relatively poor due to high turbidity, low water temperature and high water speed.

a. Fisheries

Fisheries department Hunza was established in the year 2012 with the core aim to develop and promote Fisheries and aquaculture activities in newly created district. District Hunza has rich aquatic resources of aquaculture and fisheries in forms of bluish lakes, gashing rivers, torrential streams, seasonal and perennial springs etc.

District Hunza being gate way to the CPEC and hub for tourist has great potential in terms of natural resources and well aware educated man power can contribute and play vital role in the development of the area. The scenic beauty and natural water resources of Hunza attracts a great influx of national and international tourist every year, which may directly or indirectly contribute to the economy of local people and the region.

Fisheries department Hunza has come up with novel approach and ideas to get maximum benefit from wise use and sustainable exploitation of natural resources in multiple ways with special focus on introduction and installation of cage culture system in Attabad Lake under controlled environment to enhance production with stocking and multiplication of fine varieties of fish in nature. At the same time, it has also been planned to promote sport fishery providing enabling environment and other related facilities for tourists and fish anglers.

For this the Attabad Lake having crystal clear water offers as natural gene pool reserve, ideal for excessive multiplication and better growth of many indigenous and exotic fish species.

b. Exotic Fish Species of Hunza

- i. *Salmo Trutta Fario* (Brown Trout)
- ii. *Onchorynchus Mykiss* (Rainbow Trout)

c. Indigenous Fish Species

Among the Fifteen (15) identified indigenous fish species in GB, the following Six (06) fish species are found in the Project Area:

- *Shizothorax Plagiostomus*
- *Shizothorax Nasus*
- *Ptychobarbus Conirostris*
- *Triplophysa Terwasae*
- *Triplophysa Yasinensis*
- *Diptychus Maculatus*

5.4 SOCIO-ECONOMIC ENVIRONMENT

The socio-economic aspects were studied with respect to human and economic development and quality of life values of the population in the Project Area. The human and economic development mainly focuses on population and communities, infrastructure availability, institutions, transportation network, prevailing land use, power sources and agricultural

pattern. Quality of life includes socio-cultural values, public health situation, recreational resources & development and archaeological/historical and cultural sites etc. Baseline information was gathered from literature, study reports, districts census reports and through field surveys comprising interviews and meetings by the Consultants' social team, using survey tools. During the field survey interviews and meetings with the different categories of respondents were conducted and observations were also recorded after giving due consideration during survey.

5.4.1 Approach and Methodology for the Study

The methodology was developed after thorough review of the Terms of References (TORs), the quantum of work/expected outputs and the prescribed period of study. The survey mainly used quantitative methods and included supplementary qualitative information and analysis, wherever possible. The design of the assessment was limited to measuring the overall socioeconomic condition of the population living in the proposed project area. **Table 5-15** presents a summary of the objectives, key indicators, tools, and survey methods used for data collection.

Table 5-15: Survey Objectives, Key Indicators, and Methods

Sr. No.	Objectives	Key Indicators	Method	Tools
1.	<ul style="list-style-type: none"> Demographic Profile Occupation Income of the Respondents Source of Income Expenditures Asset Ownership 	<ul style="list-style-type: none"> Demographic Information (Age, Education Status, Health Status, and Work Status of Household Members) Income Levels and Sources Expenditure Level Assets - Quantity, Value, and Ownership Liabilities - Loan Amount and Sources Available Social Amenities (Electricity, Sewerage, Telephone, and Sui Gas, etc.) 	<ul style="list-style-type: none"> Sample Household Interviews 	<ul style="list-style-type: none"> Socio-economic Performa
2.	<ul style="list-style-type: none"> Availability of Social Amenities (access to and use of public services, such as access to water and sanitation, education, and health etc.) Perception about the proposed project. 	<ul style="list-style-type: none"> Availability, use, and sources of household facilities (water, sanitation, and fuel) Availability, access, and use of public facilities (education, health, sanitation, and civil acts registration, etc.) 	<ul style="list-style-type: none"> Sample Household Interviews Community Discussions 	<ul style="list-style-type: none"> Sample Household Interviews, and General Discussions with Local Community Members

5.4.2 Literature Review

Immediately after the mobilization, the consultant reviewed all the available information/data, reports and studies related to project, the detail is as followed;

- Foot Prints of the project,
- District census report for the Hunza district, and
- Project area location maps

5.4.3 Field Reconnaissance Visit

The reconnaissance site visit was conducted to develop an understanding of the proposed project. The visit helped to prepare key milestones detailing socio-economic and poverty issues as well as possible project impacts.

5.4.4 Sampling Technique

In order to achieve the target of the study, random sampling technique was adopted to select adequate and representative sample from proposed project area to make the survey findings more compatible with the highest level of statistical confidence and thus get meaningful sociological facts/findings. Accordingly, fifty-eight (58) respondents were selected from the project area and detail is provided in **Table 5-16**.

Table 5-16: Number of Respondents

Sr. No.	Settlements / Villages	Number of Respondents
1.	Sarat	06
2.	Ganish	08
3.	Attabad	06
4.	Ayeenabad	05
5.	Shishkat	07
6.	Gulmit	07
7.	Gulkin	09
8.	Passu	10
Total		58

5.4.5 Developing Survey Instruments

The TORs highlight the importance of collecting primary data; hence the consultants designed the questionnaires covering the various types of information regarding socio-economic aspects, poverty indicators and availability of the social amenities.

5.4.6 Implementation of Data Collection Survey

The field methodology was prepared for data collection, used by the field teams during the execution of the study. A map of the proposed project area was obtained prior to the survey to facilitate the identification of sample respondents in the project area. Nonetheless, following techniques were applied in data collection.

5.4.7 Rapid Appraisal Methods

Rapid appraisal method was used which is quick way to gather the views and feedback of beneficiaries and other stakeholders. Rapid appraisal methods include (i) Key informant interview, (ii) Community group interview and consultations, and (iii) Direct observation.

5.4.8 Participative Approach

- A two-ways approach was adopted and respondents were given the opportunity to express their concerns and views freely about the project;
- Community groups were the target of the study;
- The participatory tool like group meeting was applied to identify and listing of the beneficiaries;

5.4.9 Data Processing and Analysis

The following steps were undertaken to ensure proper data processing and analysis:

- The collected data/information from the field was computerized;
- A tabulation plan was prepared;
- Data was processed according to separate category of the indicators for analysis; and,
- All analyzed data was tabulated for interpretation and deriving conclusions and recommendations.

5.4.10 Findings of Socio-Economic Survey

The main objective of the socio-economic survey was to analyze socio-economic and cultural characteristics of the intended project beneficiaries in order to understand their interrelationships, dynamics, and inequalities and to identify opportunities and constraints in accessing the project benefits by all beneficiaries or a segment of them (based on gender, ethnicity, level of income, and geographical remoteness etc.)

a) District Hunza at a Glance

The Hunza District is one of the 14 districts of the Pakistani territory of Gilgit-Baltistan. It was established in 2015 by the division of Hunza-Nagar District in accordance with a government decision to establish more administrative units in Gilgit-Baltistan. The district headquarter is the town of Karimabad. Hunza Valley is also hosting the ancient watchtowers in Ganish, Baltit Fort, and Altit Fort. Watchtowers are located in the heart of Ganish Village. Baltit Fort stands on top of Karimabad, whereas Altit Fort lies at the bottom of the valley. The local languages spoken include Burushaski, Wakhi and Shina.

b) Must Know Facts of Hunza

- First ever district to ban the use plastic and polythene bags. (First ever in Pakistan & South Asia).
- First ever district to ban on use of tobacco - smoking is strictly prohibits at public places, hotels and restaurants.

- Hunza is known for its rich culture, traditions and customs, therefore, known for hospitality, politeness and generosity.
- People are highly civilized & cultured since the literacy rate is 98%.
- Hunza is known for its longevity meaty organic food and clean environment.

c) Geography of District Hunza

The Hunza District is bounded on the north and east by the Kashgar prefecture of Chin's Xinjianj Uyghur Autonomous Region, on the south by the Nagar District and Shigar District, on the west by the Ghizer District and on the north-west by the Wakhan District of Afghanistan's Badakhshan province. The Hunza District represents the northernmost region of the Indian subcontinent. It is home to the historic passes through the Karakoram Mountains (the Killik, Mintaka, Khunjerab and Shimshal Passes) through which trade and religion passed between Central Asia, China and India for centuries. The present day Karakoram Highway passes through the Khunjrab Pass to enter China's Xinjiang Uyghur Autonomous Region.

d) Tourist Attractions in Hunza Valley

Hunza boasts great biodiversity and natural beauty, the valley has dramatic natural beauty and there are many places which have attractions for the tourists. Hunza is one of the most exotic places in Pakistan. Several high peaks rise above 7,000 m in the surroundings of Hunza Valley. The valley provides views of several mountains, including:

Rakaposhi 7,788m (25,551ft), Ultar Sar 7,388m (24,239ft), Bojahagur Duanasir-II 7,329m (24,045ft), Diran peak 7,266m, Spantik 7,027m, Ghenta Peak 7,090m (15,631ft), Hunza Peak 6,270m (20,571ft), Darmyani Peak 6,090m (19,980ft), and Bublimate (Ladyfinger Peak) 6,000m (19,685ft).

Some lakes like Attabad Lake, Borith Lake, Shimshal Lake, and Hassanabad Lake are located in Hunza.

Khunjerab Pass is a 4,693-meter-high mountain pass in the Karakoram Mountains. It is in a strategic position on the northern border of Pakistan and on the southwest border of China and is also located in Hunza. Eco-friendly hiking treks like Ondra, Poygah, Gulmit, and Leopard Trek Shiskhat are also known for their views.

e) Administrative Setup of District Hunza

Administratively, the Hunza District comprises two tehsils, the Aliabad Tehsil and Gojal Tehsil. The villages of lower Hunza and central Hunza are located in the Aliabad Tehsil, whereas the villages from the Attabad Lake up to the Khunjrab Pass are located in the Gojal Tehsil. In lower Hunza, Shina is the main language, whereas in central Hunza, the dominant language is Burushashki and in upper Hunza, Wakhi is the main language.

District administration is exercised by the Deputy Commissioner (DC) with the assistance of Assistant Commissioners. The Hunza police force is command by the Superintendent of Police (SP).

f) Attabad Lake at a Glance

Attabad Lake is located in the Gojal region of Hunza Valley in Gilgit-Baltistan, Pakistan. It was created in January 2010 as the result of a major landslide in Attabad. The lake has become one of the biggest tourist attractions in Gilgit-Baltistan, offering activities like boating, jet-skiing, fishing and other recreational activities.

g) Demography and Population

Total area of Hunza district is 11,660 km² (4,500 sq. mi). Total population of Hunza district according to census survey report 1998 is 243,324.

h) Ethnic Groups and Religions

Most of the people of Hunza are Ismaili Shia Muslims who are the followers of Prince Karim Aga Khan IV, while in the area of Ganish Village over 90% are Asna Ashri Shia Muslims.

i) Culture

The culture of the Hunza district is unique to its people. They eat simple and healthy foods like Hunza bread, apricot products, dry fruits, and meat. They don't eat oily and spicy foods.

j) Languages

The local languages spoken include Burushaski, Wakhi and Shina, while Urdu and English are the official languages spoken.

k) Education

Education plays a pivotal role in changing social and economic condition of the individuals. The literacy rate here is 98%. The female education ratio matches the males in Hunza district. Education has always been a top priority for the residents. New public and personal sector educational establishments are growing wide to impart schooling to the younger people.

l) Aga Khan Development Network (AKDN)

After the annexation of Hunza and the abolition of the principal state a space concerning rule, law, administration and organization was created. It took a long time for the government institutions to fill this gap. AKDN is an international network and as part of Aga Khan Foundation (AKF) deals with issues such as education, rural development, culture, health services, housing programs and quite a few others. With its headquarters in Geneva and having been founded in 1967. The AKF is an international agency for development cooperation. Within the sub-branches of the AKDN, the Aga Khan Rural Support Program (AKRSP) is for rural development. The activities of the AKDN have shaped the development of the valley extraordinarily. Its various offices provide jobs for higher qualified Hunza cuts when they return from their studies in down country. Employment is also provided in the public sector in rural areas. The AKDN extends its activities to establishing healthcare facilities and educational institutions. The AKRSP was established in Gilgit and covers 84% of the

households in Gilgit-Baltistan. The AKRSP started supporting institutional development on the local level in 1982 by establishing community-based organizations (CBOs) like Village Organizations (VO) and Women Organizations (WO). These associations were established all over Hunza within a few years. It initiated developmental projects in this area aiming at improvement of the condition of the rural population and providing basic facilities to the masses, with special emphasis on infrastructure.

m) Health Facilities

The villages in the Hunza Valley have somewhat better healthcare facilities than rest of the GB except Gilgit and Skardu. Aga Khan Health Service (AKHS) and Government Health Workers are providing health facilities in the area. They provide first aid facilities and also give family planning guidance to the people.

5.4.11 Demography of Sampled Households

a) Gender Composition

The socio-economic survey was carried out to understand the demographic and socio-economic characteristics of the population in the project area. According to the survey of sampled households, the male population was high as compared to the female population in the project area. On average the male population was 53% compared to the 47% female population among the sampled families. As per the survey, the household size was 6.2 persons per household. The detail of the population of sampled households is given in **Table 5-17**.

Table 5-17: Gender Composition of Households' Population

Total Respondents	Population and Family Size				Total Population	Average HH Size
	Male	(%)	Female	(%)		
58	191	53	169	47	360	6.2

b) Age Group

Age is another important demographic characteristic which has a bearing on employment and mobility. The findings of the survey revealed that 24% of the respondent were between 21 to 30 years of age & 45% were between 31 to 45 years of age group and 31% of the were above 45 years of age group respectively. The data regarding the distribution of respondents by age is categorized and depicted in **Table 5-18**.

Table 5-18: Age Group of Respondents

Sr. No.	Frequency Distribution	Number	Percentage
1.	21-30	14	24
2.	31-45	26	45
3.	Above 45	18	31
Total		58	100

c) Education Level

If a person could read a newspaper or a journal of the same standard, and could write the simple letter in any language is defined as literate in the Census of 1998. Education is one of the key factors in assessing the socio-economic condition of any area and is a more contributing factor than the income for uplifting the living standards in society. The literacy rate is barrier with limited educational infrastructures.

Based on sample survey (**Table 5-19**), 100% respondent population was literate. In term of education distribution, 12% of the respondents got the education till primary level (five years of schooling), 9% of the respondents have the education up to middle level (8 years of schooling), and 26% & 21% of the respondents were matriculates and intermediates, respectively. However, 33% of the respondents had the education till graduation level and above.

Table 5-19: Educational Level

Sr. No.	Educational Status	Number	Percentage
1.	Primary	7	12
2.	Middle	5	09
3.	Metric	15	26
4.	Intermediate	12	21
5.	Graduation & Above	19	33
Total		58	100

d) Source of Income

Household income could be the best indicator to assess the actual socio-economic situation of the target communities. The majority of the respondents living nearby the project area were engaged in agriculture, running restaurants and tourism businesses, and some of them were doing private jobs to earn their livelihood.

The occupations have been categorized based on primary source of income. The sample survey revealed that the majority of the respondents (55%) were associated with different kind of businesses including boating, jet-skiing, tourism, honey farming, dry fruits, restaurants, hotels and shop keeping, etc. followed by 9% engaged in agriculture and 14% were doing private jobs, while 12% and 10% of the respondents were engaged in the field of driving and daily wages labor, respectively. **Table 5-20** shows the occupation of the respondents.

Table 5-20: Source of Income

Sr. No.	Professional Status	Number	Percentage
1.	Business/shop	32	55
2.	Agriculture	5	09
3.	Private Job	8	14
4.	Driver	7	12
5.	Labor	6	10
Total		58	100

e) Monthly Household Income

During the socio-economic survey, it was observed that monthly household income of the 12% respondents was up to Rs. 25,000 per month. Whereas, 10% households were earning between the range of Rs. 25,001 to 35,000 per month. However, 28% were earning between the ranges of Rs. 35,001 to 45,000. The majority of the households (50%) were earning above Rs. 45,000 per month. **Table 5-21** below shows the average monthly household income of the respondents.

Table 5-21: Monthly Household Income

Sr. No.	Distribution	Number	Percentage
1.	Up to 25,000	7	12
2.	25,001 to 35,000	6	10
3.	35,001 to 45,000	16	28
4.	Above 45,000	29	50
Total		58	100

f) Monthly Household Expenditures

Household expenditure depends on the earning of the households. 24% of respondents reported their monthly household expenditures up to 25,000 due to their low income. However, 16% of respondents reported their expenses within the range of 25,001 to 35,000 per month. Whereas, 38% of respondents reported their monthly expenditures between the ranges of 35,001 to 45,000 in order to fulfill their family needs, while 22% of the respondents reported their monthly expenditures above Rs. 45,000 in order to fulfill their family prerequisites. The information relating to the household expenditure in respect of the sample population is shown in **Table 5-22**.

Table 5-22: Monthly Household Expenditures

Sr. No.	Distribution	Number	Percentage
1.	Up to 25,000	14	24
2.	25,001 to 35,000	9	16
3.	35,001 to 45,000	22	38
4.	Above 45,000	13	22
Total		58	100

g) House Ownership Status

Housing is a major element of people's material living standards. It is essential to meet basic needs, such as shelter from harsh weather conditions, and to offer a sense of personal security, privacy and personal space. Good housing conditions are also essential for people's health and affect childhood development. Further, housing costs make up a large share of the household budget and constitute the main component of household wealth.

Regarding the ownership of the houses, findings of the study indicated that 100% of the sampled respondents owned their houses.

h) Type of the Houses

The Housing conditions of the respondents have been analyzed according to the type of houses in which they were residing. Majority of people use rock stones, concrete blocks, sand with cement for walls and floors whereas use wood for roofs.

i) Source of Drinking Water

Drinking water, also known as potable water or improved drinking water is water safe enough for drinking and food preparation. Access to safe drinking water is not only a basic need and a precondition for healthy life, but is also a basic human right. The quality of water is directly linked to the quality of health.

Springs are the only source of drinking water for the local communities. According to the local people, the water is clean and safe for drinking purpose. People fetch spring water for drinking and cooking. Most of the people have access to water supplies but these water supplies also carry the water from springs which are managed through pipelines to make easy access.

j) Satisfaction about Water Quality

During the survey, local people were asked about the quality of the drinking water. The data revealed that 100% of respondents were satisfied with the quality of water. According to the respondents, the water of springs is very good for health because it carries minerals and extracts of natural herbs.

k) Source of Energy for Cooking and Heating

The source of energy for cooking and heating purposes was also inquired during the survey from the respondents. In winters, 100% of households use wood for cooking and heating of the houses due to severe cold weather conditions. However, during the summer season, almost 85% of the households use wood for cooking and heating whereas, rest of the 15% percent use LPG as a source of cooking. Hence, Sebagton Shrub wood is used for cooking and heating purposes while the wood of old Apricot, Apple, Popular and local trees are also used for cooking and heating. **Tables 5-23 & 5-24** indicate the sources which are being used by the respondents for cooking and heating purposes.

Table 5-23: Source of Energy in Winter Season

Sr. No.	Source of Energy	Number	Percentage
1.	Wood	58	100
Total		58	100

Table 5-24: Source of Energy in Summer Season

Sr. No.	Source of Energy	Number	Percentage
1.	Wood	45	78
2.	LPG	13	22
Total		58	100

I) Basic Social Amenities in the Proposed Project Area

Social infrastructure and amenities are key to creating sustainable communities. This assessment sets the spaciousness of a household's dwelling, household amenities like availability of electricity and modern appliances, nature of access to water, fuel for cooking and type of sanitation facilities available as primary indicators for assessing the standard of living.

The results of the survey revealed that 100% of the households had electricity facility while the facility of water supply was available to 79% of the respondents, basic health unit facility was available to 100% of the respondents. The facility of schooling was available to 100% of the respondents. Moreover, the facility of mobile service was also available to 100% of the respondents. Providing a proper sewerage system to the communities is the responsibility of the government, and this particular facility was not available in the area. The information in respect of access to social amenities and their quality of services is given in **Table 5-25**.

Table 5-25: Basic Social Amenities in the Proposed Project Area

Sr. No.	Social Amenities	Available (%)	Satisfactory (%)
1.	Electricity	100	50
2.	Water Supply	79	100
3.	BHU	100	90
4.	School	100	100
5.	Mobile Service	100	100

Source: field survey

m) Mode of Transport

It was observed that most of the respondents traveled by foot when traveling between the nearest villages in the valley in the absence of proper road infrastructure. Whereas, in order to move to other cities or villages where road infrastructure exists, most of the respondents use their own transport either in shape of bike or car. **Table 5-26** describes mode of transport being used by the respondents asked during the sampled household survey. About 38% of respondents were using their own transport and 21% reported the usage of public transport. While, 41% of the respondents were using both means of transport (private & public).

Table 5-26: Mode of Transport

Sr. No.	Mode of Transport	Number	Percentage
1.	Own Transport	22	38
2.	Public Transport	12	21
3.	Both (Private & Public)	24	41
Total		58	100

5.4.12 Gender Aspects / Roles and Responsibilities

The importance of gender equality, women’s empowerment, and the realization of women’s rights in achieving sustainable development has been increasingly recognized in recent decades. This recognition is evident in a number of international norms and agreements, including principle 20 of the Rio Declaration on Environment and Development, adopted in 1992, in its statement regarding the full participation of women being essential to achieving sustainable development. The women of the proposed project area are hardworking, they have a vital role in maintaining domestic functions. During the field survey, the questions were asked from the respondents about the female participation in different activities of daily life. The survey revealed that participation of women in various household activities in the proposed project area is generally high (100%) in the case of household activities to take care and maintenance work of the household and take part in outdoor activities with their family members such as honey farming, fast food restaurant, help out in agricultural activities, fetching water, collecting fuel wood, cooking, washing, cleaning, and looking after children, etc. The **Table 5-27** depicts the routine activities and participation level of the female household members.

Table 5-27: Women Participation in the Various Activities

Sr. No.	Activities	Participation Level
1.	Household	100%
2.	Child Caring	100%
3.	Employment / Business	50%
4.	Farming	80%
5.	Social Obligations (Marriage, Birthday & Other Functions)	100%
6.	Local Representation (Counselor / Political Gathering)	30%

Source: Field Survey

6 PUBLIC CONSULTATION

6.1 GENERAL

Timely and broad-based stakeholder involvement is an essential element for an effective environmental assessment, as it is linked with Project Planning, appraisal and development in general. Public involvement during Environmental Impact Assessment (EIA) has a tendency to improve project design, environmental soundness and social acceptability.

This section describes the outcome of the stakeholders' consultation sessions held with different stakeholders that may be directly or indirectly affected by the proposed project. Public consultations are also mandatory for development projects. The adequacy of the public consultation and information disclosure is one of the basic criteria used to determine the project compliance with the national / international safeguard policies.

Under the proposed project, stakeholder consultations were carried out in the Study Area with the locals, Government Departments and general public. These consultations were carried out from 05th October to 06th October, 2022. The major categories of the people who participated in the public consultations were the local population and community groups. The Project management and implementation authorities are committed for undertaking public consultation at local levels as a part of Project planning/design for getting necessary environmental permissions.

This Chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the Project during the present EIA study. A consultation framework, describing the consultations to be carried out during the subsequent phases of the Project implementation ensuring ongoing and inclusive dialogues with key stakeholder is also provided in this chapter.

6.2 OBJECTIVES

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process. Specific tasks and purposes of consultations with stakeholders have been given in the **Table 6-1**.

Table 6-1: Tasks and Purposes of Consultations

Sr. No.	Task	Purpose of Consultation with Stakeholders
1	Why consultation with the stakeholders?	<ul style="list-style-type: none"> To build trust to ensure sustained support for the proposed project and build resilience for times of crisis. To learn about public concerns that need to be addressed and taken into account in designing of the Project concept and preparation of mitigation measures and programs. To learn about the strengths, skills and organizations that the

Sr. No.	Task	Purpose of Consultation with Stakeholders
		stakeholders can bring to support Project planning and implementation.
2	Modes and benefits of consultation	<ul style="list-style-type: none"> • Listening and dialogue with stakeholders to keep the Project at tuned to public concerns early, to pre-empt breakdowns in public confidence. • Engaging the public as advocates for the Project construction and to support the implementation of social, resettlement, and environment and health programs.

Other objectives of public involvement include:

- Informing the stakeholders about the proposed Project;
- Providing an opportunity to those who remained unable to present their views and values, therefore, allowing more sensitive consideration of mitigation measures and trade-offs;
- Providing those involved with planning the proposal with an opportunity to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;
- Providing an opportunity for the public to influence the Project design in a positive manner;
- Increasing public confidence in front of proponent, reviewers and decision makers;
- Providing better transparency and accountability in decision making;
- Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions;
- Creating a sense of ownership of the proposal in the minds of the stakeholders; and
- Developing the Project which is truly sustainable.

More intangible benefits flow from the public involvement as the participants realize that their ideas can help to improve the Project. People gain confidence and self-esteem through taking part in the decision-making process and perceptions are expanded by meeting and exchanging views with people who have different values and ideas.

6.3 STAKEHOLDER IDENTIFICATION

The first step for the stakeholder consultation is the identification of the stakeholders. WAPDA is the Project Proponent for the proposed Project. As per definition, stakeholder is an entity which is concerned with the proposed Project in any way. Direct stakeholders are those entities which are directly concerned with the Project. The Project has both primary as well as secondary stakeholders.

The primary stakeholders include all the PAP's according to their loss of assets and living conditions, Provincial and District Level Government Departments of GB such as Environmental Protection Department (EPD), Irrigation Department, Agriculture Department, Wildlife Department, etc. However, the secondary stakeholders include the public and private agencies involved in the implementation of the Project.

Following is a list of major stakeholders consulted for the proposed Project:

6.3.1 District Level Stakeholders

- Gilgit-Baltistan EPA
- WAPDA GB;
- Forest Department, Hunza;
- District Administration;
- Wildlife Department, Hunza;
- Fisheries Department, Hunza;
- Agriculture Department, Hunza;
- District Health Department, Hunza;
- District Education Department, Hunza;
- Karakoram International University, Hunza

6.3.2 Village Level Consultations

- Project Affected Persons (PAPs) - Individual Interviews;
- Community Consultations;
- NGOs;
- Local Ismaili Council Gulmit

Details regarding roles and responsibilities of the concerned agencies and departments are given below **Table 6-2**.

Table 6-2: Roles of Concerned Agencies/Departments

Sr. No.	Name	Roles
1.	Environmental Protection Agency	<ul style="list-style-type: none"> • EPA is the regulatory authority and mainly responsible for the development and implementation of the environmental policies and strategies in order to integrate the environmental issues and sustainable development approaches into the legal and regulatory frameworks as per GB Environmental Protection Act 2014; • EPAs are responsible for the issuance of Environmental Approval of the proposed Project; and • EPA-Punjab is responsible for the compliance of EMP and Environmental Approval provision during the construction and operation phases of the Project.
2.	WAPDA	<ul style="list-style-type: none"> • WAPDA is an autonomous and statutory body under the administrative control of the Federal Government and divided into three sectors Water, Power and Finance. • Water Wing of WAPDA is responsible for planning, designing and execution of Water Resources Development Projects in the sector of irrigation, drainage and hydropower. Inter-provincial major surface water Projects including large

Sr. No.	Name	Roles
		<p>dams are also operated and maintained by Water Wing, WAPDA.</p> <ul style="list-style-type: none"> • Roles of the Power Wing were redefined as Hydel Power Generation and O&M of powerhouses. • The Charter of Duties of WAPDA is to investigate, plan and execute schemes for the following fields: <ul style="list-style-type: none"> ○ Generation, Transmission, and Distribution of Power; ○ Irrigation, Water Supply, and Drainage; ○ Prevention of Water logging and Reclamation of Waterlogged and Saline Lands; ○ Flood Management; and ○ Inland Navigation.
3.	Agriculture Department	<ul style="list-style-type: none"> • Ensuring food security; • Enhancing productivity through better varieties and improved management practices; • Promoting high value crops, fruits, and vegetables; • Promoting export of high value agricultural products; • Promoting efficient use of water and other inputs; • Improving soil health; • Development of culturable wastelands; and • Ensuring fair returns for the growers in marketing of their produce.
4.	Forest Department	<ul style="list-style-type: none"> • Protection, improvement and maintenance of existing forests; • Increase forests by planting new trees; and • Extension and advisory services to the general public about tree plantation.
5.	Wildlife Department	<ul style="list-style-type: none"> • To save and protect wildlife.
6.	Fisheries Department	<ul style="list-style-type: none"> • Responsible for the Conservation, Management and Development of Natural Fisheries resources through the enforcement of Punjab Fisheries Ordinance and Rules; • Promote aquaculture practices in private sector to bridge gap of protein deficiency in the diet of common man; and • Provide white meat to improve the health of people, utilize the untapped Fisheries resources to obtain maximum production, and increase our share in the national economy.
7.	Revenue Department	<ul style="list-style-type: none"> • Provide land ownership data of the project affected parties (PAPs) which include but not limited to the ownership record, land categorization, and price details. • Responsible for implementation of all relevant Sections of LAA, 1894.

Consultations with district level departments were carried out through meetings while consultations with locals, village people, and directly affected people, etc. were undertaken

during the baseline survey of the Study Area. The consultation is an ongoing process which should be continued during the project life cycle, i.e. even after the submission of EIA.

6.4 DEPARTMENTAL CONSULTATIONS

The stakeholder consultations were held with relevant departments. The details of the departmental officials contacted are given in **Table 6-3**.

Table 6-3: List of Government Officials Consulted

Sr. No.	Designation	Name of Department/ Office
a)	Director - EPA	EPA Gilgit
b)	Assistant Commissioner, Gojal	Revenue Department
c)	Project Director, ALHPP Hunza	Water & Power Department GB
d)	District Health Officer	District Health Department Hunza
e)	Agriculture Officer Hunza	District Agriculture Department Hunza
f)	District Education Officer	District Education Department
g)	Conservator of Parks and Wildlife	Parks and Wildlife, GB
h)	DFO - Wildlife	District Wildlife Department Hunza
i)	District Forest Officer	District Forest Department Hunza
j)	Assistant Director Fisheries	District Fisheries Department Hunza
k)	Director - KIU	Karakoram International University, Hunza

6.4.1 Views & Suggestions of the Officials of Departments

The responses of the government officials about the construction of the Project were recorded during the discussions. Generally, the officials were of the view, that the construction of the proposed project will have a positive impact on the economy of the area in terms of availability of water for the irrigation purpose. The **Table 6-4** indicates the detail of issues raised/discussed and suggestions given during the consultation:

Table 6-4: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No	Agency / Department / Stakeholder	Representative's Details	Date	Apprehensions and Suggestions
1	Water and Power Development Authority (WAPDA)	Mr. Iqtadar Hussain, Project Director, ALHPP ,Hunza 0333-4481116	04-10-2022	Project Director was briefed about the activities for the update/review of the EIA report. He commented that all the stakeholders should be properly appraised about the project and the relevant

Sr. No	Agency / Department / Stakeholder	Representative's Details	Date	Apprehensions and Suggestions
				communities should be consulted.
2	Forest and Wildlife Department GB	Mr. Jilal Ahmed, Conservator of Parks and Wildlife, GB 0355556999	06-10-2022	The official was briefed about the advantages and present scenario of the proposed project. Mr. Jilal appreciated the proposed project and commented that this project will bring socio-economic benefits to the communities and will solve the problem of shortage of electricity of in the area. He further suggested that the transmission line from Attabad to Sost and Attabad to Aliabad (Hunza) would be passing through some of the Community Controlled Hunting Areas (CCHAs). Therefore, during the implementation of the project, the wildlife of the area should be protected and due care should be taken to create the least disturbance for the wildlife.
3		Mr. Muhammad Jaffar, DFO, Hunza 0355553086, 0346-9701825	04-10-2022	Mr. Jaffar was briefed about the project. He suggested that the project would go a long way for the betterment of the area. The fruit and forest plants will be affected due to the construction of transmission lines for which the PWD has a schedule of compensation. The stakeholders must be paid well in time for compensation of the effected trees.
4		Mr. Muhammad Akram, DFO Wildlife, Hunza 0312-9753399	06-07-2022	The EIA team briefed him about the project. He was appreciative of the forthcoming project. He appreciated and commented that the proposed Project will be a game changer for the area as shortage of

Sr. No	Agency / Department / Stakeholder	Representative's Details	Date	Apprehensions and Suggestions
				<p>energy and load shedding has a tremendous impact on the economy and social life of the area. He further apprised the team that the transmission line from the Attabad to Sost will trail through Community Controlled Hunting Areas (CCHAs). Therefore, during the execution of the project the necessary safeguards must be taken to avoid any disturbance and damage to the wildlife of the area.</p>
5	Agriculture Department	<p>Ms. Farhana Shah, Agriculture officer, Hunza 0349-5024259</p>	04-10-2022	<p>The official was briefed about the advantages and present scenario of the project. She was appreciative of the proposed project and commented that the project will involve the cutting of fruit trees for the construction of transmission lines, therefore, the compensation to the effected land owners for the cutting of trees should be paid as per the prevailing schedule of rates of PWD.</p>
6	Fisheries Department	<p>Mr. Shahbuddin, Assistant Director Fisheries, Hunza 0355-555251</p>	04-10-2022	<p>The official was briefed about the advantages and present scenario of the project. He was highly appreciative of the project and apprised the team that the Attabad lake is rich in Fisheries resources and Cage fishing is introduced in the Attabad lake. It will help the communities to get extra income for their livelihoods. He further suggested that during the construction phase of the project due care should be taken to avoid any damage to the aquatic life and fisheries.</p>

6.5 COMMUNITY CONSULTATIONS

For ascertaining the perceptions of different stakeholders about the project (during/ after construction) meetings were held with local communities and anticipated project PAPs within the project area of influence. These meetings were held in an open atmosphere, in which participants expressed their views freely. Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders about the project and the potential impacts both positive and adverse likely to occur due to its implementation. The views of the local residents and general public were formally recorded and effort was made to make those beneficial for the Project.

6.6 APPROACH FOR THE CONSULTATION AND INFORMATION DISSEMINATION

A series of public consultations were required to get the feedback/concerns of the different categories of stakeholders including local communities and other general public residing in and near the project area.

Consultation process included meetings with specific proposed project area residents, community meetings/consultations and semi-structured interviews with the local community members. During the consultation process, the stakeholders were briefed about the project objectives and scope. Their fears and suggestions were recorded.

These Consultations were conducted at following two levels:

- Community/Public Consultations
- Individual meetings with PAPs

Public Consultation was carried out in order to establish stakeholder's opinion regarding project implementation. The following methods were used for public consultation with project stakeholders:

- Scoping Sessions
- Formal Meetings
- Informal Meetings
- Individual Interview

6.6.1 Locations of the Public Consultations and Participation

The detail of the locations with number of participants is provided in the **Table 6-5**

Table 6-5: Consultation Locations and Number of Participants

Sr. No.	Village	Number of Participants
1.	Ganish	07
2.	Gulmit	06
3.	Attabad	11
4.	Passu	18
Total Participants		42

6.6.2 Findings of Community Consultations

Extensive consultations were conducted with the local communities and anticipated PAPs in the proposed project area to record their views and incorporating in the project planning. Four (04) consultative meetings were held with locals in the proposed project area. The major categories participated in these meetings were local population, community groups, landowners, and particular project affected persons. All participants were briefed about the importance of the project and its impacts.

During the consultations, it was assessed that mostly people were aware about the project, its benefits and adverse impacts. During discussions, participants showed keen interest in discussion, gave valuable suggestions, and also raised various questions. The local people expressed their willingness and cooperation with the project staff during survey and implementation of the project.

The question raised and response given are provided in **Table 6-6** whereas, list of participants has been provided in the **Annex-I**. Moreover, pictorial view of the community consultations, data collection, and other filed activities is depicted as **Photolog**.

Table 6-6: Consultation Meetings

Sr. No.	Questions / Concerns by Participants	Responses of Team Consultant
1.	What will be the exact location of the reservoir and where the Dam will be constructed?	The participants were briefed about the tentative location of the proposed reservoir area and location of dam axis through projects' maps and drawings. However, the final location of dam and its allied structures will be finalized after detailed geotechnical and seismic studies.
2.	How compensation for the land to be acquired will be paid and who will pay compensation?	Compensation will be given to all PAPs including the land owners. Land evaluation will be completed by Revenue Department after the demarcation of RoW of the proposed project and compensation package will be prepared for all land affected PAPs. For land compensation, the land amount will be transferred to the District Revenue Department, which will be responsible to pay the amount to the PAPs.
3.	Various surveys were conducted for the propose Dam but, there is no visible progress on the ground.	Feasibility and detailed engineering designing of the mega projects involves various studies which takes time. After completion of the respective studies, it is assessed that either the respective project is feasible or not. After approval of feasibility and detailed engineering design, projects are commenced and civil work is initiated on the ground. Respective project

Sr. No.	Questions / Concerns by Participants	Responses of Team Consultant
		will also commenced very soon in future once the necessary studies and field investigations are carried out/completed.
4.	When construction of the proposed project will get start?	After completion of the feasibility study and final approval of the detailed design, the construction work will be started.
5.	Due to construction activities as well as influx of labor, movement of the citizens particularly of females, residing in the local area will be restricted.	In order to tackle this situation, construction will be carried out during scheduled hours. So that after construction hours, local community, particularly females can easily move in the area. People would be aware about complete construction activity plans so that they can move in the area freely and safely.
6.	Dust and noise will disturb the nearby residential and commercial structures during construction.	All protective measures will be taken to keep safe the local community from noise and dust. Contractor will be bound to take all protective and precautionary measures to keep safe the health and properties of the local people. Internationally approved practices will be adopted in this regard.
7.	Skilled and unskilled work force should be hired from local community. It will enhance the acceptability of the proposed project among local people.	Contractor will be bound to hire the skilled and unskilled work force from the local community at priority. It will enhance the acceptability of the project among the masses as well as provide proper livelihood to the deprived and marginalized community.

6.7 STAKEHOLDER CONSULTATIONS FRAMEWORK FOR CONSTRUCTION AND OPERATION PHASE

Key stakeholders of the Project include provincial and district level government departments such as EPD - GB, Agriculture Department, Forest Department, Wildlife Department, Fisheries Department, Project directly affected people, land owners and local people. The community members will be compensated by project proponent and they will be encouraged to participate in project activities during the construction and operation phases. The consultations are recommended to be made in future to facilitate the community at the local level.

The consultations should be carried out during the construction and operation phases of the Project. Efforts are recommended to maximize the consultations during the project implementation. The consultations will be carried out with the objectives to develop and maintain communication linkages between the project promoters and stakeholders, provide key project information to the stakeholders, and to solicit their views on the project and its potential or perceived impacts, and ensure that views and concerns of the stakeholders are incorporated during the implementation with the objectives of reducing or offsetting negative

impacts and enhancing benefits of the proposed Project. The framework for the future consultations is elaborated in **Table 6-7**.

Table 6-7: Future Consultations Framework

Sr. No.	Stakeholders	Project Phase	Frequency of Consultation
1	Provincial Government Departments	<ul style="list-style-type: none"> • Pre-Implementation • During the Project Implementation 	<ul style="list-style-type: none"> • One round of consultation before the start of implementation of project. • Monthly during the construction phase and biannually during the operation phase of the project.
2	District Level Government Officials	<ul style="list-style-type: none"> • Pre-Implementation • During Project Implementation 	<ul style="list-style-type: none"> • One round of consultations before the start of implementation of project. • Monthly during the construction stage and biannually during the operation phase of the project.
3	PAPs	<ul style="list-style-type: none"> • Pre-Implementation • During the Project Implementation 	<ul style="list-style-type: none"> • One rounds of consultations before the start of implementation. • Fortnightly during the construction stage and biannually during the operation phase of the project.
4	Surrounding Villages	<ul style="list-style-type: none"> • Pre-Implementation • During Project Implementation 	<ul style="list-style-type: none"> • One round of consultation before the start of implementation. • Quarterly during the construction stage and biannually during the operation phase of the project.
5	Local Elders	<ul style="list-style-type: none"> • Pre-Implementation • During Project Implementation 	<ul style="list-style-type: none"> • One round of consultations before the start of implementation of project. • Monthly during the construction stage and biannually during the operation phase of the project.
6	Women	<ul style="list-style-type: none"> • Pre-Implementation • During Project Implementation 	<ul style="list-style-type: none"> • One rounds of consultations before the start of implementation. • Fortnightly during the construction stage and biannually during the operation phase of the project.

7 GRIEVANCE REDRESS MECHANISM

The grievance redress mechanism (GRM) is important for developmental projects where ongoing risks or adverse impacts are anticipated. This mechanism serves as a way to meet requirements, prevent, and address community concerns, reduce risks, and assist larger processes that create positive social change. The major objective of GRM is to implement and maintain a procedure for handling the environmental and social concerns of the project stakeholders. This procedure will include a redress mechanism scaled to the project's identified risks and adverse impacts, focusing on stakeholders.

WAPDA will establish a Grievance Redress Committee (GRC) to facilitate the resolution of complaints by Project Affected People (PAPs) and grievances about the project's environmental performance. The GRC will be coordinated by the Chief Resident Engineer and Environment Head. The GRC will address affected people's concerns and complaints promptly, using an understandable and transparent process.

7.1 COMPOSITION OF GRC

The GRC will work directly under the supervision of the Chief Resident Engineer. The following members are recommended to form a GRC to look into environmental matters:

- WAPDA Environment Cell
- Environment and Social Head of E&ST
- Representatives from PAPs
- Environmental Engineer of Management Consultant
- Environmental Engineer of Construction Contractor

The Environment and Social Head of E&ST will nominate one member of GRC and shall act as Project's Environmental Grievance Officer (PEGO). He will review the case on merit and address the problem in accordance with prevailing rules / procedures applicable to such grievances as per EMP. The PEGO will then refer the case to GRC for the final decision, whether to update and make necessary amendments in EMP. The GRC will deliver its decision within thirty (30) days of registration of the case. If the affected person does not receive a response from GRC within thirty (30) days of the registry of the complaint, he/she can appeal to the Environment and Social Head of E&ST, who should act on the complaint / grievance within two weeks of the day of its filing. If the affected person is not satisfied with the decision of the Environment and Social Head of E&ST, then it can be referred to higher authorities / relevant government departments for its resolution. As a last resort, he/she may submit the complaint to GB - EPA.

7.2 RESPONSIBILITIES OF GRC

The responsibilities of GRC will include the following;

- The GRC shall review, consider, and resolve grievances related to environmental issues during implementation of the project received by the PD office of the Project.

- Environmental Specialist of MC is responsible for conducting investigations on these grievances.

Any grievances presented to the GRC should ideally be resolved on the first day of the hearing or within a period of one week, in case of complicated issues requiring additional investigations.

GRC is empowered to take the decision which is binding on WAPDA and considered final. GRC meeting will be held in the PD office or other locations agreed upon by the committee. If needed GRC members will conduct field visits to verify and review the issues in dispute.

7.3 PROCEDURES FOR FILING THE COMPLAINTS

Any affected person can register his complaint through an application at the PD office. The PD will direct the Environment and Social Head of E&ST to address the complainant on the same day. The Environment and Social Head of E&ST will have a maximum of one week to resolve the complaint. If the complaint is not addressed within a week's time, then the complainant can raise a grievance with the GRC.

There are several ways one can report a grievance:

- Contact the PEGO of GRC over the phone. The contact details will be provided by the PD office.
- Send an email to the address provided by the PD office.

The grievance will be reviewed and will be decided by the GRC. If the grievance is not concerned with the project-related activity or the project authority finds that they are working within the applicable GB-EPA standards, the grievance will not be further processed. In these cases, this will be explained in writing to the grievant.

In all the other cases, the GRC will investigate whether they have failed to work to the intended standard and if they have identified measures that might be taken to protect against the incident occurring again.

The grievance mechanism will be made public through public consultations and information leaflets during implementation.

7.4 TYPE OF GRIEVANCE

The following are some environmental issues that could be subject to the grievance from the affected people, concerned public, and NGOs:

- Dust, noise, and air pollution from construction activities
- Nuisance
- Intensive schedule of construction activities
- Inappropriate timing of construction vehicle flow
- Traffic Movement

- Water Pollution
- Waste disposal
- Disturbances to flora and fauna
- Health and safety
- Criminal activities
- Failure to comply with standards or legal obligations
- Non Compliance of EMP
- Social and Cultural Issues.

8 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

8.1 GENERAL

This chapter identifies the potentially significant beneficial as well as adverse impacts of the pre-construction, construction and operational phases of the proposed Project on the physical, ecological and socio-economic domains of the environment. Moreover, appropriate, technically viable, and economically feasible mitigation measures have been suggested for each potentially adverse impact.

Attabad Lake was formed on January 4, 2010, when a huge mass from the right bank of Hunza River slid down near Attabad Village and blocked Hunza River. The inflow filled upstream valley and created a reservoir 14 km long till the end of May 2010. Attabad Lake is about 15 km upstream of Ganish Bridge and about 115 km upstream from Gilgit. Therefore, ALHPP will utilize the Attabad Lake water and head for the generation of the Hydel Electricity. Therefore, due to the implementation of ALHPP project, no major adverse impacts are anticipated.

8.2 METHODOLOGY FOR IMPACT IDENTIFICATION

Selection of an appropriate and customized methodology for the impact assessment is critical for the whole outcome of an EIA study. The identification, categorization and evaluation of impacts were carried out by using various tools such as impact screening checklist, impact assessment matrices and overlay. Based on the notion of significance criteria, each impact was classified. Based on the vast experience of the experts in the field of impact assessment, identification of the potentially significant and non-significant environmental impacts different tools have been utilized as detailed below:

8.2.1 Screening Checklist

Based on the findings of desk studies, processed satellite imageries, and previous studies, a screening checklist was prepared to screen out the potentially significant adverse environmental impacts during the construction and operation phases of the proposed Project. The objective of the impact screening is to assess the significance of the issues related to the atmosphere, climate, water resources, land resources, ecological environment, socio-economic environment, transport, infrastructure and communication, natural risks, hazards, and external constraints of the Project for the proposed development. After the compilation of baseline information, processing of acquired satellite imagery, the screening checklist was filled to screen out the positive and adverse impacts of the proposed Project during the construction and operational phases.

8.2.2 Impact Matrices

Various EIA methodologies are available for the identification of impacts including the checklist and the project impact matrix. Among these methods, the project impact matrix was used as impact identification methodology for the identification of temporal-based impacts.

The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e. Y-axis), and on the other axis (i.e. X-axis) the different environmental parameters likely to be affected by the proposed project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix is used by dividing the project action into different phases (design / pre-construction, construction and operational phases).

8.2.3 Overlays

In order to identify spatial-based impacts, overlays were used. An overlay is based on a set of transparent maps, each of which represents the spatial distribution of an environmental characteristic. Information for an array of variables such as land use, infrastructure, vegetation, etc. is collected for the standard geographical units within the Study Area are recorded on a series of maps, typically one for each variable. These maps are overlaid to produce a composite map. The resulting composite maps characterize the area's physical, social, ecological, land use, and other relevant parameters related to the location of the proposed project interventions (such as the construction of Cofferdams, Sediment Flushing Tunnel/Under sluice, Flexible/Rigid Overflow Structure, Headrace Tunnel, Surge Tank, Penstock, Powerhouse, Tailrace Channel, Switchyard and Project colony).

8.2.4 Notion of Significance

The “notion of significance” was based on the following criteria:

- **Extent:** The scale of impact, i.e., limited to the immediate areas of development activity (the site); limited to within a distance reach of the development; affecting the region as a whole; or occurring at a national or international scale;
- **Duration and Frequency:** A prediction/forecasting of the lifetime of the impact: i.e., short-term; medium term; long term with the impact ceasing after the operational life of the development; or considered permanent and how many times the event will occur during that period;
- **Intensity:** A description of the intensity (magnitude/size) of the impact: i.e., high, medium, low, or negligible (no impact). The specialist studies must attempt to quantify the magnitude of impacts and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact;
- **Reversible/Irreversible:** Changes considered irreversible, for example, the loss of biodiversity within a river due to a change in water quality;
- **Probability:** The likelihood that the event will actually occur; and
- **Legal Restriction:** If the action is likely to affect, or be affected by a legal restriction.

Taking into account these criteria, potential significance was classified as either:

- **Low:** an impact for which no mitigation is necessary;
- **Medium:** an impact that requires effective mitigation; and
- **High:** an impact, which, if not mitigated, could stop the Project from proceeding.

The potentially significant impacts were then further investigated in detail to carry out a comprehensive assessment of the significant impacts.

PROJECT IMPACT EVALUATION MATRIX																								
Environmental Impacts	Topography	Seismicity	Air Quality	Noise and Vibration	Sedimentation	Flooding	Soil Contamination/ Erosion	Visual and Aesthetic Value	Surface Water and Drainage	Landslides	Solid Waste and Wastewater generation	Flora	Fauna	Livestock	Fishery	Mobility of Locals / Transportation	Social/Cultural Issues	Gender Issues	Health & Safety of Workers & Community	Archaeological/Historical and Religious Sites	Agriculture	Public Infrastructure	Livelihood	Resettlement
	Project Activities																							
A. Design and Pre-construction Stage																								
Field Investigations	o	X	x	x	o	X	o	o	x	x	x	x	x	x	x	x	x	x	x	o	o	o	•	o
Land Acquisition	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	x	x	x	o	o	X	X	X	X
B. Construction Stage																								
Clearing of Land, Digging and Excavation	X	o	X	X	X	x	X	X	X	X	X	X	X	x	x	X	X	X	X	x	X	x	X	o
Upgradation of access roads and construction of roads within the Project Area	X	o	X	X	X	x	X	X	X	X	X	x	X	x	x	X	X	X	X	o	X	x	x	o
Storage of Material	x	o	x	o	X	o	X	x	x	X	x	o	o	o	o	o	x	x	X	o	o	o	o	o
Construction Camps	X	o	X	X	X	X	X	X	X	X	X	x	x	o	x	X	X	X	X	o	X	o	•	o
Coffier Dam Construction	X	o	X	X	X	X	X	X	X	X	X	o	o	o	X	X	x	x	X	o	o	o	o	o
Wier Site Construction	X	o	X	X	X	X	X	X	X	X	X	o	o	o	X	X	x	x	X	o	o	o	o	o
Headrace Tunnel Construction	X	o	X	X	X	X	X	X	X	X	x	X	x	X	X	x	x	X	o	o	o	o	o	o
Surge Tank & Penstock Construction	X	o	X	X	X	X	X	X	X	X	x	o	o	o	X	x	x	x	X	o	o	o	o	o
Sediment Flushing Channel Construction	X	o	X	X	X	X	X	X	o	X	x	x	o	x	X	x	x	x	X	o	o	o	o	o
Powerhouse Construction and Electro Mechanical Works	X	o	X	X	X	X	X	X	X	X	X	X	X	o	X	X	X	X	X	o	o	o	o	o
Use of Heavy Machinery/Equip	o	o	X	X	X	o	X	o	o	o	X	x	x	x	o	x	x	x	X	o	x	o	o	o
Wastewater Storage and Disposal	x	o	x	o	x	o	x	x	X	o	X	x	x	x	X	o	x	x	x	o	X	o	•	o
Solid Waste Storage and Disposal	x	o	x	o	X	o	X	x	x	o	X	x	x	x	X	o	x	x	x	o	X	o	•	o
Leakage & Spillage of Oils and Chemicals	o	o	x	o	X	o	X	o	X	o	X	x	x	x	o	x	x	x	o	o	o	o	o	o
Security Fencing and Lightning	X	o	o	o	o	o	o	X	o	o	o	o	x	o	o	X	o	o	X	o	o	o	o	o
C. Operational Stage																								
Landscaping	•	o	•	o	o	o	•	•	o	o	o	•	•	o	x	o	o	o	o	o	o	o	•	o
Hydropower Operations	X	o	x	X	X	X	X	x	X	X	x	o	x	x	x	X	x	x	X	o	•	o	•	o
NOTE: The above matrix shows the impact magnitude without any mitigation. With the application of mitigation, the magnitude of impacts will be either insignificant or low.																				Beneficial		Adverse		
																				•	Low	x		
																				•	Medium	X		
																				•	High	X		
o	Insignificant or No Impact																							

Figure 8-1: Project Impact Evaluation Matrix

8.3 ANTICIPATED POSITIVE IMPACTS OF THE PROJECT

8.3.1 Environmental Benefits

The GB is known for its outstanding natural beauty, high peaks, and landscape and it is a popular destination among tourists from both Pakistan and abroad. The GB offers tourists opportunities for outdoor activities such as hiking, fishing, and trophy hunting. During the construction phase of the project, the related equipment and influx of people will temporarily affect the visual and landscape values of this area. However, during the operation phase, the existence of the Flexible / Rigid Overflow Structure, headrace channel, powerhouse, and other structures will change the visual amenity of the Project area impacting the surrounding landscape and views.

The Project not only reduces or replaces equivalent electricity generation sources with all the associated environmental benefits but will also help to avoid all associated pollution caused through extraction, processing, storage, and transportation of conventional fuels required for fossil fuel power generation plants. The Project will avoid annual releases of about 149,476 tons of CO₂ from an equivalent thermal plant, which would have a corresponding reduction in atmospheric pollution.

The sustainable power supply with the development of the proposed Project is likely to attract more tourists to the Project area and will increase local business and recreational activities. Impact relating to recreational activities is considered to be moderately positive.

8.3.2 Employment

Electric power is a prerequisite to any other investments. Without electricity, both human and physical resources will remain unutilized for increasing the welfare of the masses and for providing income opportunities at or near the level available to people in the developed part of the country.

The proposed Project will also provide skilled and unskilled jobs during the implementation phase and a limited number of jobs during operation and maintenance. This will be a bonus for the locals of the area; who are migrating to down country for employment. Considering the other planned hydropower projects in the region, a highly skilled human resource will be developed which can be used in hydropower projects planned in the near future.

8.3.3 Impact on the Local Economy

Increased incomes in the area will encourage the formation and growth of local businesses, which will result in new indirect employment opportunities. In combination with programs for assistance and advice, opportunities will arise both to improve agricultural productivity and to develop new businesses.

During the operation phase, the main economic benefits of the Project will be those resulting from increased power availability locally. The lack of reliable and economical power supplies is considered a key constraint in the development of the entire Project area.

8.3.4 Exploitation of Natural Resources

The non-availability of electricity is a major constraint to undertake farm cultivation program on a large scale. There are no cold storage facilities to preserve fruits which can earn substantial income for the orchard growers. Hunza and Nagar valleys have precious mineral resources which have remained unexploited. The availability of electricity will certainly develop a set-up on a large scale to preserve fruits and for the exploration of minerals.

8.3.5 Tourism

The Gilgit-Baltistan region and its valleys are tourist paradises for tracking and mountaineering. At present, a few opportunities under Government's social and infrastructure development programs are available for the educated and skilled workforce in various trades. The reliable energy sources and transmission network are key factors for the development of tourism and mountaineering.

8.3.6 Trade Route to China

The opening up of the Gilgit-Baltistan region to China has provided an incentive to the local entrepreneurs for self-employment and outlets for income generation. Hunza is developing into a central city for economic activities for tourism. With the provision of the basic infrastructural facility of electricity, Hunza and its surrounding towns have the potential for development in the coming years. Sost is the last town of Gojal, Upper Hunza inside Pakistan on the Karakoram Highway before the Khunjerab Border. Currently, this region is also facing the shortfall of electricity and only Misghar power station is installed nearby this town. After commissioning the Proposed Project, the current electricity shortfall scenario will be changed and routine trade will be accelerated.

8.3.7 Impacts on Social Life

The Project with an installed capacity of 54 MW, will generate 373.69 GWh of electricity annually, which will assist in meeting the power demand of the Hunza Region. The project will implement several programs that are designed to improve the living standard of the area. These programs will provide improved health, education, and infrastructure facilities, while other programs will provide alternative sources of income and create improved employment opportunities.

Access roads will be built as part of the Project and will facilitate the people for goods and services accessibility. After the completion of the Project, these facilities and infrastructure will be available to the general public. Moreover, health facilities created during the construction phase will be available to local communities.

8.3.8 Clean Development Mechanism (CDM) Benefits

The CDM is an emission reduction (ER) trading agreement under the Kyoto Protocol between two countries, where greenhouse gas emissions are reduced in a non-annex country and transferred to another country. Recently, a number of international organizations such as

Asian Development Bank (ADB) have established a means of purchasing (CER) units. Unit can be traded in the open market on exchanging.

For the purposes of this analysis, it is assumed that the 373.69 GWh generated annually by this project will displace about 149,476 tons of CO₂ at 0.40 kg/kWh. One ton of CO₂ corresponds to CER, which is currently valued about 1.5 US\$. Therefore, the CDM benefits worth will be 29.921 million PKR per annum.

8.4 ANTICIPATED IMPACTS DURING PRE-CONSTRUCTION PHASE

This section identifies the potentially adverse environmental impacts anticipated during the pre-construction phase of the Project along with their mitigation measures.

8.4.1 Physical Environment

a. Impacts due to Field Investigations

Potential Impact

Low-level adverse impacts on the air quality, increase in noise level, contamination of surface water quality and soil erosion due to the pre-construction activities like geotechnical investigations including drilling, topographical surveys and seismic investigation will affect the existing settings. Activities like drilling, blasting, movement of machines, and setup of EPC Contractor and Consultant camps will also impact the soil, wildlife, noise levels, etc. This impact would be of medium significance.

Mitigation Measures

Good engineering practices and Standard Operating Procedures (SOPs) are required to be adopted by the EPC Contractor to mitigate this impact.

Measures such as sprinkling of water on the roads and dirt tracks, use of water to reduce air pollution during the stone-crushing operation and tuning of vehicles and equipment will reduce the air pollution. The excavated material will be managed by ensuring proper storage areas, located far away from the water bodies. The choice and design of these measures such as reduction of slope gradient and height, reduction in slope angle, removal of unstable material, use of reinforcement material, etc. will be the responsibility of the EPC Contractor. The EPC Contractor will be required to train his workforce in the storage and handling of materials, like oil, diesel, petrol, and chemicals, etc., which may potentially cause soil contamination. Special measures will be adopted to minimize the impacts on the nearby settlements such as avoiding noise generating activities during night-time, etc.

b. Seismic Hazard

Potential Impact

The Project area falls in Seismic Zone 2B (moderate hazard), which represents Peak ground acceleration from 0.16g to 0.24g, where g represents acceleration due to gravity. In this Zone,

the designing of various types of structures is done on the basis of Peak Ground Acceleration (PGA). A high-intensity earthquake impacting the poorly designed project site can adversely impact the future development.

This factor requires special consideration of the designers keeping in view of the above points and the impact of the earthquake of October 08, 2005.

The main tectonic features around the project site within a radius of 200 km which could be controlling the maximum earthquake hazard are as follows: Hunza Fault, Main Karakoram Thrust (MKT), and Main Mantle Thrust (MMT).

The significance of the impact is high to medium adverse.

Mitigation Measures

The proposed structure should be designed to withstand moderate to high earthquakes. A very careful analysis of the situation will be required during the design stage, as per ICOLD Guidelines and using the latest software. For seismic hazard analysis, updated structural and seismic evaluations should be consulted. Moreover, geotechnical investigations must be conducted prior to the construction phase.

Continuous monitoring of the behavior of faults will be required during the operation stage and contingency plans to deal with such a situation must be part of the project management. Instruments to monitor seismic activity must be installed at the time of construction.

Based on the analysis, the following earthquakes design parameters are concluded and recommended for the proposed project:

Operation Basis Earthquakes (OBE): OBE at a return period of 145 years is recommended as follows: OBE Horizontal = 0.24g and OBE Vertical = 0.17g

Safety Evaluation Earthquakes (SEE): For the design of dam or Flexible / Rigid Overflow Structure, the following PGA 'g' values for SEE (Safety Evaluation Earthquakes) are recommended: SEE Horizontal = 0.44g and SEE Vertical = 0.29g

For the design of appurtenant structures, the following PGA 'g' values for SEE (Safety Evaluation Earthquakes) are recommended: SEE Horizontal = 0.38g and SEE Vertical = 0.26g

c. Impacts on Flooding

Potential Impact

Flooding of the Hunza River at the Flexible / Rigid Overflow Structure site is not a common feature although some floods of high intensity have been recorded in the past at upstream site e.g. the Glacial Lake Outburst Floods (GLOF) at Shimshal River.

Flood at the proposed Project site has been estimated from the available record using different methods. Instantaneous peak flows for the period 1966 to 2015 have been presented in the **Figure 8-2**.

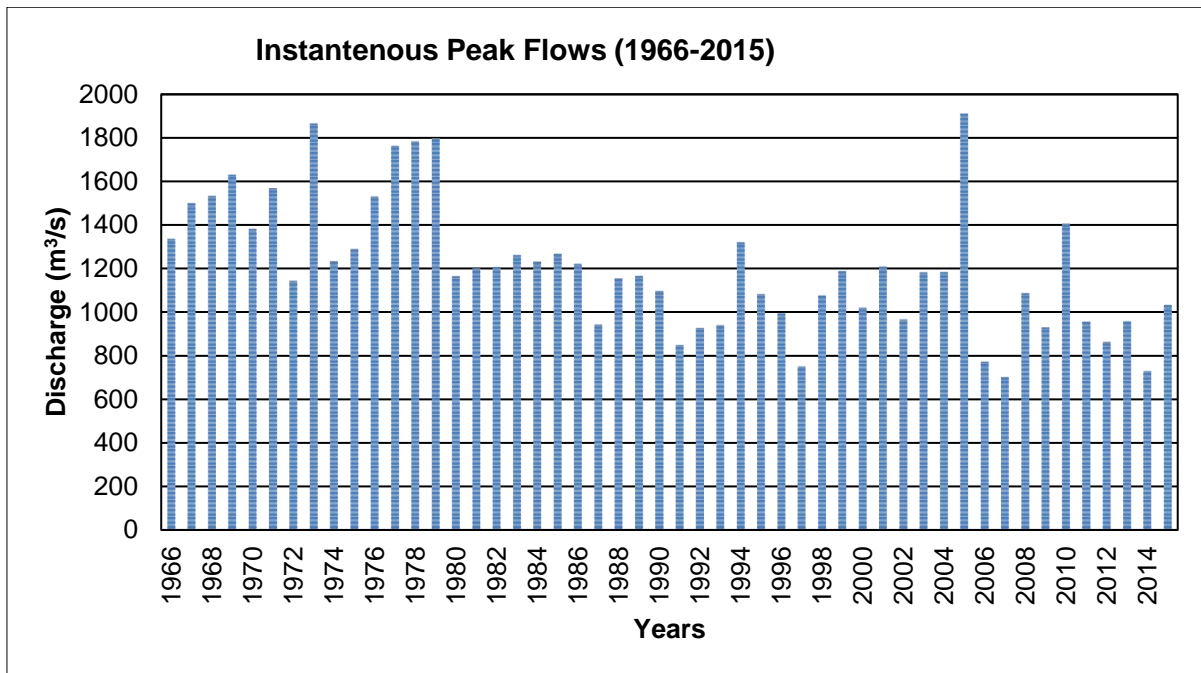


Figure 8-2: Instantaneous Peak Flows at Attabad Lake HPP Site

Confidence intervals of 5% and 95% have been used for the calculations of flood. As per the model, flood for a 1000-year return period from the computed curve has been calculated as 2,559 m³/s and from the expected probability curve it is 2,695 m³/s. Flood for a 10,000-year return period, is 3,016 m³/s from the computed curve and 3,292 m³/s from the expected probability curve. With the confidence interval of 5% and 95%, maximum flood values are 3,682 m³/s and 2,606 m³/s. ¹⁶

The flow in Hunza River varies greatly at different times of the year, the discharge is at a minimum during the colder months when Attabad Lake is frozen, and there is a rise of water in the spring and early summer seasons when glaciers melt.

Recently, a massive GLOF occurred in Hunza district's Hassanabad village sweeping away the Hassanabad Bridge on the Karakoram Highway. The Shisper Glacier started discharging 5,000 cusecs of water owing to premature melting, leaving Hunza, Gilgit disconnected.

As river water will pass through the headrace tunnel and overflow spillways, there is a chance that these tunnels and spillway could not accommodate the flows in abnormal years, which may pose a threat to the main structures and this impact may be treated as High Significant.

Mitigation Measures

Keeping in view the different types of flood estimations and generation of high peaks due to GLOFs, it is recommended to adopt design flood of 10,000 years return period at Flexible /

¹⁶ Using Hydrologic Engineering Center's (HEC) Statistical Software Package (HEC-SSP) Software.

Rigid Overflow Structure site. Therefore, design flood of 3,250 m³/s at Flexible / Rigid Overflow Structure site has been assumed for the calculations of the design of structures.

It is also suggested to have close monitoring of Glaciers in Hunza Region to have better judgment of GLOFs and remedial measures for the safety of Attabad Lake and downstream areas. However, a comprehensive study will be undertaken during Detailed Engineering Design of the Project by the EPC Contractor.

d. Resource Conservation

Potential Impact

Resources involved in the construction of the proposed Project would include water, fuel, and construction materials.

Excessive water consumption by the construction staff may stress water resources in the Project Area and in certain cases may disturb the existing water supplies in the Project Area. Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, sand, lining material, earthworks, reinforced and structural steel, etc. Almost all the materials to be used in the construction of the proposed Project are non-renewable and, therefore, their efficient use is necessary for the future use.

Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For the conservation of energy, the efficiency of the engines and burning processes is important. The impact significance is medium adverse.

Mitigation Measures

Following practices shall be adopted to conserve these natural resources:

- Use water bowser tanks for construction works and mineral water bottles/ground water for drinking purpose;
- Reduction of wastage of water through training of workers involved in water use;
- Reuse of construction waste materials may be adopted wherever possible;
- The efficient and well maintained equipment and machinery should be used;
- The equipment and machinery should be turned off when not in use;
- Ensure adequate insulation to reduce heat loss through batching plants;
- Regularly monitor CO and CO₂ content of the flue gases to verify that combustion systems are using practical excess air volumes; and
- A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels.

8.4.2 Ecological Environment

a. Flora

Potential Impacts

During the pre-construction phase, activities such as installation of the construction camps, construction of temporary/access roads and mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is medium significant and needs to be encountered prior to the start of the construction stage.

Mitigation Measures

- The camps, mobility of machinery and construction of temporary/access road should be properly planned and well designed to avoid any loss to local green cover;
- It is recommended to establish the construction camps where minimum or no vegetation exists, as per criteria provided in section 3.7.12;
- Similarly, the alternate routes for roads and location for camps are recommended where no loss of vegetation is expected; and
- An inventory of trees/vegetation may be prepared by the EPC Contractor with the help of the concerned department (Forest) before clearing the site.

b. Fauna

Potential Impacts

As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary access road (if any) may also affect the habitat of locally available fauna. This impact is of low significance.

Mitigation Measures

- The standard measures must be adopted to minimize noise due to machinery movements and installations;
- EPC Contractor shall ensure compliance with NEQS.
- Wildlife movements and routes must be considered during activities and should be avoided to their maximum level;
- The camps shall be properly fenced and gated to check the entry of animals in search of eatable goods; and
- Wastes of the camps shall be properly disposed of to prevent them from being eaten by local fauna/avifauna, as it may be hazardous to them.

c. Aquatic Life

Potential Impact

Fisheries Department Hunza has introduced several thousand fingerlings of exotic fish species namely *Salmo Trutta Fario* (Brown Trout) at Attabad lake and downstream river during the period from 2012 to date for propagation and the said specie has made breeding grounds at Attabad lake and downstream as well. Besides this, a number of indigenous fish species also exist in the same water bodies having commercial as well as ecological importance. The destruction of habitat will have significant adverse impact on the aquatic life and fisheries.

Fish usually migrate from one place to another in search of food, shelter, and spawning / breeding. Due to the implementation of the proposed Project fish migration might be affected up to some extent. Water requirements and movement of aquatics along with other risks may also be anticipated due to the proposed project. This impact is categorized as medium to high significance.

Mitigation Measures

- Annual restocking plan of fish fingerlings shall be included in the project to compensate the stock depletion due to decrease in fish breeding grounds.
- Fish ladder shall be in sure for free movement of fishes;
- Fish screening system shall be developed so that fish may not be trapped at the fore bay or penstock pipe or channel.
- Besides the above-mentioned points a Fisheries research unit and a brown trout hatchery with research/management staff should be established at the project site for research purposes as well as impact assessment during the construction as well as operational phases of the said project.
- The establishment of fish hatcheries under this project should be ensured by GB Fisheries Department, Hunza in close consultation and coordination with GB EPA;
- The minimum flow to be ensured through the Flexible / Rigid Overflow Structure during the whole year. In case the hydrological records are enhanced, the figure of minimum requirement for maintenance of aquatic ecosystem has to be revised likewise;
- To conserve the freshwater fishery resources, it is important to involve fisheries scientists and local communities in all study phases of proposed project;
- Moreover, the impact on fish fauna, both up and downstream of the project site specially the migration patterns and breeding grounds need to be taken into account during all stages of the project and should be monitored by the contractor specialized professionals in consultation with GB, Fisheries Department Hunza;
- GB, Fisheries Department has the authority to update, change and add/recommend any standard as per law of land and in best public interest; and
- The custodian Department should have a close liaison with GB EPA and Fisheries Department GB to ensure the conservational aspects of fisheries during all stages of the project to avoid any negative impacts on the local natural environment.

8.4.3 Socio-Economic Environment

a. Permanent Land Acquisition

Potential Impact

Permanent land will be acquired for the Project components such as Powerhouse, Flexible / Rigid Overflow Structure & Associated Structures, Access Roads and Project Colony. Total permanent land to be acquired is approximately 183 Acres (05 Acres for Contractor's Camp, 60 Acres for Project Colony and Powerhouse Area, 103 Acres for Intake Area and Access Corridor and 15 Acres for Spoil Area) which includes both private and government land. This will result in loss of land. Similarly, due to the impounding of reservoir area, based on 2424 m.a.s.l, the estimated land required is 777.5 Acres. However, the estimation of land requirement will be finalized after the detail design by the EPC Contractor.

The ownership record of affected land will be prepared by the Revenue Department according to separate categories of the land. The significance of impact is high adverse needs to be encountered prior to the start of construction stage.

Mitigation Measures

Government owned land for the Project area will be acquired as per the policy of government of GB. While private land will be acquired as per provision of LAA, 1894. The process of land acquisition will start before the Project will enter into the construction phase and section-4 of land acquisition act, 1894 will be notified by relevant agency.

The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the displaced by providing sufficient budget in the project cost.

b. Temporary Land on Rental/Lease Basis

Potential Impact

During the construction activities, the EPC Contractor will establish contractor camps, storage areas for materials and equipment including vehicles, workshops, stockpile yard, etc. The EPC Contractor need to lease the land for these areas in the vicinity of the construction sites. These areas will be acquired on temporary basis by direct negotiation and agreement with the owners or negotiated with or decided by the district administration office. Temporary acquisition will principally be the responsibility of the contractor. The significance of impact is high to medium adverse.

Mitigation Measures

Land for the above-mentioned facilities will be directly rented from the private landowners by the EPC Contractor. The provisions of the Land Acquisition Act (LAA), 1894 will not be involved as the acquisition of the land will be temporary and will be covered by short-term lease agreements between the landowners and EPC Contractor. Temporary acquisition will

principally be the responsibility of the EPC Contractor. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be made in the local language to make the process clear.

As mentioned the locations of these areas are not finalized yet; therefore, a criterion has been suggested which should be followed to avoid the adverse impact on the environment. The land for above-mentioned facilities should be selected and leased prior to the start of the construction phase.

Lease agreement should also govern the process of site restoration of the leased or rented land after the construction phase and will ensure through the terms of the construction contracts that landowners are compensated according to the terms of the lease agreements and the site restoration plans agreed upon by the EPC Contractor are duly carried out.

The following general site selection criteria have been suggested to be complied by the EPC Contractor:

- Minimize the resettlement, and relocation of the existing infrastructure like roads, cultural and religious sites, etc. and avoid the cutting of trees;
- It should be elevated to avoid floods and for other security reasons;
- Proximity to the major disaster and emergency management authorities;
- Avoid potentially security vulnerable areas;
- Minimize disturbance to the natural habitats of flora and fauna;
- Avoid densely populated areas/towns;
- Avoid wildlife sanctuaries, national parks, and game reserves;
- Appropriate distance from the sensitive receptors (for instance, minimum 500m); and
- Avoid cultural, religious, and historical buildings.

c. Impact on Miscellaneous Structures

Potential Impact

In the reservoir area of the proposed project, miscellaneous residential, commercial, and community structures will be affected due to the project intervention. These structures will be demolished permanently and will have to relocate and move their dwellings elsewhere. The community and religious structures are very sensitive to impact and need special care during execution of the project; because people think that these structures might not be rebuilt if once demolished. A graveyard fall in the reservoir area of the proposed Project. Shifting and demolishing the graveyard may cause serious social issues. Due to adverse impact on the residential, commercial, and community structures, the human disturbance will occur which creates magnitude social, gender, livelihood, and cultural issues. This impact can be categorized as negative, local, high, permanent, and irreversible. The inventory of structures along with the detailed measurements of structures will be completed by the EPC contractor during the phase of detailed planning.

Mitigation Measures

- Due consideration should be given to minimum and no impact on the residential, commercial, and religious structures;
- Compensation for the affected structures should be evaluated and provided as per market rates.
- Compensation should be given for all affected crops and trees;
- The effort will be made by making changes in design to avoid the sensitive and religious structures and to minimize the issues to the possible extent. If needs demolishing/shifting, a mechanism will be developed for the restoration of these structures during the detailed design by the EPC contractor with the community consultation;
- Affected Persons should be compensated for the full replacement cost of each category to construct a new structure of the same type; and
- Proper consultations and coordinations with project affected persons during the resettlement process.

d. Other Social Issues

Potential Impact

During the planning and design phase of the project, it is anticipated that there will not be any potentially significant adverse impact on the socio-economic environment. Locals may be temporarily disturbed due to the field investigations and drilling activities, disturbance to electricity poles and existing tracks/roads within the project boundary. This impact can be categorized as medium Significant.

Mitigation Measures

- Proper compensation and restoration mechanism of public utilities will be considered during the detailed design of the Project;
- Complete rehabilitation of affected public utilities will be ensured;
- The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department;
- Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area;
- Timely public notification of unexpected disruption of services; and
- Good engineering practices shall be adopted to avoid or reduce these impacts.

8.5 ANTICIPATED IMPACTS DURING CONSTRUCTION PHASE

The construction phase impacts are mostly of a temporary nature and their magnitudes are subject to the engineering management practices adopted during construction. Such impacts are related to soils (erosion and slope stability), water quality, noise, air quality and disruption to the biological environment, public health, interruption of communications, at-risk population / safety, community stability, and cultural and religious values / properties. The anticipated impacts during the construction phase are discussed below.

8.5.1 Physical Environment

a. Aesthetics

Potential Impact

Attabad Lake is an important recreational site for the tourists including foreign visitors. Construction activities may result in some visual impacts. The construction activities will involve the cutting of trees / bushes, excavation, soil filling and cutting operation. This disturbs the natural scenic value of the environment. In addition to that the sitting of construction equipment and the lacks of resurfacing / replanting of exposed areas are also the leading factor to aesthetic reduction. The impact significance is medium adverse.

Mitigation Measures

The adverse environmental impacts related to the aesthetic could be effectively minimized at the construction phase. These will be mitigated by the control of clearing vegetation to the area in the construction limits and by plantation and quick re-vegetation during the construction phase. Good house-keeping, cleaning, and efficient solid waste management system should be implemented to improve the aesthetics of the working environment.

b. Topography

Potential Impact

Construction activities are not expected to impact the topography of the area significantly except for those areas where physical activities including digging and excavation, storing or dumping sites for excessive material, and movement of heavy construction machinery will be carried out. The excavated material will be generated due to the construction of various components of the Project such as the construction of Cofferdams, Sediment Flushing Tunnel/Under sluice, Flexible / Rigid Overflow Structure, Headrace Tunnel, Surge Tank, Penstock, Powerhouse, Tailrace Channel, Switchyard and Project colony. The area where excavated material is to be dumped may also be impacted. The impact significance is medium to low adverse.

Mitigation Measures

The excavated material will require safe disposal by the EPC Contractor. Most of the excavated material could be used for back-filling purpose, where applicable. A detailed development and operation plan for borrow areas must be prepared by the EPC Contractor before the starts of extraction of material from each borrow area. EPC Contractor should strictly follow the provisions of approved plan in order to minimize any adverse impact associated with the borrow areas. Likewise, excavated material should be dumped at suitable and approved disposal sites.

c. Landslide

Potential Impact

The construction activities for the proposed Project interventions involving cutting of rocks by blasting (where applicable), excavation, dumping of soil and to create space for the headrace tunnel and other structures may disturb the stable geological formation of the area.

High seismic potential and unstable geological formations are two major causes of land sliding in the area. Landslides are common in the project area due to the high steepness, unstable geological formations on both sides of the river, and common seismic activities. These effects could promote landslide in an unstable area. Furthermore, due to the Project activities, especially in case of blasting or cutting of rocks in some areas, the formation will become loose and the risk of landslides will increase in the immediate vicinity of the construction sites, especially at the right bank of Hunza River, which may be considered as a high adverse impact. The impact significance is high to medium adverse.

Mitigation Measures

To avoid the major risks, all structures have been proposed on the left bank of the Hunza River. Blasting should be avoided or minimized where possible, if inevitable then low intensity explosive material should be used instead of high intensity explosive material. It is strongly recommended to perform appropriate confirmatory geotechnical investigations all along the alignment of the Headrace tunnel and other components for assessing strength parameters of natural material either rocks, moraines, or scree. This shall be done so that the safety of this major Project component and adjacent areas can be ensured through the proper design of cut slopes.

Landslide risks shall be mitigated by the installation of safety barriers at construction sites, and by monitoring and informing locals about construction schedules, and any weather events that might exacerbate landslide risk. Construction work will be avoided during rain to the extent possible. The EPC Contractor will prepare the Management Plan for blasting activities and implement the same after approval from the Management Consultant and Client.

d. Site Accessibility

Potential Impact

The proposed Project Area falls within the Hunza Valley which is located about 115 km from Gilgit city. The Project site can be accessed through Karakoram Highway (KKH) which is the only major mode of transportation in the Project area. Heavy vehicles will be utilized to transfer construction plants, equipment, construction materials, cement and fuel. These activities may have adverse impacts on the existing infrastructure. Apart from that it may cause air and noise pollution. The impact significance is high to medium adverse.

Mitigation Measures

The access roads to the hydropower site have to be pre-determined in consultation with the concerned departments. Access roads would have to be widened and/or improved to carry the anticipated load of traffic.

During the course of the construction of the proposed Project, the EPC Contractor will provide the signage and/or traffic control to the extent deemed necessary by the traffic utilizing or accessing the site roads. These signs will inform, control, warn, shift, or stop traffic on all site roads affected by the Project's heavy traffic. The following measures will be taken by the EPC Contractor during the construction phase for the effective implementation of the traffic plan:

- National and local traffic rules and regulations, instructions manual for motor vehicle and mobile machinery operation should be followed;
- No one will be allowed to drive motor vehicle or operate mobile machinery without a driving license;
- It should be prohibited to drive or operate vehicle in case of over fatigued or mental disease;
- Traffic speeds on unpaved roads should be limited to no more than allowable traffic speed;
- Traffic speed signs should be displayed prominently at all site entrances;
- A daily routine check-up of vehicles should be conducted no less than 5 minutes before its service;
- Use of appropriate signs, equipment, and traffic control measures that conform to the provisions in the traffic manual of city traffic police;
- Traffic inspection and security during transportation;
- Limit vehicular traffic to designated access roads, construction laydown areas, parking areas and the Project site;
- All damaged, destroyed or modified pavement legend, traffic control devices, signing and striping associated with the proposed development should be replaced as required prior to issuance of a certificate of occupancy; and
- Construction signs, lighting and barricading should be provided during construction as required.

The EPC Contractor should also be responsible to prepare a comprehensive Traffic Management Plan and follow the conditions of the Contract Agreement.

e. Natural Drainage

Potential Impact

Construction activities such as excavation, filling and construction will affect the existing soil pattern in the Project Area including water pathways in its surroundings. In addition, this will lead to changes in the existing drainage pattern. The conditions will be more hazardous during the flood periods and may affect the construction activities. The impact significance is high to medium adverse.

Mitigation Measures

During the construction phase, excavated material should be properly disposed of ensuring that it will not block the natural drainage paths. Open drains for drainage of rain/flood water should be constructed, if considered necessary during the construction period.

f. Soil Contamination & Erosion

Potential Impact

During the construction phase of the proposed Project, large quantities of materials, chemicals, fuel and lubricants will be used apart from the generation of solid waste and liquid waste from the construction camps. Fuels and chemicals will be stored at the site for their immediate use, which will contaminate the soil if not handled properly, particularly at asphalt plant sites, workshop areas and equipment washing yards.

Similarly, the removal of vegetation and shrubs for the purpose of construction activities will lead to loosing of the soil, soil disturbances, and exposure of bare soil surface. This causes problems of soil erosion during rain. Similarly, steep gradients increase erosion on these slopes due to reduced water infiltration and increased runoff accumulation. Soil erosion may also occur in the workshop areas as a result of the improper drainage system of equipment washing-yards and improper management of construction activities. The impact significance is high to medium adverse.

Mitigation Measures

- Sites disturbed by construction activities will be restored to their original conditions upon completion of construction work and photographic record will be maintained to ensure pre-post subproject conditions intact;
- Soil contamination by asphalt should be minimized by placing all containers in caissons;
- The EPC Contractor will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination;
- Material Safety Data Sheets (MSDS) will be strictly followed during the handling and storage of chemicals;
- If any contaminated soils are found at the construction sites or at camp sites, they shall be removed and deposited in a sealed pit in a designated area;
- The EPC Contractor will be required to prepare training manual and modules for all the construction related activities along with the schedule of training program and submit them to the Supervision Consultant for approval;
- Solid waste generated at the camp sites will be properly treated and safely disposed only in the demarcated waste disposal sites/areas;
- Subproject sites will be selected to avoid or minimize vegetation removal/clearing which would accelerate erosion and increase landslide risk;
- The EPC Contractor shall adopt good engineering practices that will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas; and

- Site restoration plan for the Project should be strictly followed.

g. Wastewater Generation

Potential Impact

Wastewater will be generated at the construction camps, from construction activities and residential colony (for EPC Contractor, the Consultant and the Employer staff). If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water apart from soil contamination. Water from dewatering activities (during rainy season) has the potential to contain suspended solids and oil and grease and if disposed of untreated may affect the soil quality. The **Table 8-1** provides the anticipated composition and estimate of the wastewater to be generated during the course of the construction phase of the project assuming that on average the water demand per person is 40 liters per day and that 80% of the water demand will become wastewater.

Table 8-1: Estimated Wastewater Generated by Workers in Construction Camp

No. of Workers*	Estimated Total Water Demand** (liters/day)	Estimated Wastewater Generated (liters/day)***
350	14,000	11,200

* Refer Table 3-7 "Estimated Work Force Requirements"

** = (350) x (40) = 14,000 liters/day

*** = 14,000 (80%) = 11,200 liters/day

This 11,200 liters/day (approx.) of wastewater will be generated from the construction camps. This impact would be of medium significance.

Mitigation Measures

To dispose of the liquid waste generated from the construction activities, the following steps will be taken by the EPC Contractor:

- Domestic and chemical effluents from the construction camp will be disposed of by the development of on-site sanitation systems i.e. septic tanks (as provided in **Figure 8-3**);
- The domestic sewage will be treated with biological treatment technology and will be discharged as per NEQS. Proper monitoring to check the compliance of NEQS will be carried out;
- Proper monitoring to check the compliance of NEQS will be carried out. Septic tank will be located adjacent to the construction camp;
- Sewage from construction camps will be disposed of after proper pre-treatment;
- Water discharged to drains should contain a minimum quantity of suspended solids; and
- Site for construction camp will be selected at least 500 m away from the settlements.

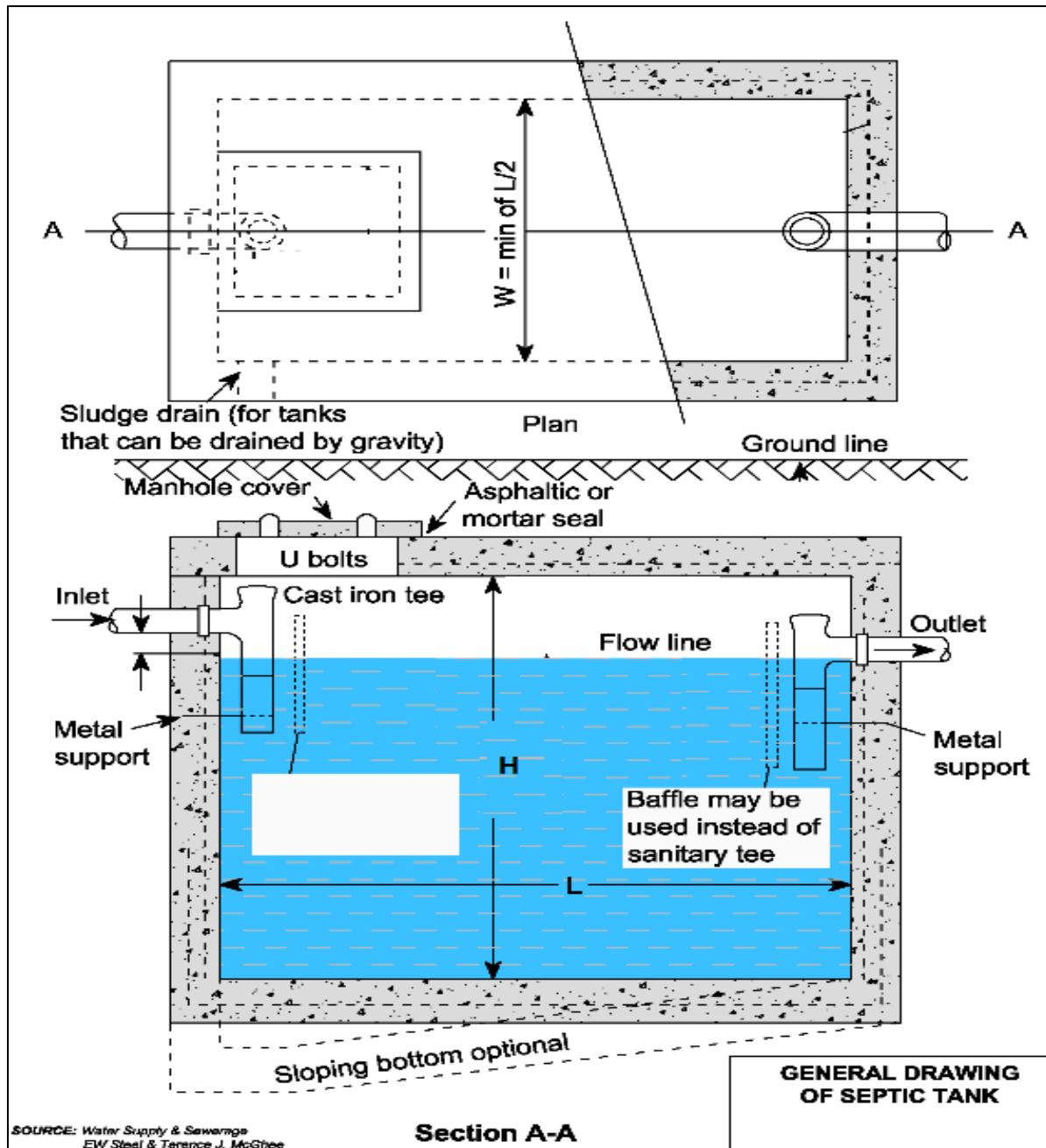


Figure 8-3: General Drawing of Septic Tank

h. Generation of Solid Waste (Construction, Municipal and Hazardous Waste)

Potential Impact

Different types of waste including construction (waste concrete and asphalt, empty containers, excavated material), municipal (from construction camps) and hazardous wastes (including empty containers of paint, lubricants, grease, fuel oil, electrical wiring, pipes etc.) are likely to be generated during the construction phase of the proposed Project and from the EPC Contractor's Camps (the solid waste generation is estimated to be 157.5 kg/day for 350

construction workers assuming 0.45 kg/capita/day waste generation)¹⁷, which may have potential to serve as breeding grounds for the disease spreading vectors and rodents. During the construction phase, significant quantities of rock will to be excavated. In order to reduce the amount of rock to be disposed of, excavated rock can be used in the Project for different types of infrastructural works. The remaining spoil will be disposed in designated and safe disposal areas. Throwing away solid wastes into water channels may cause blockages in drainage channels, contamination of nearby water bodies and soil contamination (rendering them unfit for plantation).

Empty containers containing toxic, flammable, and corrosive materials may pose a hazard to the workers. This may result in health risks to the workforce and the public if the disposal site is improperly selected.

All these, if left unattended, can become a source of nuisance and environmental pollution in the subprojects area. Discarded materials and equipment may also pose traffic safety risks if left on or near transport routes. This impact is moderate adverse in nature.

Mitigation Measures

- Minimize the generation of spoils by recycling the excavated rock to the maximum extent possible by using them as aggregate material in the concrete works;
- Construction waste will be routinely collected and safely disposed of in clearly demarcated waste disposal sites located near each subproject site following international best practices;
- Waste disposal will be carried out following international best practices and will ensure that there are no negative impacts on soil, water bodies, existing waste management systems, transport routes, and aesthetic value of the area;
- The debris produced during construction would preferably be dumped at nearby depressions rather than being thrown away and left unattended. Leftover material would not be dumped into water bodies;
- The labor workforce (including community labor) will be trained on the handling, storage, and disposal of construction waste. Burning of waste shall be prohibited;
- PPEs shall be provided and worn by the personnel involved in construction activities and training them in their use;
- Waste containers with proper color coding will be provided on site to store different types of waste;
- Site Specific Solid Waste Management Plans (SWMPs) will be developed and implemented by Contractors; and
- It will be ensured that no waste or leftover construction material is left behind in the cultivation fields.

¹⁷ The World Bank Report 2012 – *What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day*

i. Surface Water Quality

Potential Impact

Surface water quality of the Attabad Lake may get deteriorated due to the construction activities. During the construction phase of the proposed Project, materials like sand, gravel and stones will be required in large quantities. Extraction of the materials will also affect the surface water quality by increasing the sediment load. This water will be used during different construction activities. The movements of heavy vehicles on the unpaved tracks, excavation activities, cut and fill processes in the Project Area, fuel and chemical spills may deteriorate the quality of the surface water. These activities will also increase the sediments and turbidity of the water.

Waste streams can bleed toxic materials from items such as batteries, used computer equipment, leftover paints and pathogenic organisms including specific strains of bacteria like E. coli. Leachate from waste piles caused by exposure to precipitation and from residual liquids in the waste itself may contain organic matter, nutrients, metals, salts, pathogens, and hazardous chemicals. If allowed to migrate, leachate can contaminate surface water. This impact is moderately adverse in nature.

Mitigation Measures

The excavated material will be managed by ensuring proper storage areas located far away from the water bodies. All the solid waste from the camps should be properly collected at the source by placing containers and disposed of through a proper solid waste management system. To reduce the impact of sediment, load the EPC Contractor should make arrangements such as fine screens and drains to limit the siltation into the water bodies. A simplified sedimentation tank shall be built on the construction site for the primary treatment of the construction equipment wastewater, detergents and mud. Wastewater effluent from the Contractors' workshops and equipment washing-yards should be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. This is the general guideline principle for the contractor. Appropriate sanitation and water supply facilities will be provided in the labor camps.

Spillage of fuel/oils and other construction materials shall be contained with best handling/construction practices and strict skilled supervision. The EPC Contractor will ensure that construction debris does not find their way into the water bodies without proper treatment

Treating and disposing of the sewage in a manner that the soil and water are not contaminated and ensure compliance with NEQS or international standards/guidelines, whichever is stringent will be followed.

j. Ambient Air Quality and Climate Change Aspect

Potential Impact

A large number of machinery and equipment will be deployed at the site for the implementation of the Project. Different varieties of machinery/equipment will be required during the construction phase of the Project.

During the construction period, the impacts on air quality are mainly due to material movement and the construction activities (particularly blasting of rocks, operation of batching and mixing plants, drilling, stone crushers) causing an increase in emission of carbon monoxide, sulfur oxides, nitrogen oxides, un-burnt hydrocarbons and other greenhouse gases, as well as fine particulate matter. The pollution causing activities during the construction phase are loading/unloading and stocking of construction material, transportation of construction and excavated material, diesel generator, construction equipment, vehicles rock cutting operations, site clearance, excavation, concrete batching and concrete mixer. The ambient air quality over the immediate influence area will be affected and the criteria pollutants levels and greenhouse gases in ambient air might increase, over longer distances depending on atmospheric conditions. Emission of greenhouse gases causes global warming and other climatic changes on regional and global scales. Cutting trees will also reduce the carbon sequestering and overall increase the CO₂ content in the atmosphere.

The impact of emissions is assessed to be temporary and moderate and is unlikely to have lasting impacts after construction work is complete.

Mitigation Measures

- In order to reduce the dust emissions in the construction area due to material transport and construction activities, provisions will be made for sprinkling of water in the area where earth filling, excavation and other dust emissions causing activities are being carried out. It will be ensured that the construction debris is removed on daily basis;
- Construction materials and spoil materials will be transported through trucks covered with tarpaulins. During windy conditions stockpiles of fine material will be wetted or covered with plastic;
- In no case, loose earth will be allowed to pile up along the approach roads/ public access areas;
- PPEs such as dust masks will be made available to the construction workers at the site to avoid potential health hazards;
- Idling of delivery trucks or other equipment will not be permitted during periods of unloading or when they are not in active use;
- Open burning of solid waste at the construction site will not be allowed;
- All vehicles and other equipment used during construction will be properly and regularly tuned and maintained;
- Ensure compliance with the NEQS;
- Diesel generator should be fitted with acoustic enclosure and stack of appropriate height for the proper dispersion of emission;

- Awareness programs of causes and effects of climate change will be conducted for mitigating GHG emissions, plantation of trees and use of solar panels where possible;
- Regular monitoring of air quality in accordance with the formulated environmental monitoring plan (given in EIA).

k. Noise / Vibration

Potential Impact

Noise and vibration will occur due to the operation of construction machinery and other equipment. The major sources of noise and vibration¹⁸ are construction activities, movement of vehicles, construction equipment, blasting, drilling, pouring equipment, stone crushers and generators etc.

Existing environment of the area is free from noise pollution and the use of machines such as vehicles in the daily activities of the locals is almost negligible. During the construction phase, the increase in traffic may also lead to increase in noise levels. Similarly, the use of explosives during the excavation and construction will have a significant adverse impact on the safety of the workers. High background noise levels can cause significant disturbance to local wildlife, and have adverse psychological and physiological effects on individuals residing in nearby communities.

Significant noise pollution impacts are expected only during the construction phase of activities involving large civil works. The cumulative effects from several machines can be significant and may cause significant nuisances. In all cases, the impacts are likely to be short-term and mitigatable and will not have any lasting effects once construction activities have completed. The significant impact may be of high magnitude for the labor working in a place that is close to the area where explosives are in operation. This is impact medium adverse in nature.

Mitigation Measures

- Construction vehicles and machinery will be kept in good working condition, and be properly tuned and maintained through the duration of construction work with the objective of minimizing excessive noise and vibration;
- High noise/vibration emitting equipment will be used during regular working hours (9 AM to 5 PM) so as to reduce the potential of creating a noise nuisance during the night to nearby communities. This equipment will be fitted with noise reduction devices such as mufflers and silencers wherever possible
- The vibration from major construction activities such as excavation, compacting, drilling, blasting, etc. are considered intermittent and short-term, and likely to be tolerated if prior warning is given to potentially affected residents;

¹⁸ According to British Standards of Noise and Vibration, humans are particularly sensitive to vibration with the threshold of perception typically being in the range of 0.14 to 0.3 mm/sec. Peak Particle Velocity (PPV) and levels above this may cause annoyance. However, significantly higher levels than this can be tolerated for single short-term events and do not cause annoyance or disturbance to humans.

- Vibration measurement will be carried out during the construction phase by the EPC Contractor near the settlements;
- Personal Protective Equipment (PPEs) shall be provided and worn by the personnel involved in construction activities and training them in their use;
- Construction schedules will be disclosed to all nearby communities within the vicinity of project sites prior to the commencement of construction work;
- The EPC Contractor shall ensure compliance with NEQS; and
- All complaints will be recorded and responded to in a timely and professional manner.

8.5.2 Ecological Environment

a. Flora

Potential Impact

The project will involve destruction of vegetation cover due to the implementation of proposed Project. It is initially examined that approximately 575 number of trees may be affected (**Annex - II**) due to proposed project activities. The number of possibly impacted trees is calculated by using Remote Sensing technique through GIS and field observation. Moreover, no impact on the production of medicinal plants is anticipated, as the area has least number of these plants. Exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities the EPC Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). This impact is categorized as medium significant.

Loss of Agriculture Land

Due to the impounding of reservoir area, based on 2424 m.a.s.l, it is estimated that about 14.28 Acres of crops of agriculture land may be affected. However, it is anticipated that there will be no impact on agriculture land due to the construction activities for other components (such as Flexible / Rigid Overflow Structure, headrace tunnel, surge tank, penstock, powerhouse, switchyard and tailrace). This impact can be categorized as medium significant.

Pasture and Grazing Land

The Power House will be constructed on the communal land owned by the Ganish village, having grazing area. Similarly, impounding of reservoir area may also result in loss of vegetation cover which will subsequently affect the community's pasture and grazing area and livestock. This impact is categorized as permanent, irreversible and moderate in nature.

Mitigation Measures

- Incorporate technical design measures to minimize removal of trees, if possible;
- Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized;

- A tree plantation program shall be formulated with the recommendations and technical support of concerned Forest Department;
- As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality. Total 5,750 trees will be planted in lieu/compensation of 575 affected trees of similar floral function at the available spaces in/around the project area;
- Proponent shall implement the plantation program with the help of Forest Department and with the consultation of Supervision Consultant;
- The Forest Department shall involve the communities (if required) for carrying out plantation;
- Open fires should be banned in the area to avoid hazards of fire in the area;
- Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land;
- However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth;
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement;
- The EPC Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes;
- The EPC Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed;
- Compensation for the loss of crops to the land owners and cultivators as the case may be will be paid, in accordance with the prevailing market prices and uniformity in rates will be ensured within the local areas;
- The whole process of the payment to the farmers will be made transparent, judicious and without any discrimination or favour; and
- As far as possible, barren land without any crop will be selected for the camp sites and disturbance to the crops and natural vegetation will be avoided as much as possible.

b. Fauna

Potential Impact

During the construction phase, the existing population of mammals and reptiles of the construction areas may be affected due to disturbance arising from construction activities involving excavation, movement of machinery and vehicular traffic, movement of labor, camping, blasting, excavation, drilling etc. The existing animals will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations.

Moreover, the movements of the mammals and reptiles will be restricted during the construction phase;

Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.

Noise generated from machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the wildlife of the Project Areas. Food and refuse at the EPC Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is medium significant.

Mitigation Measures

- Care shall be taken during construction activities for avoiding purposely or chance killing of animals;
- If found any wild species and habitat during constructing that must be dealt carefully and local wildlife department officials should be called;
- Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard;
- The EPC Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department;
- Client must have obtained NOC from the relevant departments prior to construction phase;
- Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding;
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and
- Noise produced by construction activities may be kept to acceptable level and ensure compliance with NEQS.

c. Aquatic Ecology

During construction phase of proposed Project, cutting, blasting, excavation, drilling, extraction, removing and dumping activities of materials at large scale will contribute heavy sedimentation and soil erosion which may cause habitat destruction, contamination and toxic accumulation of waste not only at Attabad lake but its impact can be seen downstream up to confluence of Gilgit River and beyond. Heavy machinery and equipment shall be used during construction phase, which may also result in heaps of leftovers of explosives, grease, chemicals, lubricants, and other harmful materials. These pollutants through run off rain water enter into the lake and river course increase toxicity of water causing rapid destruction of fish population and riverine ecology.

This situation can contribute up to great extent to destruct the aquatic life, ecology, breeding and spawning grounds of fishes, benthic fauna, food chain and abundance of micro and macro living organisms. This may lead rapid shortage of food like benthic population, phytoplankton, zooplankton, nekton etc. which play an important role to sustain food chain with different trophic level in any eco-system. This impact is categorized as medium to high significant.

Mitigation Measures

- Solid waste generated from construction and camp sites will be safely disposed in demarcated waste disposal sites and the EPC Contractor will provide a proper waste management plan, to avoid the water contamination;
- Land sliding and soil erosion are also the main factor to contribute silt load on river bed manifold causing damage to resting and nesting grounds of fishes. Construction of protective walls and gabions at certain points to make sure the stoppage of sliding debris. Plantation and vegetation cover can also be helpful for slope stabilization. Plants, herbs and shrubs reduce the level of pollution and toxicity at a great extent as bio-filter and carbon suckers;
- Prior NOC from Fisheries Department may also be considered for smooth implementation of the project activities;
- The labour working at construction site should be aware to protect especially edible fish and to avoid fish catching by any means. As according to law of land fish hunt is prohibited with all types including net, cages and by the use of dynamite;
- Training of work force in the storage and handling of hazardous materials and chemicals should be encouraged and educated to practice waste minimization and reuse to reduce quantity of the waste;
- Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies;
- Construction waste should be crushed and reused in other sites, where possible;
- It will be ensured that no waste or left over construction material is left behind in the cultivation fields;
- Construction vehicles and machinery will be kept in good working condition, and be properly tuned and maintained through the duration of construction work with the objective of minimizing excessive noise and vibration; and
- The EPC Contractor shall ensure the compliance with NEQS.

8.5.3 Socio Economic Environment

a. Discovery and Impact on of Heritage Sites and Structures during Excavation

Potential Impact

During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Tourism, Sports, Culture, and Archaeology & Museums Department Government of GB to take further suitable action to preserve those antiques or sensitive remains.

According to the field survey, no notified archeological site was present in the Project Area. This impact can be categorized as low to medium significant in nature.

Mitigation Measures

- In case of finding archeological remains during excavation, the EPC Contractor shall immediately report through Supervision Consultant to Tourism, Sports, Culture, and

Archaeology & Museums Department Government of GB to take further suitable action to preserve those antiques or sensitive remains. Chance finds procedure is given in **Annex- III**; and

- The EPC Contractor needs to obtain approval for excavation and submit the plan of rehabilitation of the site after excavation.

b. Social and Cultural Conflicts

Potential Impact

During the construction phase of the project, conflicts may arise between labor force and local community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore, difference in cultural values may also cause discomfort to local residents. This impact is medium adverse in nature.

Mitigation Measures

- Local labor especially from nearby communities will be given preference for the construction works;
- Careful planning and training of work force to minimize disturbance to the local people;
- Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and
- Adequate training of especially for the transitive workforce of the station (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure.
- Code of Conduct will be prepared by the EPC Contractor and adopted during the project execution. All project personnel will be required to sign and follow the Code of Conduct.

c. Occupational Health and Safety

Potential Impact

Occupational Health and Safety (OHS) related impacts may arise during construction phase of the proposed Project due to installation of Contractor camp, movement of machinery & equipment, lifting operations, work at height, concrete pouring, working in night and manual handling during loading/unloading operation, as result of these works there will be a direct impact on the health and safety of all staff working on the Project. The most common impacts include eye injuries which may occur due to stone or metal particles, hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc.

Other impacts will be falling in trench, contact with electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand and head injury, slip and trip hazards, exposed

to high levels of noise for longer durations etc. This impact may be classified as high adverse in nature.

Mitigation Measures

- The EPC Contractor will be required to follow the national/local acts related to OHS and World Bank Group General EHS Guidelines, 2007. The EPC Contractor will prepare the site specific occupational health and safety plan;
- Occupational health and safety monitoring programs of the EPC Contractor should verify the effectiveness of prevention and control strategies;
- Providing basic medical training to specified work staff and basic medical service to workers. The EPC Contractor will ensure the provision of basic medicines, first aid kits etc. at the camp site;
- Ensure periodic medical screening of the staff;
- Complying with the safety precautions for the construction workers as per applicable International Labor Organization (ILO) Conventions;
- Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety proper task specific Personal Protective Equipment (PPEs);
- Moreover, proper planning should be done for food storage, setting up of kitchens, wastewater collection system and solid waste management. Improper planning for these facilities may result in multiplication of rodents like rats, mice and shrew etc. and vectors like mosquitoes, bugs and flies which will have a negative impact on workers' health and safety;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- All trenches deeper than two meter should be protected with wooden bracing to avoid safety risks to workers and locals;; Ensure that the site will be restricted for the entry of irrelevant people particularly children, disabled and elderly people;
- Ensure the use of safety and warning signs at the construction site;
- Ensure the provision of fire prevention and firefighting equipment; and
- Ensure the provision of training related to emergency prevention, preparedness and response arrangements by the EPC Contractor.

These requirements will be incorporated into the bidding specification and contract documents, and will be binding on the EPC Contractor, at risk of penalty for noncompliance, as charges to be recovered from the EPC Contractor for unsafe act or condition.

d. Community Health and Safety

Potential Impact

Community health and safety issues during the construction of proposed project may include dust, noise, and vibration from construction vehicle transit, and communicable disease associated with the influx of temporary construction labor. The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of water

resources available in the nearby local communities may be affected due to the oil spillage and leakage, roadside accidents, etc. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. The labor works with different transmittable diseases (HIV/AIDS, COVID-19, respiratory diseases, and skin and eye infections etc.) may cause spread out of those diseases in the locals of nearby community. The impact significance is moderate adverse.

Mitigation Measures

- The EPC Contractor will prepare the site specific community health and safety plan in compliance with relevant sections of the WBG General Environmental Health and Safety Guidelines (WBG 2007), chosen methodology and will be required to strictly follow;
- Ensure that the site will be restricted for the entry of irrelevant people particularly children, disabled and elderly peoples. Ensure the use of safety signs at the construction site;
- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- Ensure proper maintenance and repair of all vehicles, machinery and equipment to prevent the oil spills;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Provision of proper safety and diversion signage, particularly at sensitive/accident-prone spots;
- Setting up speed limits in close consultation with the local stakeholders;
- The mitigation measures provided in the sub-sections for air and noise & vibration shall be adopted to reduce the air pollution, noise pollution and vibrational impacts on nearby community;
- Ensure effective implementation of GRM (to be prepared by the EPC Contractor) to timely address the issues;
- The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, COVID-19 will be prevented by successful initiative typically involving health awareness; education initiatives; training health workers in disease treatment; immunization program and providing health service;
- All workers must perform complete sanitization at the site as per updated / latest SOPs/guidelines issued by WHO and the national guidelines issued by the GoP¹⁹;
- Ensure prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat near to human settlements and by eliminating any unusable impounding of water; and

¹⁹ <https://covid.gov.pk/guideline>

- The EPC Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. The EPC Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.

Any environmental condition that is disagreeable to the public and causes an avoidable nuisance can be addressed with additional provisions in addition to those described above.

These requirements will be incorporated into the bidding specification and contract documents, and will be binding on the EPC Contractor, at risk of penalty for noncompliance, as charges to be recovered from the EPC Contractor for unsafe act or condition.

e. Influx of Labor

Potential Impact

For the implementation of Project activities, skilled and unskilled labor is required by the EPC Contractor. Mostly, skilled and unskilled workers have been associated with the EPC Contractor since long which they utilize, where they are required for the Projects, and while other workers are hired from the different areas that belong to different cultural backgrounds. Social problems and conflicts that are associated with Labor Influx are as follows:

- Risk of social conflict: Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other;
- Increased risk of illegitimate behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such illegitimate behavior and crimes can include theft, physical assaults, substance abuse, sexual assault and human trafficking;
- Impacts on community dynamics: Depending on the number of incoming workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes;
- Increased burden on and competition for public service provision: The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the influx of workers is not accommodated by additional and separate supply systems;
- Increased risk of communicable diseases and burden on local health services: The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the Project's medical facility and instead go anonymously to local medical providers, this can result in an additional burden on local health resources;

- Local inflation of prices, accommodations and rents: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and crowding out of community consumers. Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of local residents; and
- Increase in traffic and related accidents: Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

This impact is medium negative and temporary in nature.

Mitigation Measures

- Contractor camp will be established away from residential and populated area;
- Preference will be given to the local people to work with the EPC Contractor, and the EPC Contractor will hire maximum labor force from the project area because this will reduce the labor influx;
- Awareness will be created among the work force to ensure respect for local customs;
- Construction work will be completed within the stipulated time to move workers to next location;
- Labor force will be shuffled with the time;
- Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all Project sites;
- Provide adequate personal hygiene facilities in good condition with adequate supply of clean water;
- Make arrangements to treat the affected workers on time to control the movement of vectors disease;
- Sensitize workers and surrounding communities on awareness and prevention of COVID-19, HIV/AIDS and sexually transmitted infections (STI) through training, awareness campaigns and workshops during community meetings;
- Provide proper and free HIV/AIDS and STI health screening and counselling for site workers and community members;
- Develop and enforce a strict Code of Conduct for workers to regulate behavior in the local communities;
- Taking all sensible precautions to avert illicit, vicious conduct by or amongst the EPC Contractor's personnel, and to preserve unity and harmony, and protection of people and property on and near the sites;
- Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel;
- Site security preparations must be contained within the Bills of Materials (BoMs) to avoid any delays which might be caused due to insecurity;
- Appropriate fencing, security check points, gates and security guards will be provided at the construction sites to ensure the security of all plant, equipment, machinery and materials, as well as to secure the safety of site staff; and
- The EPC Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.

f. Gender Based Violence (GBV)

Potential Impact

In the society, female plays important role in managing household as well as in income earning activities, but they face various challenges to get access to educational institutions and employment opportunities due to cultural bindings, economic vulnerability and lack of facilities.

According to Pakistan Demographic and Health Survey (PDHS), 2017-18, 28 percent of women of Pakistan age 15 to 49 have experienced physical violence, six percent have experienced sexual violence, and seven percent experienced violence during pregnancy. Three in ten women who have ever experienced physical or sexual violence sought help to stop the violence, yet 56 percent never sought help nor told anyone.

During construction phase gender based violence might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site, and moving on the roads and markets. Women in the Project area are participating in other outdoor activities such as livestock rearing, bringing of potable water, collection of fire wood etc. that may also be affected by the Project activities. This impact is medium negative in nature during construction stage.

Mitigation Measures

- Trainings will be given to construction workers, alongside the implementation of strict measures and punishments in case of any sexual assaults, or gender based violence.
- During the timing of educational institutions workers will not be allowed to crowd in the surroundings;
- Alternative routes for pedestrian will be provided to avoid mixing of women with workers;
- Gender protection act will strictly be enforced during the construction activities in the project area, and monitor the implementation through field staff and district level structure;
- Raise awareness among the communities of the potential risks of GBV, and establish response services in the communities that can respond to instances of GBV (particularly those related to issues of labor influx);
- The EPC Contractor will make sure that no discrimination is made on the basis of gender while hiring of workers. Complete SOPs will be formed and implemented by the contractor regarding working women at site. Implementation on these SOPs will be monitored by the Supervision Consultants;
- Provisions of gender disaggregate bathing, changing, and sanitation facilities; and
- Contractor will take proper measures to address and resolve issues relating to harassment, intimidation, and exploitation, especially in relation to women.
- Establish workers' camps separated from local communities with strict protocols for interaction with local communities in order to avoid project impacts from labor influx.

- Project staff will receive training on the prevention of SEA/SH. Engagement of skilled trainers to raise awareness among project workers of the risks, expected behaviors, and consequences of violations, communicated through training, and publicized codes of conduct. It may also be important to raise awareness of the risks among community members and local health authorities and inform them about available grievance mechanisms.
- Arrange and support local organizations and/or government initiatives on community STD education, prevention, and treatment programs.
- Extensive training for awareness raising strategy which describes how workers and local communities will be sensitized to SEA and SH risks, and the worker's responsibilities under the Code of Conduct.
- The routes/places used by the women will be avoided as far as possible. If unavoidable, alternate routes will be identified for the communities, if required, especially along routes frequented by women folk, such as route to the local water source.
- Construction crew will avoid entering villages and settlements.
- Communities will be informed and consulted before commencing works inside or near the communities.
- Provision related to SEA/SH will be incorporated in the bidding document.

g. Child Labor

Potential Impact

There are two basic conventions on child labor adopted by the ILO, and one adopted by the United Nations. The ILO Minimum Age Convention, 1973 (No. 138) and its accompanying Recommendation (No. 146) set the goal of elimination of child labor, and the basic minimum age for employment or work (in developing countries at 14 years of age or the end of compulsory schooling, whichever is higher; and 15 or the end of compulsory schooling for developed countries). The Convention sets a minimum age of 2 years younger for "light work," i.e., 12 and 13 years, respectively; and a higher minimum age for dangerous or hazardous work (basically 18 years of age, but 16 in certain circumstances). The Convention also has various other flexibility clauses.

Inhabitants of the Project Area have mix economic background and different sources of income. Children of low income groups mostly involve in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods. However, the Employment of Children Act, 1991 prohibits the employment of child and restrict the employment of adolescents in certain occupations and processes such as construction industry, and whoever employs or permits a child (person under the age of 14 years) to work in an establishment shall be liable to punishment with imprisonment.

The child labor impact might arise during construction stage, as large number of skilled and unskilled labor will be required by the EPC Contractor for the construction activities of the proposed Project. This impact is medium negative in nature during construction stage.

Mitigation Measures:

- Awareness will be created among the local communities about the adverse impacts of child labor. For the public awareness, meetings will be held in the Project area, and announcements will be made using the available local platforms with the involvement of all sectors of the society;
- The EPC Contractor through contractual agreement will be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities will be monitored by the social and environmental staff of the implementing agency;
- Client and Supervision consultant will ensure that the EPC Contractor shall have its employment policy in accordance with relevant act and labor policies in Pakistan;
- The EPC Contractor will ensure the presence of all persons at site are adults and have their proper identity cards with them;
- Penalize the EPC Contractors/employees using the child labor and penalize adults who violate children's rights and who force children to enter child labor.

h. Indigenous People**Potential Impact**

During the social field survey of the Project, no indigenous group of people was identified, which comes under the definition of the "Indigenous People". So, no impact on the indigenous people is envisaged due to the implementation of the Project.

Mitigation Measures

No mitigation required.

i. Other Social Issues**Potential Impact**

The community belonging to the reservoir and Project Area will be affected during the construction phase as follows:

- During the construction phase, the general mobility of the local residents and their livestock in and around the Study Area is likely to be hindered;
- Unmonitored construction activities, e.g. blasting may create an accidental risk for the local residents particularly the women and children;
- Usage of community common resources like potable water, fuel wood etc. by Contractor workforce may create conflicts between the community and the Contractor;
- Community will have to face the noise and dust problems during the construction activities;
- Induction of outside workers in the Contractor labor may cause cultural issues with the local community; and
- Theft problems to the community by the Contractor's workers and vice versa.

This impact is Site Specific, Medium Term, Irreversible, Likely, Medium Significant.

Mitigation Measures

- During the construction phase, mobility of the workers in the nearby areas should be strictly restricted by the Contractor to avoid any inconvenience to the local communities;
- Proper arrangements in the form of alternative routes should be made to ensure that the mobility of locals should not be disturbed;
- Before starting the construction activities, Contractor should inform residents of the Project Area about the scheme of work, likely disturbances, and their duration as to whom they should address their complaints.
- The Contractors will be required to maintain close liaison with the local communities to ensure that any potential conflicts relating to the common resource utilization are resolved quickly;
- Contractor will take care of the concerns of the local community and the sensitivity towards the local customs. Contractor also needs a proper security to avoid any theft issue by the community;
- Use of good engineering practices such as water sprinkling, encasement and provision of silencer and mini stacks of generators etc. should be adopted to avoid inconvenience to the locals due to noise, smoke and fugitive dust; and
- The Contractor will warn the workers not to indulge in any theft activities and if anyone gets involved in such activities, he will have to pay heavy penalty and would be handed over to the police. Similarly, at the time of employing, the Contractor has to take care that the workers should be of good repute. The Contractor camp should be fenced properly and main gate.

j. Impact on Tourism

Potential Impact

The Attabad Lake has become one of the biggest tourist attraction in valley, offering activities like boating, jet-skiing, fishing and other recreational activities. Tourists also enjoy Ice Skating the Lake gets frozen during winters, making it the perfect place for ice skating. Passu Cones is also a popular tourist destination in Hunza valley and all over the world because of its easy accessible sweeping landscapes and vistas of the 7,478m (24,534 ft) tall Passu Sar mountain, the Passu Glacier and Tupopdan.

Due to construction activities of Attabad Hydropower Project and movement of heavy machinery on roads the traffic flow is likely to be affected during construction activities and damage of roads as well, tourists will face the difficulties to reach at their desire destination like Attabad Lake for boating and jet-skiing, to visit the Passu Cones, Khanjrab Pass other tourists spots and high peaks for hiking.

Due to construction of Attabad Hydropower Project livelihood of the locals will disturb who are directly associated with tourism business like boat owners and operators, owners of fast food

restaurants, shopkeepers, hotels owners and working labor and so many others attach with tourism.

Mitigation Measures

- The EPC Contractor will prepare and implement the site specific environmental, health and safety management plans to ensure the safety of the locals and tourists.
- Necessary measures will be taken to ensure the safety of traffic during construction, including barricades, safety signs, pavement markings, flags, and lights, erected for tourists and locals as well.
- A Traffic Management Plan will be implemented that will aim at ensuring access tourists to reach their destinations safe and sound, residential areas, and preventing of unsafe situations, especially near construction areas, camps and offices;
- Liaison with traffic police will be maintained in order to facilitate the tourists both local and foreigner; and
- Vehicle speeds near / within the communities will be kept low, to avoid safety hazards.

k. Communication Loss

Potential Impact

The general mobility of the local residents and their livestock in and around the Project Area is likely to be hindered and may need to be travel long distances.

Likewise access to the natural resource may be affected. This particularly implies to the women folk and children where women observe norms and values and do not interact with non-locals. This impact is medium significant in nature.

Mitigation Measures

The EPC Contractor will ensure that the mobility of the local communities and their livestock is not hindered by the construction activities. The EPC Contractor will provide crossing points at appropriate places to facilitate the locals for their daily works, where applicable.

The EPC Contractor shall always consider the local sensitivities while performing the Project activities. All the personnel engaged would also be properly briefed about the local norms and ethics prior to commencement of work.

8.6 ANTICIPATED IMPACTS DURING OPERATIONAL PHASE

The anticipated environmental impacts during the operation are discussed herewith;

8.6.1 Physical Environment

a. Sedimentation

Potential Impact

Sediment sources are glaciers, precipitation in the form of storms and heavy rains, hill slopes, landslides and gully erosion etc. The average sediment concentration is about 0.321% (by weight) or 3,210 ppm and the average suspended sediment yield per year is about 20.06 million metric tons. The observed minimum concentration is 2 ppm and observed maximum concentration is 21,300 ppm. Almost all of the suspended sediment is brought down by the river during the period of June to September. The river carries on the average, about 27% sand, 50% silt and 21% clay. The unit weight of fresh deposits of this sediment is about 1122.4 kg/m³.

Accumulation of sediment may disturb the efficiency of Project components. Sediment load released from the sand trap could have adverse effect and synergetic with low flow of water will put aquatic system under stress. However, it should be kept in mind that during low flows the sediment concentration is very low. Floods and heavy rains carry large sediment loads, which could have a more severe medium impact than the sand trap flushing.

Mitigation Measures

For Attabad HPP, initial trap efficiency was estimated to be 58%. In order to do the reservoir sediment empirical modeling, the average sediment inflows have been taken as 24.06 million metric tons. Furthermore, an initial density of 1,122.4 kg/m³ has been used for the conversion of sediment load to sediment volume. By using above sediment flow in Attabad Lake, it will be filled in 10 years. So, reservoir life of the Attabad Lake HPP is about more than 11 years without flushing.

A sediments clearing mechanism will be provided in the detail design and should be followed. Sediment flushing and de-silting arrangements have to be carefully designed by the EPC Contractor. It is recommended that a sediment sampling program during high flow season for estimating bed material load and bed load and its gradation are initiated with the help of WAPDA's Surface Water Hydrology Directorate.

b. Liquid and Solid Waste Generation

Potential Impact

Wastewater may generate by the workers during the operation and maintenance related activities and from the residential colony. However, at this stage it is not possible to estimate quantity of waste generation. The improper disposal of liquid waste can cause air, water, and soil pollution. Different types of solid waste including construction, dismantled material,

municipal and hazardous (chemicals, spent solvents and oily rags, empty paint cans, chemical containers, used lubricating oil, electrical wires and lighting equipment) wastes are likely to be generated during the operation phase, can potentially cause soil and water contamination. The quantity of this liquid waste is expected to be small. This impact can be categorized as medium to low significant in nature.

Mitigation Measures

- Ensure training program regarding waste minimization quantity of the waste;
- Solid waste generated will be safely disposed in demarcated waste disposal sites and ensure provision of PPEs to workers;
- Ensure immediate collection of solid waste after the completion of maintenance works, no waste or left over construction material is left behind;
- Proponent should make final disposal arrangements in consultation with the concerned government department and should take approvals for final disposal of the waste at the designated disposal site.
- A separate solid waste management system for waste from the office building and other allied facilities will be required. During the collection of solid waste, recyclable and reusable waste will be separated for resource recovery and reuse of the generated material; and
- Proper monitoring to check the compliance of NEQS will be carried out, if required;

c. Soil and Surface Water Contamination

Potential Impact

The accidental oil leakages from the power house may contaminate the soil and water quality of the Attabad Lake and Hunza River downstream of the powerhouse. The maintenance works (may involve the use of materials, chemicals, fuel and lubricants) may also have potential to contaminate the soil and surface water. This impact is site-specific and can be classified as medium significant.

Mitigation Measures

Proper drainage and dewatering system is recommended for the proposed Project. A drainage pump of appropriate capacity will be specified to cope with the leakage of powerhouse. Dewatering pumps will be specified for Unit dewatering. Both of these pumps will be installed in drainage and dewatering pit and they will provide redundancy for each other. Sites disturbed by the maintenance works shall be restored to their original conditions upon completion of works and photographic record will be maintained to ensure pre-post conditions intact. It will be ensured that no soil is left unconsolidated after completion of work and excess will be disposed of at designated sites. Storage of fuel, paint, and oil containers, oil filters, oily parts, and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inches thick done on brick edge flooring lined with polyethylene sheet. Material Safety Data Sheets (MSDS) will be strictly followed.

d. Fire Breaking

Potential Impact

For the proposed hydropower plant there is also a risk of fire breaking out in powerhouse which may become a serious risk for residents living in allied facilities and/or nearby in the vicinity of the proposed hydropower Project. This impact can be classified as medium significant.

Mitigation Measures

- Fire protection and detection systems shall be provided and implemented to protect life, property, equipment, and operation of the powerhouse. The detection and fire alarm, fire protection and fire-fighting systems shall include, but not be limited to the following:
 - Firefighting water storage, may be combined with raw water tank, depending on local regulations;
 - Firefighting pumps;
 - Fire water ring main system, including hydrants;
 - Fire protection systems; and
 - Fire alarm and detection system.

- The building / tunnel shall be subdivided into various fire areas, separated by approved fire resistant barriers and elements;
- Fire walls, ceilings and partitions shall have a fire resistance rate of not less than 2 hours;
- All penetrations for electrical cables or pipes in fire resistant walls or ceilings shall be sealed with approved seals;
- One electric motor driven fire pump and one electric motor driven stand-by fire pump, located in a pump house adjacent to the water storage tank, shall draw fire fighting water from the tank and supply it through the fire service main to the hose stations and water spray fixed systems. One electric motor driven jockey pump with a capacity of approx. 3 l/s shall also be provided to keep the line pressure of 5 bars. The fire pump shall have a capacity of approx. 40 l/s at a delivery head of approx. 6 bars;
- The water spray fixed systems shall be designed, installed and tested in accordance with NFPA15;
- The total flooding carbon dioxide extinguishing systems shall be designed in accordance with NFPA 12, standard on carbon Dioxide extinguishing systems (latest edition) and will be adopted for the fire protection of Attabad HPP generators;
- The selection, installation and testing of portable fire extinguisher shall be in accordance with NFPA-10 for initial firefighting. Portable fire extinguishers with capacities of 6 kg chemical dry powder, for rooms containing electrical equipment with capacities of 5 kg clean agent, shall be provided and placed in the rooms and buildings at strategic locations and next to exits;

- In addition to the portable extinguishers, two mobile 30 kg clean agent, and two mobile 50 kg dry powder extinguishers, mounted on wheeled hand carts and furnished with 6 m hoses, shall be provided and located in the machine hall of the powerhouse and GIS floor and diesel generator room; and
- All systems shall be subject to the approval of the insurance company. The system shall be complete with all necessary piping, pumps, safety valves, mobile equipment, and vehicles. The EPC Contractor shall prepare an Emergency Response Plan (ERP) to cope with the emergency situations. Fire protection system for Generator fire protection system is also recommended.

e. Ambient Air Quality and Climate Change Aspect

Potential Impact

The air quality of the area will improve significantly in comparison to construction phase. Vegetation cover in the area will also increase after tree plantation. However, during operation phase, operation of stand-by generator and unnecessary idling of diesel run will also result in the emission of pollutants (CO, Smoke, NO₂, SO₂, PM_{2.5} and PM₁₀ etc.) into the air, thus deteriorating air quality. Ambient Air quality may also be affected during the maintenance works of subprojects. These emissions may adversely affect the health of the nearby residents and working staff. This impact is moderate in nature.

Mitigation Measures

- Ensure the use of low Sulphur fuel;
- Ensure plantation of trees around the project area that will help in absorbing the emissions;
- The height of the generator stacks shall be enough to disperse the emissions in the air; and
- Ensure compliance with NEQS and provision of budget for regular monitoring of ambient air quality in accordance with the NEQS.

f. Noise and Vibration

Potential Impact

During operation phase, noise and vibration levels may be generated due to the operation of proposed project, standby generators and traffic which will be a constant source of nuisance for the staff and the nearby communities. Noise levels may also be increased during the maintenance works. The significance of this impact is considered to be low adverse.

Mitigation Measures

- Ensure regular maintenance and periodic checking all parts of the standby generators, replacement in case of malfunctioning and periodic noting of noise levels;
- Installation signs to disallow the use of pressure horns;

- Plantation of trees will also help to attenuate the noise impacts to the surrounding area;
- Ensure compliance with NEQS and provision of budget for regular monitoring of noise levels in accordance with the NEQS and vibration (where applicable).

g. Change in Land Use

Potential Impact

During the operational phase the land use pattern of the area will be changed to some extent. The commercial and recreational activities will also be increased which may affect ecosystem of the area and bring economic boom in the area. This impact is Site-specific, Long Term, Irreversible, and Likely, Medium Significant.

Mitigation Measures

The tree plantation will be carried out in and nearby the Study Area and will have positive impact on the eco system of the area.

8.6.2 Ecological Environment

a. Flora

Potential Impact

During operational stage of the Project, there will be minimal effect on flora or release of any significant pressure detrimental to flora. Low level impact is expected at operational phase on Flora due to the operation and maintenance activities. This impact is low Significant.

Mitigation Measures

- The implementation of plantation plan recommends compensation for cutting of trees and work should be started during operational phase to ensure the ecological balance and to avoid any impact on local environment;
- Large scale planting with suitable indigenous trees, shrubs and ornamental plants in the form of tree groves, and linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation;
- Proper check and balance for above activities is highly recommended. Plantations so raised must be maintained according to the Silvicultural practices which includes proper irrigation, cleaning, pruning, thinning at prescribed intensity, silt clearance and trench-opening, etc.;
- Maintenance and security of the plantation should be done for at-least four years (in consultation with the Forest department). Measures such as fencing, watch guards and fire protection should be considered; and
- All activities must be done under the technical supervision of forest department

b. Fauna

Potential Impact

There is no protected area, game reserve, game sanctuary or national park in the project area so no major impact on wildlife and livestock in the area is expected through noise, vibration and any type of normal activity in the project area. This impact is Insignificant.

However, proposed reservoir area, which is nearly 8 Km in length, shall not be available for grazing to livestock and other wildlife existing in the area, which is adverse impact on fauna.

Mitigation Measures

Strict control must be exercised for stoppage of killing/poaching of available wildlife species (if any) by enhancing protection practices; and

The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area.

Improved micro climate and moisture conditions along the periphery of the reservoir will help in grass production and improved vegetation, which will be useful for livestock grazing and improve habitat for birds.

c. Aquatic Life

Once the construction phase is completed and water diverted at the site of Flexible/ Rigid Overflow Structure will change the water flow regime from Flexible/ Rigid Overflow Structure to powerhouse. The adverse impact on aquatic life will be due to low flow in the Hunza River especially during low flow season. The minimum environmental flow needs proper follow-up.

Mitigation Measures

- Annual restocking plan of fish fingerlings should be included in the said project to compensate the stock depletion due to decrease in fish breeding grounds.
- Fisheries research unit and a brown trout hatchery with research/management staff should be established at the project side for research purposes as well as impact assessment during operational phases of the project.
- To conserve the aquatic life of the river downstream of the Flexible/ Rigid Overflow Structure, minimum flow of 3 m³/s has been calculated as the environmental flow. It will be obligatory for project operating agency to release 3 m³/s in the river throughout the year as environmental flow.
- The design recommended measures should be implemented and maintained by the proponents.

8.6.3 Socio-economic Environment

a. Safety during Reservoir Operation

Potential Impact

During operational stage of the Project, due to the impounding of the reservoir, the safety issues will arise. Main reservoir area is the major threat for accidents. Locals and workers can drown. This impact is site specific and high significant in nature.

Mitigation Measures

Since the reservoir was formed in January 2010 as a result of massive land slide and no new area would be submerged.

However, during operational stage of the Project, a security plan should be prepared for the reservoir area to prohibit youths from using reservoir for bathing, swimming and other recreational activities. Boating should not be allowed without the provision of life saving jackets and presence of a lifeguard.

b. HSE Considerations

Potential Impact

During the operation phase, health and safety issues related to workers and communities may arise. Operation and maintenance activities may cause health and safety risks such as movement of machinery and manual handling during loading unloading operation, poor handling and storage of hazardous substances, injuries due to electric shocks, falling of objects, slips or trips, dust, noise, accidents, transmittable diseases etc. The impact is moderate to low adverse in nature.

Mitigation Measures

- Ensure proper maintenance of machinery and equipment;
- Proper storage and handling of generator fuel, chemicals, solvents and other hazardous substances;
- Ensure emergency prevention, preparedness and response arrangements;
- Emergency numbers should be clearly posted and communicated to the staff and community (where applicable);
- Fire extinguishing equipment should be installed at adequate and appropriate locations;
- Ensure provision of PPEs to the skilled and unskilled labors and visitors;
- Proper training should be given to workers on health and safety measures;
- Hazardous materials should be well labeled and stored in their original containers;
- Ensure that the site will be restricted for the entry of irrelevant people;
- Ensure health awareness; education initiatives; training health workers in disease treatment and prevention; immunization program and providing health service; and

- Staff will strictly warned, not to involve in any unethical activities and to obey the local norms and cultural restrictions.

c. Water Rights in Lower Riparian

Potential Impact

The capacity of the reservoir at El 2,409 m.a.s.l is calculated as 125 Mm³, which is very small compared to inflows. As the Attabad Lake HPP is a run-of-river power project, with the implementation of the project there is no chance of reduction of discharge in the river except in the section between Flexible/ Rigid Overflow Structure and end of tailrace (2 km). Presently, in this section of the river, water is not being used for any purposes either for human consumption or for agriculture. Therefore, it is anticipated that there will be no impact on human population due to the diversion of discharge into the tunnel, therefore, no mitigation is required.

Employment Opportunities

After completion of the construction works, employment opportunities will suddenly seize and unemployment for local residents may increase. However, with the experience gained from the proposed Project, the local people will have potential opportunities in future hydropower projects in GB, and other parts of country. WAPDA could develop a preferential system for local workers with good qualifications and experience at the end of construction of proposed Project. Construction workers could also qualify for positions in operation and maintenance activities.

d. Impact on Civic Amenities

The accessibility to the project area will be improved due to the construction of link roads and widening of existing road. Schools, mosques, dispensary will be constructed for the project staff but after the completion of the project these facilities will also be available for the locals of the project area. The impacts will be in the category of high beneficial.

e. Impacts on Local Public Health

The project area is lacking in health facilities. After the construction of this project, better health facilities will be available in the area which is a positive impact of the project.

9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 GENERAL

This Chapter provides an overall approach for the implementation, management and monitoring of the mitigation measures to reduce or avoid the identified potentially significant environment and social impacts for the proposed Attabad Hydropower Project. EMP provide institutional framework, resource allocations and environmental costs required to be included in the Project budget for the implementation of the suggested measures.

EMP is the tool for the implementation of the mitigation measures for the potential adverse environmental and social impacts during the project life cycle and covers all the stages from design to operation and maintenance. However, it is a live document and needs to be reviewed and updated at each stage of the Project based on the changes in the Project design monitoring and evaluation.

9.2 OBJECTIVES OF EMP

The basic objective of the EMP is to manage potentially significant adverse environmental and social impacts of the Project. The specific objectives of the EMP are to:

- Provide the details of the Project impacts along with the proposed mitigation measures, and the corresponding implementation activities;
- To ensure that all necessary corrective actions are carried out and monitored in time to counter any adverse environmental and social impact under a systematic monitoring approach;
- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Define the role and responsibilities of the Project Proponent (WAPDA), the EPC Contractor, Management Consultant and other key players in order to effectively communicate environmental and social issues among them;
- Define a monitoring mechanism, reporting frequency and identify monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented;
- Design the training and capacity building plan for enhancing the capacities of the WAPDA, the EPC Contractor and Management Consultant on environmental and social management;
- Identify the resources required to implement the EMP and outline the corresponding financing arrangements; and
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies.

The EMP will be managed through a number of tasks and activities and site specific management plans. One purpose of the EMP is to record the procedure and methodology for management of mitigation identified for each adverse impacts of the Project. The management

will clearly delineate the responsibility of various participants and stakeholders involved in planning, implementation and operation of the Project.

9.3 LEGAL REQUIREMENT

All the legal requirements have been discussed in detail in Section-2.

9.4 INSTITUTIONAL SETUP FOR IMPLEMENTATION AND MANAGEMENT OF EMP

The institutional requirements for the implementation of EMP of the proposed project are provided in below sections.

9.4.1 Institutional Setup for Implementation and Management of EMP

The key players involved during construction phase of the proposed project are the WAPDA as proponent, GB EPA, Management Consultant and the EPC Contractor.

WAPDA will make the EPC Contractor bound through contract documents to implement the EMP and other terms and conditions of the Environmental Permit/No Objection Certificate. The whole EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies' requirements, before commencement of construction works. The organizational setup for implementation of EMP during construction phase is provided in **Figure 9-1**.

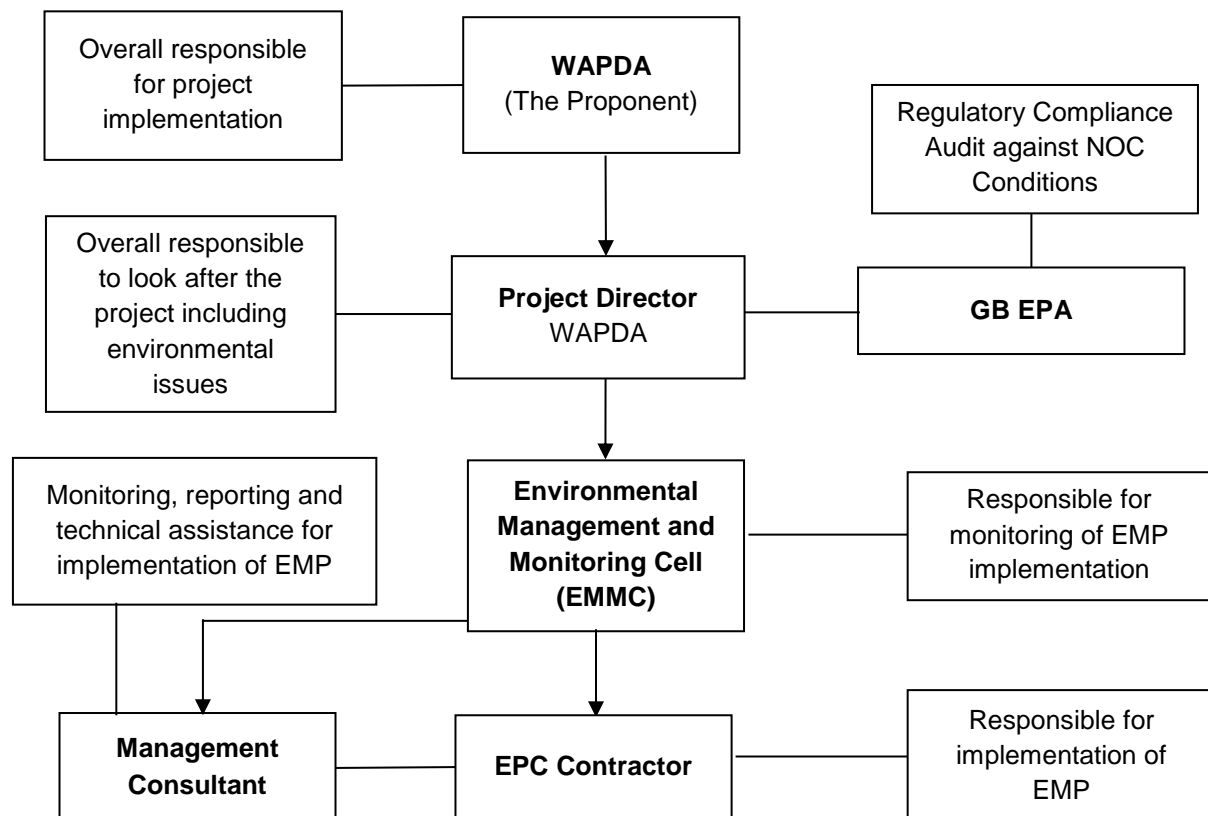


Figure 9-1: Institutional Arrangement for Implementation of EMP

9.4.2 Roles and Responsibilities for EMP Implementation during construction Phase

a. WAPDA / Environmental Management & Monitoring Cell EMMC

WAPDA will set-up Environmental Management/ Monitoring Cell (EMMC) specifically for ALHPP. The staff of EMMC will be deputed from WAPDA. The EMMC will be headed by Deputy Director Environment & Resettlement, who will report to the Project Director of Attabad Lake Hydropower Project. Deputy Director Environment & Resettlement will be assisted by a two member professional team consisting of Assistant Director Environment and Assistant Director Social. The EMMC will be responsible for the proper environmental monitoring proposed under the Project, overseeing and coordinating the work of the Management Consultant on behalf of WAPDA. They will also be responsible for interaction with the Community/ NGO's etc. for socioeconomic and resettlement issues. The specific responsibilities of WAPDA/EMMC are as follows:

- Setting up systems for environmental management;
- Ensuring that the EPC Contractor develop and carry out environmental implementation plans that are consistent with the EMP;
- Liaising between the project staff and the Supervisory Consultant's staff to monitor environmental and social compliance during construction phase;
- Ensuring that the required environmental and social training is provided to the concerned staff;
- Responsible for carrying out random site visits to the construction sites to review the environmental performance of the EPC Contractors;
- Monitoring the progress of environment and social related activities;
- Make sure that the EPC Contractor is implementing the additional measures, suggested by the Supervisory Consultant in monthly environmental monitoring reports;
- To assist the EPC Contractor for obtaining necessary approvals from the concerned departments;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the GB EPA on status of EMP implementation.

b. Management Consultant (MC)

The Management Consultant (MC) will administer the civil work's contracts, make engineering decisions, be responsible for quality assurance, provide general guidance and furnish timely responses to the EPC Contractor in all matters relating to the civil works, and ensure that all clauses of the Contract Agreement including environmental and social clauses between the civil works the EPC Contractor and WAPDA are respected. MC will have a field based environmental and social specialist to ensure the implementation of EMP. The environmental and social specialist of MC will also develop training modules, conduct environmental and social trainings for the EPC Contractor staff, and ensure social issues are properly addressed and mitigated during the project life.

Environmental and Social Experts (ESEs) of MC will oversee the performance of the EPC contractor to make sure that the EPC contractor is carrying out the work in accordance with

EMP as mentioned in the contract documents. He will provide guidance to the EPC contractor's ESE for implementing each of the activity as given in EMP. ESEs will be responsible for record keeping, providing instruction through the Resident Engineer (RE) for corrective actions and will ensure the compliance of various statutory and legislative requirements.

However, overall responsibilities of ESEs are as follows:

- To oversee the performance of the EPC Contractor to make sure that the Contractor is complying with EMP;
- Discussing various environmental and social issues and environmental mitigation, enhancement and monitoring actions with all concerned personnel's;
- Inspect and monitor all the construction and allied activities related to the EMP for the project and oversee the performance of the EPC Contractor to make sure that the EPC Contractor is complying with EMP;
- Visiting construction sites including incomplete construction work sites, where there is no contractor's activities, active construction work sites, completed areas of work sites, construction camps and workshop areas to ensure the EPC Contractor compliance with EMP stipulations and conditions of statutory bodies;
- Assisting the EPC Contractor in all matters related to public contacts including public consultation pertaining to environmental and community issues;
- To organize periodic environmental training programs and workshops for the concerned staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

c. EPC Contractor

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

- ESEs will be responsible for Implementation of the mitigation measures at construction site;
- ESEs will prepare Site Specific Environmental Management Plan (SSEMP) and will submit all the plans to the MC.
- ESEs of the EPC Contractor will be responsible for the implementation of EMP and to take effective measures against corrective actions plan;
- ESEs will prepare the monthly compliance and monitoring reports as per schedule and will submit it to the MC;
- Provision of proper Personal Protective Equipment's (PPEs) to the workers and train them for their proper use;
- ESEs will conduct the environmental, health and safety trainings for the staff and labor; and

- The EPC Contractor shall submit the Code of Conduct that will apply to all of the Contractor's staff. The EPC Contractor shall submit an outline of how the Code of Conduct will be implemented. The aspects to be addressed include:
 - Ensure compliance with applicable environment, health and safety standards and procedures associated with risks and impacts of project activities;
 - Ensure compliance with all acquired approvals, applicable to the proposed project;
 - Ensure protection of local community (including vulnerable and disable assemblies), and the EPC Contractor's staff, sub-contractors and daily wage workers;
 - Ensure employment of fulltime security guards, and necessary security measures and instruments (CCTV) at site;
 - Ensure provision of adequately stocked first aid kit at site for dealing with accidental injuries, and natural hazards;
 - Prohibit use of illegal items such as weapons, alcohol and drugs at site;
 - Ensure that project property is protected against vandalism, theft, and noxious activity;
 - Ensure that positive attitude of respect and warmth is given to staff and community members;
 - Ensure good housekeeping practices shall be adopted at site;
 - Ensure that employment decisions are not made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin;
 - Ensure establishment and strictly enforcement of "No Sexual Harassment Policy";
 - Ensure provision of necessary sanitation requirements for site workers (both for men and women);
 - Ensure workers only use specified sanitary facilities provided by their employer and not in open areas;
 - Restriction on burning solid waste;
 - Restriction on dumping solid and liquid waste into nearby water bodies;
 - Prohibition for cutting trees, and clearing vegetative areas for construction camps, and for cooking purpose as a source of fuel; and
 - Prohibition on illegal hunting of local fauna.

The Code of Conduct should be written in local and simple language (Urdu and English) and signed by each site staff to specify that they have received a copy of the code; code explained and clarified to them; acknowledged adherence to this Code of Conduct as a condition of employment; and understood that violations of the Code can result in serious consequences. A copy of the code shall be displayed at strategic location of the site, and mainly in the EPC Contractor site office.

d. GB Environmental Protection Agency

GB EPA is the regulatory authority for issuance of NOC for the proposed project. As part of its mandate, protection of environment is its responsibility. Therefore, the agency will undertake an audit (as and when required) of the activities of the project (both phases i.e. construction and operation) with respect to the protocols as defined in EMP and in NOC. The specific responsibilities are as follows:

- Liaison with the Project Director of WAPDA on the proposed project to ensure compliance of measures as given in the EMP and in NOC issued by it for the construction activities of the proposed project;
- Environmental Audit of the activities being undertaken by WAPDA and all other relevant stakeholders as provided in the EMP and NOC through random site visits and meetings.

9.5 PARTICIPATORY CONSULTATION FRAMEWORK

This aspect has been discussed in detail in the Chapter 6.

9.6 PLANNING FOR EMP IMPLEMENTATION

9.6.1 NOC and Other Approvals

- **EPA Approval Process**

The EIA report duly reconciled with WAPDA is to be submitted to GB EPA for obtaining NOC. A demand draft of required EIA review fee has to be deposited along with the report by the Proponent to GB EPA for initiating the review and EIA approval process. The approval from GB EPA is the mandatory requirement before commencement of the proposed project activities.

- **Provincial Departments of Wildlife, Forest and Archaeology**

At the feasibility stage of the project as per the requirement of EPA guidelines for the Sensitive and Critical Areas, concerned provincial forest and wildlife departments are informed through letters for the proposed project.

During the construction stage, if the implementation of the proposed project involves the clearing of vegetation and trees which belongs to the forest or wildlife department, the EPC Contractor will be responsible for acquiring a NOC from the provincial department. The application for an NOC will need to be endorsed by WAPDA. Similarly, if any Archaeological monument or site is crossed by or near to the proposed project concerned provincial archeological department needs to be contacted for NOC.

Where construction is to be carried out in the close proximity of the any archaeology sites (if identified during construction stage), WAPDA is required to coordinate with the concerned departments to ensure that the impacts are minimized. The EPC Contractor is also required

to contact with concerned department before the start of the construction work.

- **Provincial Revenue Departments**

Under the national law, matters relating to the land-use and ownership are the provincial subjects and the revenue department of the concerned province is empowered to carry out the acquisition of private land or built-up property for public purposes, including on behalf of other provinces. For this purpose, the concerned department must lodge an application with the concerned provincial department to depute a Land Acquisition Collector (LAC) and other revenue staff, who will be responsible for handling the matters related to the acquisition and disbursement of compensation.

9.6.2 Stakeholder Coordination

Notwithstanding the efforts so far put in for public participation, this activity will have to be pursued through the forthcoming implementation phases of the Project. In particular, the focus will be on the improvement and modification of the proposed intervention designs.

Participation mechanisms facilitate the consultative process and include information sharing and dissemination, disclosure, and participation of affected people and other stakeholders in the proposed project related activities. In the particular social set-up of the project area, it is also important to involve the religious leaders as representatives of the public as well as part of effective communication process. They can provide a very effective medium to bring information to the affected male population through Friday prayers. Local business community, especially the affected one, should also be brought into the process of awareness and participation.

The related institutional arrangements should also be in place for continuous consultation throughout the process of planning and implementation. During construction, WAPDA Node will have to implement EMP.

The construction schedule will be established / updated before the commencement of construction work considering the activities specifically suggested in EMP for its implementation.

9.7 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) provides the framework for the implementation of the mitigating measures and environmental management and monitoring during the design, construction and operation phases of the proposed project. **Tables 9-1** shows impacts, targets, mitigations and the responsible organizations for the implementation of the mitigation measures during the design, construction and the operation phases respectively.

Table 9-1: Environmental Management Plan

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
A. Design / Pre-Construction Phase				
1	<p>Field Investigations and setting up of construction camps</p> <p>Low level adverse impacts on the air quality, increase in noise level, contamination of surface water quality and soil erosion due to the pre-construction activities like geotechnical investigations including drilling, topographical surveys and seismic investigation will affect the existing settings. Activities like drilling, blasting, movement of machines and setup of EPC Contractor and Consultant camps will also impact the soil, wildlife, noise levels etc. This impact would be of medium significance.</p>	<p>Good engineering practices and Standard Operating Procedures (SOPs) are required to be adopted by the EPC Contractor to mitigate this impact.</p> <p>Measures such as sprinkling of water on the roads and dirt tracks, use of water to reduce air pollution during the stone crushing operation and tuning of vehicles and equipment will reduce the air pollution. The excavated material will be managed by ensuring proper storage areas located far away from the water bodies. The choice and design of these measures such as reduction of slope gradient and height, reduction in slope angle, removal of unstable material, use of reinforcement material etc. will be the responsibility of the EPC Contractor. The EPC Contractor will be required to train his workforce in the storage and handling of materials, like oil, diesel, petrol and chemicals, etc., which may potentially cause soil contamination. Special measures will be adopted to minimize the impacts on the nearby settlements such as avoiding noise generating activities during night time, etc.</p>	EPC Contractor	MC WAPDA
2	<p>Seismicity</p> <p>The Project area falls in Seismic Zone 2B (moderate hazard), which represents Peak ground acceleration</p>	<p>The proposed structure should be designed to withstand moderate to high earthquakes, a very careful analysis, followed by ICOLD Guidelines and using latest software, of the situation will be required during the design stage. For seismic hazard analysis, updated structural and seismic</p>	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>from 0.16g to 0.24g, where g represents acceleration due to gravity. In this Zone, designing of various types of structures are done on the basis of Peak Ground Acceleration (PGA). A high intensity earthquake impacting the poorly designed project site can adversely impact the future development.</p>	<p>evaluations should be consulted. Moreover, geo-technical investigations must be conducted prior to construction phase.</p> <p>Continuous monitoring of the behavior of faults will be required during the operation stage and contingency plans to deal with such a situation must be part of the project management. Instruments to monitor seismic activity must be installed at the time of construction.</p> <p>Based on the analysis, the following earthquakes design parameters are concluded and recommended for the proposed project:</p> <p>Operation Basis Earthquakes (OBE): OBE at return period of 145 years is recommended as follows: OBE Horizontal = 0.24g and OBE Vertical = 0.17g.</p> <p>Safety Evaluation Earthquakes (SEE): For the design of dam / Flexible/ Rigid Overflow Structure, the following PGA 'g' values for SEE (Safety Evaluation Earthquakes) are recommended: SEE Horizontal = 0.44g and SEE Vertical = 0.29g.</p> <p>For the design of appurtenant structures, the following PGA 'g' values for SEE (Safety Evaluation Earthquakes) are recommended: SEE Horizontal = 0.38g and SEE Vertical = 0.26g.</p>		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
3	<p>Flooding</p> <p>As river water will pass through the headrace tunnel and overflow spillways, there is a chance that these tunnel and spillways could not accommodate the flows in abnormal years, which may pose a threat to the main structures and this impact may be treated as High Significant.</p>	<p>Keeping in view the different types flood estimations and generation of high peaks due to GLOFs, it is recommended to adopt design flood of 10,000 years return period at Flexible/ Rigid Overflow Structure site. Therefore, design flood of 3,250 m³/s at Flexible / Rigid Overflow Structure site has been assumed for the calculations of design of structures.</p> <p>It is also suggested to have close monitoring of Glaciers in Hunza Region to have better judgment of GLOFs and remedial measures for the safety of Attabad Lake and downstream areas. However comprehensive study will be undertaken during Detailed Engineering Design of the Project by the EPC Contractor.</p>	EPC Contractor	MC WAPDA
4	<p>Resource Conservation</p> <p>Resources involved in the construction of proposed Project would include water, fuel and construction materials.</p> <p>Excessive water consumption by the construction staff may stress water resources in the Project Area and in certain cases may disturb the existing water supplies in the Project Area. Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt,</p>	<ul style="list-style-type: none"> ▪ Use water bowser tanks for construction works and mineral water bottles/ ground water for drinking purpose; ▪ Reduction of wastage of water through training of workers involved in water use; ▪ Reuse of construction waste materials may be adopted wherever possible; ▪ The efficient and well maintained equipment and machinery should be used; ▪ The equipment and machinery should be turned off when not in use; ▪ Ensure adequate insulation to reduce heat loss through batching plants; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>cement, sand, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed Project are non-renewable and, therefore, their efficient use is necessary for the future use. Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. The impact significance is medium adverse.</p>	<ul style="list-style-type: none"> ▪ Regularly monitor CO and CO₂ content of the flue gases to verify that combustion systems are using practical excess air volumes; and ▪ A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels. 		
5	<p>Flora</p> <p>During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads and mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is site-specific,</p>	<ul style="list-style-type: none"> ▪ The camps, mobility of machinery and construction of temporary road should be properly planned and well designed to avoid any loss to local green cover; ▪ It is recommended to establish the construction camps where minimum or no vegetation exists; ▪ Similarly, the alternate routes for roads and location for camps are recommended where no loss of vegetation is expected; and ▪ An inventory of trees/vegetation may be prepared by the contractor with the help of concerned department (Forest) before clearing the site. 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	temporary, reversible, possible, medium significant and needs to be encountered prior to the start of construction stage.			
6	<p>Fauna</p> <p>As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary access road (if any) may also affect the habitat of locally available fauna. This impact is site-specific, temporary, irreversible, possible and low significant.</p>	<ul style="list-style-type: none"> As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary access road (if any) may also affect the habitat of locally available fauna. This impact is site-specific, temporary, irreversible, possible and low significant 	EPC Contractor	MC WAPDA
7	<p>Aquatic Life</p> <p>Fisheries Department Hunza has introduced several thousand fingerlings of exotic fish species namely Salmo Trutta Fario (Brown Trout) at Attabad lake and downstream river during the period from 2012 to date for propagation and the said specie has made breeding</p>	<ul style="list-style-type: none"> Annual restocking plan of fish fingerlings shall be included in the project to compensate the stock depletion due to decrease in fish breeding grounds. Fish ladder shall be in sure for freely movement of fishes; Fish screening system shall be developed so that fish may not be trap at fore bay or penstock pipe or channel. Besides the above mentioned points a Fisheries research unit and a brown trout hatchery with 	EPC Contractor in consultation with Fisheries Department, GB	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>grounds at Attabad lake and downstream as well. Besides this a number of indigenous fish species also exist in the same water bodies having commercial as well as ecological importance. The destruction of habitat will have significant adverse impact on the aquatic life and fisheries.</p> <p>Fish usually migrate from one place to another for search of food, shelter and spawning/breeding. Due to implementation of the proposed Project fish migration might be affected up to some extent. Water requirements and movement of aquatics along with other risks may also be anticipated due to the proposed project. This impact is categorized as medium to high significant.</p>	<p>research/management staff should be established at the project side for research purposes as well as impact assessment during construction as well as operational phases of the said project.</p> <ul style="list-style-type: none"> ▪ The establishment of fish hatcheries under this project should be ensured by GB Fisheries Department, Hunza in close consultation and coordination with GB EPA; ▪ The minimum flow to be ensured through the Flexible/Rigid Overflow Structure during the whole year. In case the hydrological records are enhanced, the figure of minimum requirement for maintenance of aquatic ecosystem has to be revised likewise; ▪ To conserve the freshwater fishery resources, it is important to involve fisheries scientists and local communities in all study phases of proposed project; ▪ Moreover, the impact on fish fauna, both up and downstream of the project site specially the migration patterns and breeding grounds need to be taken into account during all stages of the project and should be monitored by the contractor specialized professionals in consultation with GB, Fisheries Department Hunza; ▪ GB, Fisheries Department has authority to update, change and add/ recommend any standard as per law of land and in best public interest; and ▪ The custodian Department should have a close liaison with GB EPA and Fisheries Department GB to ensure the conservational aspects of fisheries during all stages 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
		of the project to avoid any negative impacts on local natural environment.		
8	<p>Permanent land</p> <p>It will be acquired for the Project components such as Powerhouse, Flexible/ Rigid Overflow Structure & Associated Structures, Access Roads and Project Colony. Total land to be acquired is approximately 183 acres (05 acres for Contractor's Camp, 60 acres for Project Colony and Powerhouse Area, 103 acres for Intake Area and Access Corridor and 15 acres for Spoil Area) for project components which includes both private and government land. The estimated total land to be acquired is 777.5 acres due to the impounding of reservoir upto maximum conservation level including free board, including river bed. This will result in loss of land. The estimation of land requirement will be finalized after the detail design by the EPC Contractor. The ownership record of affected land will be prepared by the Revenue Department according to separate</p>	<p>Government owned land for the Project area will be acquired as per the policy of government of GB. While private land will be acquired as per provision of LAA, 1894. The process of land acquisition will start before the Project will enter into construction phase and section-4 of land acquisition act, 1894 will be notified by relevant agency.</p> <p>The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the displaced by providing sufficient budget in the project cost</p>	<p>WAPDA District Government</p>	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	categories of the land. The significance of impact is high adverse needs to be encountered prior to the start of construction stage			
9	<p>Temporary Land acquisition</p> <p>During the construction activities, the EPC Contractor will establish contractor camps, storage areas for materials and equipment including vehicles, workshops, stockpile yard, etc. The EPC Contractor need to lease the land for these areas in the vicinity of the construction sites. These areas will be acquired on temporary basis by direct negotiation and agreement with the owners or negotiated with or decided by the district administration office. Temporary acquisition will principally be the responsibility of the contractor. The significance of impact is high to medium adverse.</p>	<p>Land for above mentioned facilities will be directly rented from the private landowners by the EPC Contractor. The provisions of the Land Acquisition Act (LAA), 1894 will not be involved as the acquisition of the land will be temporary and will be covered by short-term lease agreements between the landowners and the EPC Contractor. Temporary acquisition will principally be the responsibility of the EPC Contractor. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be made in local language to make the process clear.</p> <p>As mentioned the location of these areas are not finalized yet, therefore, a criterion has been suggested which should be followed to avoid the adverse impact on the environment. The land for above mentioned facilities should be selected and leased prior to the start of construction phase.</p> <p>Lease agreement should also govern the process of site restoration of the leased or rented land after the construction phase and will ensure through the terms of the construction contracts that landowners are compensated according to the terms of the lease agreements and the site restoration</p>	<p>WAPDA District Government</p>	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
		<p>plans agreed upon by the EPC Contractor are duly carried out.</p> <p>The following general site selection criteria have been suggested to be complied by the EPC Contractor:</p> <ul style="list-style-type: none"> ▪ Minimize the resettlement, relocation of the existing infrastructure like roads, cultural and religious sites etc. and avoid the cutting of trees; ▪ It should be elevated to avoid floods and for other security reasons; ▪ Proximity to the major disaster and emergency management authorities; ▪ Avoid potentially security vulnerable areas; ▪ Minimize disturbance to the natural habitats of flora and fauna; ▪ Avoid densely populated areas/towns; ▪ Avoid wildlife sanctuaries, national parks and game reserves; ▪ Appropriate distance from the sensitive receptors (for instance, minimum 500m); and ▪ Avoid cultural, religious and historical buildings 		
10	<p>Impact on structures</p> <p>In the reservoir area of the proposed project miscellaneous residential, commercial and community structures will be affected due to the</p>	<ul style="list-style-type: none"> ▪ Due consideration should be given to minimum and no impact on the residential, commercial, and religious structures; ▪ Compensation for the affected structures should be evaluated and provided as per market rates. 	<p>WAPDA District Government</p>	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>project intervention. These structures will be demolished permanently and will have to relocate and move their dwellings elsewhere. The community and religious structures are very sensitive to impact and need special care during execution of the project; because people think that these structures might not be rebuilt if once demolished. A graveyards fall in the reservoir area of the proposed Project. Shifting and demolishing of the graveyard may cause serious social issues. Due to adverse impact on the residential, commercial, and community structures, human disturbance will occur which create magnitude social, gender, livelihood and cultural issues. This impact can be categorized as negative, local, high, permanent and irreversible. The inventory of structures along with the detailed measurement of structures will be completed by the EPC contractor during the phase of detailed planning.</p>	<ul style="list-style-type: none"> ▪ Compensation should be given for all affected crops and trees; ▪ The effort will be made by making changes in design to avoid the sensitive and religious structures and to minimize the issues at possible extend. If needs demolishing/shifting, a mechanism will be developed for the restoration of these structures during the detailed design by the EPC contractor with the community consultation; ▪ Affected Persons should be compensated on full replacement cost of each category to construct a new structure of the same type; and ▪ Proper consultations and coordination's with project affected persons during resettlement process. 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
11	<p>Impact on Social Life</p> <p>During the planning and design phase of the project, it is anticipated that there will not be any potentially significant adverse impact on the socio-economic environment. Locals may be temporarily disturbed due to the field investigations and drilling activities, disturbance to electricity poles and existing track/roads within project boundary. This impact can be categorized as medium Significant.</p>	<ul style="list-style-type: none"> ▪ Proper compensation and restoration mechanism of public utilities will be considered during the detailed design of the Project; ▪ Complete rehabilitation of affected public utilities will be ensured; ▪ The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department; ▪ Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area; ▪ Timely public notification of unexpected disruption of services; and ▪ Good engineering practices shall be adopted to avoid or reduce these impacts. 	EPC Contractor	MC WAPDA
B. Construction Phase				
1	<p>Aesthetic Value of the Project Area</p> <p>Attabad Lake is an important recreational site for the tourists including foreign visitors. Construction activities may result in some visual impacts. The construction activities will involve the cutting of trees/bushes, excavation, soil filling and cutting operation. This</p>	<p>The adverse environmental impacts related to the aesthetic could be effectively minimized at the construction phase. These will be mitigated by the control of clearing vegetation to the area in the construction limits and by plantation and quick re-vegetation during the construction phase. Good house-keeping, cleaning, efficient solid waste management system should be implemented to improve the aesthetics of the working environment.</p>	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	disturbs the natural scenic value of the environment. In addition to that the sitting of construction equipment and the lacks of resurfacing / replanting of exposed areas are also the leading factor to aesthetic reduction. The impact significance is medium adverse.			
2	<p>Topography</p> <p>Construction activities are not expected to impact the topography of the area significantly except for those areas where physical activities including digging and excavation, storing or dumping sites for excessive material and movement of heavy construction machinery will be carried out. The excavated material will be generated due to the construction of various components of the Project such as construction of Cofferdams, Sediment Flushing Tunnel/Under sluice, Flexible/ Rigid Overflow Structure, Headrace Tunnel, Surge Tank, Penstock, Powerhouse, Tailrace Channel, Project colony. The area where excavated material is to</p>	<ul style="list-style-type: none"> The excavated material will require safe disposal by the EPC Contractor. Most of the excavated material could be used in back filling purpose, where applicable. A detailed development and operation plan for borrow areas must be prepared by the EPC Contractor before the starts of extraction of material from each borrow area. The EPC Contractor should strictly follow the provisions of approved plan in order to minimize any adverse impact associated with the borrow areas. Likewise, excavated material should be dumped at suitable and approved disposal sites 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	be dumped may also be impacted. The impact significance is medium to low adverse.			
3	<p>Land Slide</p> <p>Landslides are common in the project area.</p> <p>Due to the Project activities, especially in case of blasting or cutting of rocks in some areas, the formation will become loose and the risk of landslides will increase in the immediate vicinity of the construction sites, especially at the right bank of Hunza River, which may be considered as a high adverse impact. The impact significance is high to medium adverse.</p>	<p>To avoid the major risks, all structures have been proposed on the left bank of Hunza River. Blasting should be avoided or minimized where possible, if inevitable then low intensity explosive material should be used instead of high intensity explosive material. It is strongly recommended to perform appropriate confirmatory geotechnical investigations all along the alignment of Headrace tunnel and other components for assessing strength parameters of natural material either rocks, moraines or scree. This shall be done so that safety of this major Project component and adjacent areas can be ensured through proper design of cut slopes.</p> <ul style="list-style-type: none"> Landslide risks shall be mitigated by the installation of safety barriers at construction sites, and monitoring and informing locals about construction schedules, and any weather events that might exacerbate landslide risk. Construction work will be avoided during rain to the extent possible. The EPC Contractor will prepare the Management Plan for blasting activities and implement the same after approval from the Supervision Consultant and Client. 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
4	<p>Site Accessibility</p> <p>The proposed Project Area falls within the Hunza Valley which is located about 115 km from Gilgit city. The Project site can be accessed through Karakoram Highway (KKH) which is the only major mode of transportation in the Project area. Heavy vehicles will be utilized to transfer construction plants, equipment, construction materials, cement and fuel. These activities may have adverse impacts on the existing infrastructure. Apart from that it may cause air and noise pollution. The impact significance is high to medium adverse.</p>	<p>The access roads to the hydropower site have to be pre-determined in consultation with the concerned departments. Access roads would have to be widened and/or improved to carry the anticipated load of traffic.</p> <p>During the course of construction of proposed Project, the EPC Contractor will provide the signage and/or traffic control to the extent deemed necessary by the traffic utilizing or accessing the site roads. These signs will inform, control, warn, shift, or stop traffic on all site roads affected by the Project's heavy traffic. The following measures will be taken by the EPC Contractor during the construction phase for the effective implementation of the traffic plan:</p> <ul style="list-style-type: none"> ▪ National and local traffic rules and regulations, instructions manual for motor vehicle and mobile machinery operation should be followed; ▪ No one will be allowed to drive motor vehicle or operate mobile machinery without a driving license; ▪ It should be prohibited to drive or operate vehicle in case of over fatigued or mental disease; ▪ Traffic speeds on unpaved roads should be limited to no more than allowable traffic speed; ▪ Traffic speed signs should be displayed prominently at all site entrances; ▪ A daily routine check-up of vehicles should be conducted no less than 5 minutes before its service; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
		<ul style="list-style-type: none"> ▪ Use of appropriate signs, equipment, and traffic control measures that conform to the provisions in the traffic manual of city traffic police; ▪ Traffic inspection and security during transportation; ▪ Limit vehicular traffic designated access roads, construction laydown area, parking areas and the Project site; ▪ All damaged, destroyed or modified pavement legend, traffic control devices, signing and striping associated with the proposed development should be replaced as required prior to issuance of a certificate of occupancy; and ▪ Construction signs, lighting and barricading should be provided during construction as required. ▪ The EPC Contractor should also be responsible to prepare a comprehensive Traffic Management Plan and follow the conditions of Contract Agreement. 		
5	<p>Natural Drainage</p> <p>Construction activities such as excavation, filling and construction will affect the existing soil pattern in the Project Area including water pathways its surroundings. In addition, this will lead to changes in the existing drainage pattern. The conditions will be more hazardous during the flood periods and may</p>	<p>During the construction phase, excavated material should be properly disposed of ensuring that it will not block the natural drainage paths. Open drains for drainage of rain/flood water should be constructed, if considered necessary during construction period.</p>	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	affect the construction activities. The impact significance is high to medium adverse.			
6	<p>Soil Contamination & Erosion</p> <p>During the construction phase of the proposed Project, large quantities of materials, chemicals, fuel and lubricants will be used apart from the generation of solid waste and liquid waste from the construction camps. Fuels and chemicals will be stored at the site for their immediate use, which will contaminate the soil if not handled properly particularly at asphalt plant sites, workshop areas and equipment washing yards.</p> <p>Similarly, removal of vegetation and shrubs for the purpose of construction activities will lead to loosing of the soil, soil disturbances, and exposure of bare soil surface. This causes problems of soil erosion during rain. Similarly, steep gradients increase erosion on these slopes due to reduced water infiltration and</p>	<ul style="list-style-type: none"> ▪ Sites disturbed by construction activities will be restored to their original conditions upon completion of construction work and photographic record will be maintained to ensure pre-post subproject conditions intact; ▪ Soil contamination by asphalt should be minimized by placing all containers in caissons; ▪ The EPC Contractor will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination; ▪ Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals; ▪ If any contaminated soils are found at the construction sites or at camp sites, they shall be removed and deposited in a sealed pit in at designated area; ▪ The EPC Contractor will be required to prepare training manual and modules for all the construction related activities along with the schedule of training program and submit to the Supervision Consultant for approval; ▪ Solid waste generated at the camp sites will be properly treated and safely disposed only in the demarcated waste disposal sites/areas; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	increased runoff accumulation. Soil erosion may also occur in the workshop areas as a result of improper drainage system of equipment washing-yards and improper management of construction activities. The impact significance is high to medium adverse.	<ul style="list-style-type: none"> ▪ Subproject sites will be selected to avoid or minimize vegetation removal/clearing which would accelerate erosion and increase landslide risk; ▪ The EPC Contractor shall adopt good engineering practices that will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas; and ▪ Site restoration plan for the Project should be strictly followed. 		
7	<p>Wastewater Generation</p> <p>Wastewater will be generated at the construction camps, from construction activities and residential colony (for the EPC Contractor, the Consultant and the Employer staff). If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water apart from soil contamination. Water from dewatering activities (during rainy season) has the potential to contain suspended solids and oil and</p>	<p>To dispose the liquid waste generated from the construction activities, the following steps will be taken by the EPC Contractor:</p> <ul style="list-style-type: none"> ▪ Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks; ▪ The domestic sewage will be treated with biological treatment technology and will be discharged as per NEQS. Proper monitoring to check the compliance of NEQS will be carried out; ▪ Proper monitoring to check the compliance of NEQS will be carried out. Septic tank will be located adjacent to the construction camp; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	grease and if disposed of untreated may affect the soil quality.	<ul style="list-style-type: none"> ▪ Sewage from construction camps will be disposed of after proper pre-treatment; ▪ Water discharged to drains should contain a minimum quantity of suspended solids; and ▪ Site for construction camp will be selected at least 500 m away from the settlements 		
8	<p>Solid Waste</p> <p>Different types of waste including construction (waste concrete and asphalt, empty containers, excavated material), municipal (from construction camps) and hazardous wastes (including empty containers of paint, lubricants, grease, fuel oil, electrical wiring, pipis etc.) are likely to be generated during the construction phase of the proposed Project and from the EPC Contractor's Camps (the solid waste generation is estimated to be 157.5 kg/day (as per 0.45 kg/capita/day waste generation)²⁰ for 350 construction workers) which may have potential to serve as breeding grounds for the disease spreading vectors and</p>	<ul style="list-style-type: none"> ▪ Minimize the generation of spoils by recycling the excavated rock to the maximum extent possible by using them as aggregate material in the concrete works; ▪ Construction waste will be routinely collected and safely disposed of in clearly demarcated waste disposal sites located near each subproject site following international best practices; ▪ Waste disposal will be carried out following international best practices and will ensure that there are no negative impacts on soil, water bodies, existing waste management systems, transport routes, and aesthetic value of the area; ▪ The debris produced during construction would preferably be dumped at nearby depressions rather than being thrown away and left unattended. Leftover material would not be dumped into water bodies; ▪ The labor workforce (including community labor) will be trained on the handling, storage, and disposal of construction waste. Burning of waste shall be prohibited; 	EPC Contractor	MC WAPDA

²⁰ The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>rodents. During the construction phase, significant quantities of rock will to be excavated. In order to reduce the amount of rock to be disposed, excavated rock can be used in the Project for different types of infrastructural works. The remaining spoil will be disposed in designated and safe disposal areas. Throwing away of solid wastes into water channels may cause blockages in drainage channels, contamination of nearby water bodies and soil contamination (render them unfit for plantation).</p> <p>Empty containers containing the toxic, flammable and corrosive materials may pose hazard to the workers. This may result in health risk to work force and public, if disposal site is improperly selected.</p> <p>All these, if left unattended, can become a source of nuisance and environmental pollution in the subprojects area. Discarded materials and equipment may also</p>	<ul style="list-style-type: none"> ▪ PPEs shall be provided and worn by the personnel involved in construction activities and training them in their use; ▪ Waste containers with proper color coding will be provided on site to store different type of waste; ▪ Site Specific Solid Waste Management Plans (SWMPs) will be developed and implemented by Contractors; and ▪ It will be ensured that no waste or left over construction material is left behind in the cultivation fields 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	pose traffic safety risks if left on or near transport routes. This impact is moderate adverse in nature.			
9	<p>Surface Water</p> <p>Surface water quality of the Attabad Lake may get deteriorated due to the construction activities. During the construction phase of the proposed Project, materials like sand, gravel and stones will be required in large quantities. Extraction of the materials will also affect the surface water quality by increasing the sediment load. This water will be used during different construction activities. The movements of heavy vehicles on the unpaved tracks, excavation activities, cut and fill processes in the Project Area, fuel and chemical spills may deteriorate the quality of the surface water. These activities will also increase the sediments and turbidity of the water.</p> <p>Waste streams can bleed toxic materials from items such as</p>	<p>The excavated material will be managed by ensuring proper storage areas located far away from the water bodies. All the solid waste from the camps should be properly collected at source by placing containers and disposed of through proper solid waste management system. To reduce the impact of sediment, load the EPC Contractor should make arrangements such as fine screens and drains to limit the siltation into the water bodies. A simplified sedimentation tank shall be built on the construction site for the primary treatment of the construction equipment wastewater, detergents and mud. Wastewater effluent from the Contractors' workshops and equipment washing-yards should be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. This is the general guideline principle for the contractor. Appropriate sanitation and water supply facilities will be provided in the labor camps.</p> <p>Spillage of fuel/oils and other construction materials shall be contained with best handling/construction practices and strict skilled supervision. The EPC Contractor will ensure that construction debris does not find their way into the water bodies without proper treatment</p>	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	batteries, used computer equipment, leftover paints and pathogenic organisms include specific strains of bacteria like E. coli into the leachate of dumps. Leachate from waste piles caused by exposure to precipitation and from residual liquids in the waste itself may contain organic matter, nutrients, metals, salts, pathogens, and hazardous chemicals. If allowed to migrate, leachate can contaminate surface water. This impact is moderate adverse in nature.	Treating and disposing the sewage in a manner that the soil and water is not contaminated and ensure compliance with NEQS or international standards/guidelines, whichever is stringent will be followed.		
10	<p>Ambient Air Quality and Climate Change Aspects</p> <p>During construction period, the impacts on air quality are mainly due to material movement and the construction activities (particularly blasting of rocks, operation of batching and mixing plants, drilling, stone crushers) causing an increase of emission of carbon monoxide, sulfur oxides, nitrogen oxides, unburnt hydrocarbons and other greenhouse gases, as well as fine particulate matter. The pollution</p>	<ul style="list-style-type: none"> ▪ In order to reduce the dust emissions in the construction area due to material transport and construction activities, provisions will be made for sprinkling of water in the area where earth filling, excavation and other dust emissions causing activities being carried out. It will be ensured that the construction debris is removed on daily basis; ▪ Construction materials and spoil materials will be transported through trucks covered with tarpaulins. During windy conditions stockpiles of fine material will be wetted or covered with plastic; ▪ In no case, loose earth will be allowed to pile up along the approach roads/ public access areas; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>causing activities during the construction phase are: loading/unloading and stocking of construction material, transportation of construction and excavated material, diesel generator, construction equipment, vehicles rock cutting operations, site clearance, excavation, concrete batching and concrete mixer. The ambient air quality over the immediate influence area will be affected and the criteria pollutants levels and greenhouse gases in ambient air might increase, over longer distances depending on atmospheric conditions. Emission of greenhouse gases causes global warming and other climatic changes on regional and global scale. Cutting of trees will also reduce the carbon sequestering and overall increase the CO₂ content in atmosphere.</p> <p>The impact of emissions is assessed to be temporary and moderate and is unlikely to have lasting impacts after construction work is complete</p>	<ul style="list-style-type: none"> ▪ PPEs such as dust masks will be made available to the construction workers at the site to avoid potential health hazards; ▪ Idling of delivery trucks or other equipment will not be permitted during periods of unloading or when they are not in active use; ▪ Open burning of solid waste at construction site will not be allowed; ▪ All vehicles and other equipment used during construction will be properly and regularly tuned and maintained; ▪ Ensure compliance with the NEQS; ▪ Diesel generator should be fitted with acoustic enclosure and stack of appropriate height for the proper dispersion of emission; ▪ Awareness programs of causes and effects of climate change will be conducted for mitigating GHG emissions, ensure plantation of trees and use solar panels where possible; ▪ Regular monitoring of air quality in accordance with the formulated environmental monitoring plan (given in EMP). 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
11	<p>Noise and Vibration</p> <p>Noise and vibration will occur due to the operation of construction machinery and other equipment. The major sources of noise and vibration²¹ are construction activities, movement of vehicles, construction equipment, blasting, drilling, pouring equipment, stone crushers and generators etc.</p> <p>High background noise levels can cause significant disturbance to local wildlife, and have adverse psychological and physiological effects on individuals residing in nearby communities.</p> <p>Significant noise pollution impacts are expected only during the construction phase of activities involving large civil works. The cumulative effects from several machines can be significant and may cause significant nuisances. In all cases, the impacts are likely to be short-term and mitigatable and will</p>	<ul style="list-style-type: none"> ▪ Construction vehicles and machinery will be kept in good working condition, and be properly tuned and maintained through the duration of construction work with the objective of minimizing excessive noise and vibration; ▪ High noise/vibration emitting equipment will be used during regular working hours (9 AM to 5 PM) so as to reduce the potential of creating a noise nuisance during the night to nearby communities. This equipment will be fitted with noise reduction devices such as mufflers and silencers wherever possible ▪ The vibration from major construction activities such as excavation, compacting, drilling, blasting, etc. are considered intermittent and short-term, and likely to be tolerated if prior warning is given to potentially affected residents; ▪ Vibration measurement will be carried out during construction phase by the EPC Contractor near the settlements; ▪ Personal Protective Equipment (PPEs) shall be provided and worn by the personnel involved in construction activities and training them in their use; ▪ Construction schedules will be disclosed to all nearby communities within vicinity of project sites prior to commencement of construction work; 	EPC Contractor	MC WAPDA

²¹ According to British Standards of Noise and Vibration, humans are particularly sensitive to vibration with the threshold of perception typically being in the range of 0.14 to 0.3 mm/sec. Peak Particle Velocity (PPV) and levels above this may cause annoyance. However, significantly higher levels than this can be tolerated for single short-term events and do not cause annoyance or disturbance to humans.

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	not have any lasting effects once construction activities have completed. The significant impact may be of high magnitude for the labor working in a place that is close to the area where explosives are in operation. This impact medium adverse in nature.	<ul style="list-style-type: none"> ▪ The EPC Contractor shall ensure the compliance with NEQS; and ▪ All complaints will be recorded and responded to in a timely and professional manner. 		
12	<p>FLORA</p> <p>The project will involve destruction of vegetation cover due to the implementation of proposed Project. It is initially examined that approximately 575 number of trees/saplings may be affected (Annex - II) due to proposed project activities. The number of possibly impacted trees is calculated by using Remote Sensing technique through GIS and field observation. Moreover, no impact on the production of medicinal plants is anticipated, as the area has least number of these plants.</p> <p>Exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will</p>	<ul style="list-style-type: none"> ▪ Incorporate technical design measures to minimize removal of trees, if possible; ▪ Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized; ▪ A tree plantation program shall be formulated with the recommendations and technical support of concerned Forest Department; ▪ As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality. Total 5,750 trees will be planted in lieu/compensation of 575 affected trees of similar floral function at the available spaces in/around the project area; ▪ Proponent shall implement the plantation program with the help of Forest Department and with the consultation of Supervision Consultant; ▪ The Forest Department shall involve the communities (if required) for carrying out plantation; ▪ Open fires should be banned in the area to avoid hazards of fire in the area; 	EPC Contractor in consultation with Forest Department	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>adversely affect health and vigor of plants. During construction activities the EPC Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). This impact is categorized as medium significant.</p> <p>Loss of Agriculture Land</p> <p>Due to the impounding of reservoir area, based on 2424 m.a.s.l, it is estimated that about 14.28 acres of crops of agriculture land may be affected. However, it is anticipated that there will be no impact on agriculture land due to the construction activities for other components (such as Flexible/ Rigid Overflow Structure, headrace tunnel, surge tank, penstock, powerhouse, switchyard and tailrace). This impact can be categorized as medium significant.</p> <p>Pasture and Grazing Land</p> <p>The Power House will be constructed on the communal land owned by the</p>	<ul style="list-style-type: none"> ▪ Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land; ▪ However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth; ▪ Construction vehicles, machinery and equipment will remain confined within their designated areas of movement; ▪ The EPC Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes; ▪ The EPC Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed; ▪ Compensation for the loss of crops to the land owners and cultivators as the case may be will be paid, in accordance with the prevailing market prices and uniformity in rates will be ensured within the local areas; ▪ The whole process of the payment to the farmers will be made transparent, judicious and without any discrimination or favour; and ▪ As far as possible, barren land without any crop will be selected for the camp sites and disturbance to the crops 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	Ganish village, having grazing area. Similarly, impounding of reservoir area may also result in loss of vegetation cover which will subsequently affect the community's pasture and grazing area and livestock. This impact is categorized as permanent, irreversible and moderate in nature.	and natural vegetation will be avoided as much as possible.		
13	<p>FAUNA</p> <p>During construction phase the existing population of mammals and reptiles of the construction areas may be affected due to disturbance arising from construction activities involving excavation, movement of machinery and vehicular traffic, movement of labor, camping, blasting, excavation, drilling etc. The existing animals will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations.</p> <p>Moreover, the movements of the mammals and reptiles will be</p>	<ul style="list-style-type: none"> ▪ Care shall be taken during construction activities for avoiding purposely or chance killing of animals; ▪ If found any wild species and habitat during constructing that must dealt carefully and local wildlife department officials should be called; ▪ Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard; ▪ The EPC Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department; ▪ Client must have obtained NOC from the relevant departments prior to construction phase; 	EPC Contractor in Consultation with Wildlife Department	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>restricted during the construction phase;</p> <p>Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.</p> <p>Noise generated from machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the wildlife of the Project Areas. Food and refuse at the EPC Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is medium significant.</p>	<ul style="list-style-type: none"> ▪ Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding; ▪ Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and ▪ Noise produced by construction activities may be kept to acceptable level and ensure compliance with NEQS 		
14	<p>Aquatic Life</p> <p>During construction phase of proposed Project, cutting, blasting, excavation, drilling, extraction, removing and dumping activities of</p>	<ul style="list-style-type: none"> ▪ Solid waste generated from construction and camp sites will be safely disposed in demarcated waste disposal sites and the EPC Contractor will provide a proper waste management plan, to avoid the water contamination; ▪ Land sliding and soil erosion are also the main factor to contribute silt load on river bed manifold causing 	EPC Contractor in consultation with Fisheries Department, GB	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>materials at large scale will contribute heavy sedimentation and soil erosion which may cause habitat destruction, contamination and toxic accumulation of waste not only at Attabad lake but its impact can be seen downstream up to confluence of Gilgit River and beyond. Heavy machinery and equipment shall be used during construction phase, which may also result in heaps of leftovers of explosives, grease, chemicals, lubricants, and other harmful materials. These pollutants through run off rain water enter into the lake and river course increase toxicity of water causing rapid destruction of fish population and riverine ecology.</p> <p>This situation can contribute up to great extent to destruct the aquatic life, ecology, breeding and spawning grounds of fishes, benthic fauna, food chain and abundance of micro and macro living organisms. This may lead rapid shortage of food like benthic population, phytoplankton,</p>	<p>damage to resting and nesting grounds of fishes. Construction of protective walls and gabions at certain points to make sure the stoppage of sliding debris. Plantation and vegetation cover can also be helpful for slope stabilization. Plants, herbs and shrubs reduce the level of pollution and toxicity at a great extent as bio-filter and carbon suckers;</p> <ul style="list-style-type: none"> ▪ Prior NOC from Fisheries Department may also be considered for smooth implementation of the project activities; ▪ The labour working at construction site should be aware to protect especially edible fish and to avoid fish catching by any means. As according to law of land fish hunt is prohibited with all types including net, cages and by the use of dynamite; ▪ Training of work force in the storage and handling of hazardous materials and chemicals should be encouraged and educated to practice waste minimization and reuse to reduce quantity of the waste; ▪ Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies; ▪ Construction waste should be crushed and reused in other sites, where possible; ▪ It will be ensured that no waste or left over construction material is left behind in the cultivation fields; 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	zooplankton, nekton etc. which play an important role to sustain food chain with different trophic level in any eco-system. This impact is categorized as medium to high significant.	<ul style="list-style-type: none"> Construction vehicles and machinery will be kept in good working condition, and be properly tuned and maintained through the duration of construction work with the objective of minimizing excessive noise and vibration; and The EPC Contractor shall ensure the compliance with NEQS. 		
15	<p>Discovery and Impact on of Heritage Sites and Structures during Excavation</p> <p>During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Tourism, Sports, Culture, and Archaeology & Museums Department Government of GB to take further suitable action to preserve those antiques or sensitive remains.</p> <p>According to the field survey, no notified archeological site was present in the Project Area. This</p>	<ul style="list-style-type: none"> In case of finding archeological remains during excavation, the EPC Contractor shall immediately report through Supervision Consultant to Tourism, Sports, Culture, and Archaeology & Museums Department Government of GB to take further suitable action to preserve those antiques or sensitive remains. Chance finds procedure is given in Annex- III; and The EPC Contractor needs to obtain approval for excavation and submit the plan of rehabilitation of the site after excavation. 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	impact can be categorized as low to medium significant in nature.			
16	<p>Social and Cultural Conflicts</p> <p>During the construction phase of the project, conflicts may arise between labor force and local community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore, difference in cultural values may also cause discomfort to local residents. This impact is medium adverse in nature.</p>	<ul style="list-style-type: none"> ▪ Local labor especially from nearby communities will be given preference for the construction works; ▪ Careful planning and training of work force to minimize disturbance to the local people; ▪ Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and ▪ Adequate training of especially for the transitive workforce of the station (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure. ▪ Code of Conduct will be prepared by the EPC Contractor and adopted during the project execution. All project personnel will be required to sign and follow the Code of Conduct. 	EPC Contractor	MC WAPDA
17	<p>Occupational Health and Safety</p> <p>Occupational Health and Safety (OHS) related impacts may arise during construction phase of the proposed Project due to installation of Contractor camp, movement of</p>	<ul style="list-style-type: none"> ▪ The EPC Contractor will be required to follow the national/local acts related to OHS and World Bank Group General EHS Guidelines, 2007. The EPC Contractor will prepare the site specific occupational health and safety plan; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>machinery & equipment, lifting operations, work at height, concrete pouring, working in night and manual handling during loading/unloading operation, as result of these works there will be a direct impact on the health and safety of all staff working on the Project. The most common impacts include eye injuries which may occur due to stone or metal particles, hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc.</p> <p>Other impacts will be falling in trench, contact with electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand and head injury, slip and trip hazards, exposed to high levels of noise for longer durations</p>	<ul style="list-style-type: none"> ▪ Occupational health and safety monitoring programs of the EPC Contractor should verify the effectiveness of prevention and control strategies; ▪ Providing basic medical training to specified work staff and basic medical service to workers. The EPC Contractor will ensure the provision of basic medicines, first aid kits etc. at the camp site; ▪ Ensure periodic medical screening of the staff; ▪ Complying with the safety precautions for the construction workers as per applicable International Labor Organization (ILO) Conventions; ▪ Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety proper task specific Personal Protective Equipment (PPEs); ▪ Moreover, proper planning should be done for food storage, setting up of kitchens, wastewater collection system and solid waste management. Improper planning for these facilities may result in multiplication of rodents like rats, mice and shrew etc. and vectors like mosquitoes, bugs and flies which will have a negative impact on workers' health and safety; ▪ Efforts will be made to create awareness about road safety among the drivers operating construction vehicles; ▪ All trenches deeper than two meter should be protected with wooden bracing to avoid safety risks to workers and locals;; Ensure that the site will be restricted for the entry 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	etc. This impact may be classified as high adverse in nature.	<p>of irrelevant people particularly children, disabled and elderly people;</p> <ul style="list-style-type: none"> ▪ Ensure the use of safety and warning signs at the construction site; ▪ Ensure the provision of fire prevention and firefighting equipment; and ▪ Ensure the provision of training related to emergency prevention, preparedness and response arrangements by the EPC Contractor. <p>These requirements will be incorporated into the bidding specification and contract documents, and will be binding on the EPC Contractor, at risk of penalty for noncompliance, as charges to be recovered from the EPC Contractor for unsafe act or condition.</p>		
18	<p>Community Health and Safety</p> <p>Community health and safety issues during the construction of proposed project may include dust, noise, and vibration from construction vehicle transit, and communicable disease associated with the influx of temporary construction labor. The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with</p>	<ul style="list-style-type: none"> ▪ The EPC Contractor will prepare the site specific community health and safety plan in compliance with relevant sections of the WBG General Environmental Health and Safety Guidelines (WBG 2007), chosen methodology and will be required to strictly follow; ▪ Ensure that the site will be restricted for the entry of irrelevant people particularly children, disabled and elderly peoples. Ensure the use of safety signs at the construction site; ▪ Providing basic medical training to specified work staff and basic medical service and supplies to workers; ▪ Ensure proper maintenance and repair of all vehicles, machinery and equipment to prevent the oil spills; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>presence of heavy equipment. Quality of water resources available in the nearby local communities may be affected due to the oil spillage and leakage, roadside accidents, etc. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. The labor works with different transmittable diseases (HIV/AIDS, COVID-19, respiratory diseases, and skin and eye infections etc.) may cause spread out of those diseases in the locals of nearby community. The impact significance is moderate adverse.</p>	<ul style="list-style-type: none"> ▪ Efforts will be made to create awareness about road safety among the drivers operating construction vehicles; ▪ Timely public notification on planned construction works; ▪ Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links; ▪ Provision of proper safety and diversion signage, particularly at sensitive/accident-prone spots; ▪ Setting up speed limits in close consultation with the local stakeholders; ▪ The mitigation measures provided in the sub-sections for air and noise & vibration shall be adopted to reduce the air pollution, noise pollution and vibrational impacts on nearby community; ▪ Ensure effective implementation of GRM (to be prepared by the EPC Contractor) to timely address the issues; ▪ The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, COVID-19 will be prevented by successful initiative typically involving health awareness; education initiatives; training health workers in disease treatment; immunization program and providing health service; 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
		<ul style="list-style-type: none"> ▪ All workers must perform complete sanitization at the site as per updated / latest SOPs/guidelines issued by WHO and the national guidelines issued by the GoP²²; ▪ Ensure prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat near to human settlements and by eliminating any unusable impounding of water; and ▪ The EPC Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. The EPC Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions. <p>Any environmental condition that is disagreeable to the public and causes an avoidable nuisance can be addressed with additional provisions in addition to those described above.</p> <p>These requirements will be incorporated into the bidding specification and contract documents, and will be binding on the EPC Contractor, at risk of penalty for noncompliance, as charges to be recovered from the EPC Contractor for unsafe act or condition.</p>		

²² <https://covid.gov.pk/guideline>

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
19	<p>Labour Influx</p> <p>For the implementation of Project activities, skilled and unskilled labor is required by the EPC Contractor. Mostly, skilled and unskilled workers have been associated with the EPC Contractor since long which they utilize, where they are required for the Projects, and while other workers are hired from the different areas that belong to different cultural backgrounds. Social problems and conflicts that are associated with Labor Influx are as follows:</p> <ul style="list-style-type: none"> ▪ Risk of social conflict: Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other; 	<ul style="list-style-type: none"> ▪ Contractor camp will be established away from residential and populated area; ▪ Preference will be given to the local people to work with the EPC Contractor, and the EPC Contractor will hire maximum labor force from the project area because this will reduce the labor influx; ▪ Awareness will be created among the work force to ensure respect for local customs; ▪ Construction work will be completed within the stipulated time to move workers to next location; ▪ Labor force will be shuffled with the time; ▪ Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all Project sites; ▪ Provide adequate personal hygiene facilities in good condition with adequate supply of clean water; ▪ Make arrangements to treat the affected workers on time to control the movement of vectors disease; ▪ Sensitize workers and surrounding communities on awareness and prevention of COVID-19, HIV/AIDS and sexually transmitted infections (STI) through training, awareness campaigns and workshops during community meetings; ▪ Provide proper and free HIV/AIDS and STI health screening and counselling for site workers and community members; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<ul style="list-style-type: none"> ▪ Increased risk of illegitimate behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such illegitimate behavior and crimes can include theft, physical assaults, substance abuse, sexual assault and human trafficking; ▪ Impacts on community dynamics: Depending on the number of incoming workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes; ▪ Increased burden on and competition for public service provision: The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand 	<ul style="list-style-type: none"> ▪ Develop and enforce a strict Code of Conduct for workers to regulate behavior in the local communities; ▪ Taking all sensible precautions to avert illicit, vicious conduct by or amongst the EPC Contractor’s personnel, and to preserve unity and harmony, and protection of people and property on and near the sites; ▪ Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel; ▪ Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity; ▪ Appropriate fencing, security check points, gates and security guards will be provided at the construction sites to ensure the security of all plant, equipment, machinery and materials, as well as to secure the safety of site staff; and ▪ The EPC Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft. 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the influx of workers is not accommodated by additional and separate supply systems;</p> <ul style="list-style-type: none"> ▪ Increased risk of communicable diseases and burden on local health services: The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the Project's medical facility and instead go anonymously to local medical providers, this can result in an additional burden on local health resources; ▪ Local inflation of prices, accommodations and rents: A 			

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>significant increase in demand for goods and services due to labor influx may lead to local price hikes and crowding out of community consumers. Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of local residents; and</p> <ul style="list-style-type: none"> ▪ Increase in traffic and related accidents: Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure. <p>This impact is medium negative and temporary in nature.</p>			
20	<p>Gender Based Violence</p> <p>In the society, female plays important role in managing household as well as in income earning activities, but they face various challenges to get access</p>	<ul style="list-style-type: none"> ▪ Trainings will be given to construction workers, alongside the implementation of strict measures and punishments in case of any sexual assaults, or gender based violence. ▪ During the timing of educational institutions workers will not be allowed to crowd in the surroundings; 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>to educational institutions and employment opportunities due to cultural bindings, economic vulnerability and lack of facilities.</p> <p>According to Pakistan Demographic and Health Survey (PDHS), 2017-18, 28 percent of women of Pakistan age 15 to 49 have experienced physical violence, six percent have experienced sexual violence, and seven percent experienced violence during pregnancy. Three in ten women who have ever experienced physical or sexual violence sought help to stop the violence, yet 56 percent never sought help nor told anyone.</p> <p>During construction phase gender based violence might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site, and moving on the</p>	<ul style="list-style-type: none"> ▪ Alternative routes for pedestrian will be provided to avoid mixing of women with workers; ▪ Gender protection act will strictly be enforced during the construction activities in the project area, and monitor the implementation through field staff and district level structure; ▪ Raise awareness among the communities of the potential risks of GBV, and establish response services in the communities that can respond to instances of GBV (particularly those related to issues of labor influx); ▪ The EPC Contractor will make sure that no discrimination is made on the basis of gender while hiring of workers. Complete SOPs will be formed and implemented by the contractor regarding working women at site. Implementation on these SOPs will be monitored by the Supervision Consultants; ▪ Provisions of gender disaggregate bathing, changing, and sanitation facilities; and ▪ Contractor will take proper measures to address and resolve issues relating to harassment, intimidation, and exploitation, especially in relation to women. ▪ Establish workers' camps separated from local communities with strict protocols for interaction with local communities in order to avoid project impacts from labor influx. ▪ Project staff will receive training on the prevention of SEA/SH. Engagement of skilled trainers to raise awareness among project workers of the risks, expected 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	roads and markets. Women in the Project area are participating in other outdoor activities such as livestock rearing, bringing of potable water, collection of fire wood etc. that may also be affected by the Project activities. This impact is medium negative in nature during construction stage.	<p>behaviors, and consequences of violations, communicated through training, and publicized codes of conduct. It may also be important to raise awareness of the risks among community members and local health authorities and inform them about available grievance mechanisms.</p> <ul style="list-style-type: none"> ▪ Arrange and support local organizations and/or government initiatives on community STD education, prevention, and treatment programs. ▪ Extensive training for awareness raising strategy which describes how workers and local communities will be sensitized to SEA and SH risks, and the worker's responsibilities under the Code of Conduct. ▪ The routes/places used by the women will be avoided as far as possible. If unavoidable, alternate routes will be identified for the communities, if required, especially along routes frequented by women folk, such as route to the local water source. ▪ Construction crew will avoid entering villages and settlements. ▪ Communities will be informed and consulted before commencing works inside or near the communities. ▪ Provision related to SEA/SH will be incorporated in the bidding document. 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
21	<p>Child Labour</p> <p>There are two basic conventions on child labor adopted by the ILO, and one adopted by the United Nations. The ILO Minimum Age Convention, 1973 (No. 138) and its accompanying Recommendation (No. 146) set the goal of elimination of child labor, and the basic minimum age for employment or work (in developing countries at 14 years of age or the end of compulsory schooling, whichever is higher; and 15 or the end of compulsory schooling for developed countries). The Convention sets a minimum age of 2 years younger for “light work,” i.e., 12 and 13 years, respectively; and a higher minimum age for dangerous or hazardous work (basically 18 years of age, but 16 in certain circumstances). The Convention also has various other flexibility clauses.</p> <p>Inhabitants of the Project Area have mix economic background and different sources of income. Children</p>	<ul style="list-style-type: none"> ▪ Awareness will be created among the local communities about the adverse impacts of child labor. For the public awareness, meetings will be held in the Project area, and announcements will be made using the available local platforms with the involvement of all sectors of the society; ▪ The EPC Contractor through contractual agreement will be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities will be monitored by the social and environmental staff of the implementing agency; ▪ Client and Supervision consultant will ensure that the EPC Contractor shall have its employment policy in accordance with relevant act and labor policies in Pakistan; ▪ The EPC Contractor will ensure the presence of all persons at site are adults and have their proper identity cards with them; ▪ Penalize the EPC Contractors/employees using the child labor and penalize adults who violate children’s rights and who force children to enter child labor. 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>of low income groups mostly involve in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods. However, the Employment of Children Act, 1991 prohibits the employment of child and restrict the employment of adolescents in certain occupations and processes such as construction industry, and whoever employs or permits a child (person under the age of 14 years) to work in an establishment shall be liable to punishment with imprisonment.</p> <p>The child labor impact might arise during construction stage, as large number of skilled and unskilled labor will be required by the EPC Contractor for the construction activities of the proposed Project. This impact is medium negative in nature during construction stage.</p>			

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
22	<p>Other Social Issues</p> <p>The community belonging to the reservoir and Project Area will be affected during the construction phase as follows:</p> <ul style="list-style-type: none"> During the construction phase, the general mobility of the local residents and their livestock in and around the Study Area is likely to be hindered; Unmonitored construction activities, e.g. blasting may create an accidental risk for the local residents particularly the women and children; Usage of community common resources like potable water, fuel wood etc. by Contractor workforce may create conflicts between the community and the Contractor; Community will have to face the noise and dust problems during the construction activities; Induction of outside workers in the Contractor labor may cause 	<ul style="list-style-type: none"> During the construction phase, mobility of the workers in the nearby areas should be strictly restricted by the Contractor to avoid any inconvenience to the local communities; Proper arrangements in the form of alternative routes should be made to ensure that the mobility of locals should not be disturbed; Before starting the construction activities, Contractor should inform residents of the Project Area about the scheme of work, likely disturbances, and their duration as to whom they should address their complaints. The Contractors will be required to maintain close liaison with the local communities to ensure that any potential conflicts relating to the common resource utilization are resolved quickly; Contractor will take care of the concerns of the local community and the sensitivity towards the local customs. Contractor also needs a proper security to avoid any theft issue by the community; Use of good engineering practices such as water sprinkling, encasement and provision of silencer and mini stacks of generators etc. should be adopted to avoid inconvenience to the locals due to noise, smoke and fugitive dust; and The Contractor will warn the workers not to indulge in any theft activities and if anyone gets involved in such activities, he will have to pay heavy penalty and would be handed over to the police. Similarly, at the time of 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>cultural issues with the local community; and</p> <ul style="list-style-type: none"> ▪ Theft problems to the community by the Contractor's workers and vice versa. <p>This impact is Site Specific, Medium Term, Irreversible, Likely, Medium Significant.</p>	<p>employing, the Contractor has to take care that the workers should be of good repute. The Contractor camp should be fenced properly and main gate.</p>		
23	<p>Impact on Tourism</p> <p>The Attabad Lake has become one of the biggest tourist attraction in valley, offering activities like boating, jet-skiing, fishing and other recreational activities. Tourists also enjoy Ice Skating the Lake gets frozen during winters, making it the perfect place for ice skating. Passu Cones is also a popular tourist destination in Hunza valley and all over the world because of its easy accessible sweeping landscapes and vistas of the 7,478m (24,534 ft) tall Passu Sar mountain, the Passu Glacier and Tupopdan.</p> <p>Due to construction activities of Attabad Hydropower Project and</p>	<ul style="list-style-type: none"> ▪ The EPC Contractor will prepare and implement the site specific environmental, health and safety management plans to ensure the safety of the locals and tourists. ▪ Necessary measures will be taken to ensure the safety of traffic during construction, including barricades, safety signs, pavement markings, flags, and lights, erected for tourists and locals as well. ▪ A Traffic Management Plan will be implemented that will aim at ensuring access tourists to reach their destinations safe and sound, residential areas, and preventing of unsafe situations, especially near construction areas, camps and offices; ▪ Liaison with traffic police will be maintained in order to facilitate the tourists both local and foreigner; and ▪ Vehicle speeds near / within the communities will be kept low, to avoid safety hazards. 	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>movement of heavy machinery on roads the traffic flow is likely to be affected during construction activities and damage of roads as well, tourists will face the difficulties to reach at their desire destination like Attabad Lake for boating and jet-skiing, to visit the Passu Cones, Khanjrab Pass other tourists spots and high peaks for hiking.</p> <p>Due to construction of Attabad Hydropower Project livelihood of the locals will disturb who are directly associated with tourism business like boat owners and operators, owners of fast food restaurants, shopkeepers, hotels owners and working labor and so many others attach with tourism.</p>			
24	<p>Communication Loss</p> <p>The general mobility of the local residents and their livestock in and around the Project Area is likely to be hindered and may need to be travel long distances.</p> <p>Likewise access to the natural resource may be affected. This</p>	<p>The EPC Contractor will ensure that the mobility of the local communities and their livestock is not hindered by the construction activities. The EPC Contractor will provide crossing points at appropriate places to facilitate the locals for their daily works, where applicable.</p> <p>The EPC Contractor shall always consider the local sensitivities while performing the Project activities. All the personnel engaged would also be properly briefed about the local norms and ethics prior to commencement of work.</p>	EPC Contractor	MC WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	particularly implies to the women folk and children where women observe norms and values and do not interact with non-locals. This impact is medium significant in nature.			
C. Operational Phase				
1	<p>Sedimentation</p> <p>Accumulation of sediment may disturb the efficiency of Project components. Sediment load released from the sand trap could have adverse effect and synergetic with low flow of water will put aquatic system under stress. However, it should be kept in mind that during low flows the sediment concentration is very low. Floods and heavy rains carry large sediment loads, which could have a more severe medium impact than the sand trap flushing.</p>	<ul style="list-style-type: none"> A sediments clearing mechanism will be provided in the detail design and should be followed. Sediment flushing and de-silting arrangements have to be carefully designed by the EPC Contractor. It is recommended that a sediment sampling program during high flow season for estimating bed material load and bed load and its gradation are initiated with the help of WAPDA's Surface Water Hydrology Directorate. 	WAPDA	
2	<p>Liquid and Solid Waste Generation</p> <p>Wastewater may generate by the workers during the operation and maintenance related activities and</p>	<ul style="list-style-type: none"> Ensure training program regarding waste minimization quantity of the waste; Solid waste generated will be safely disposed in demarcated waste disposal sites and ensure provision of PPEs to workers; 	WAPDA	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	from the residential colony. The improper disposal of liquid waste can cause air, water, and soil pollution. Different types of solid waste are likely to be generated during the operation phase, can potentially cause soil and water contamination. This impact can be categorized as medium to low significant in nature	<ul style="list-style-type: none"> ▪ Ensure immediate collection of solid waste after the completion of maintenance works, no waste or left over construction material is left behind; ▪ Proponent should make final disposal arrangements in consultation with the concerned government department and should take approvals for final disposal of the waste at the designated disposal site. ▪ A separate solid waste management system for waste from the office building and other allied facilities will be required. During the collection of solid waste, recyclable and reusable waste will be separated for resource recovery and reuse of the generated material; and ▪ Proper monitoring to check the compliance of NEQS will be carried out, if required 		
3	<p>Soil and Surface Water Contamination</p> <p>The accidental oil leakages from the power house may contaminate the soil and water quality of the Attabad Lake and Hunza River downstream of the powerhouse. The maintenance works (may involve the use of materials, chemicals, fuel and lubricants) may also have potential to contaminate the soil and surface water. This impact is site-specific and</p>	<ul style="list-style-type: none"> ▪ Proper drainage and dewatering system is recommended for the proposed Project. A drainage pump of appropriate capacity will be specified to cope with the leakage of powerhouse. Dewatering pumps will be specified for Unit dewatering. Both of these pumps will be installed in drainage and dewatering pit and they will provide redundancy for each other. Sites disturbed by the maintenance works shall be restored to their original conditions upon completion of works and photographic record will be maintained to ensure pre-post conditions intact. It will be ensured that no soil is left unconsolidated after completion of work and excess will be disposed of at designated sites. Storage of fuel, paint, and oil containers, oil filters, oily parts, and oily rags on 	WAPDA	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	can be classified as medium significant.	impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inches thick done on brick edge flooring lined with polyethylene sheet. Material Safety Data Sheets (MSDS) will be strictly followed.		
4	<p>Risk of Fire</p> <p>For the proposed hydropower plant there is also a risk of fire breaking out in powerhouse which may become a serious risk for residents living in allied facilities and/or nearby in the vicinity of the proposed hydropower Project. This impact can be classified as medium significant.</p>	<ul style="list-style-type: none"> ▪ Fire protection and detection systems shall be provided and implemented to protect life, property, equipment, and operation of the powerhouse. The detection and fire alarm, fire protection and fire-fighting systems shall include, but not be limited to the following: <ul style="list-style-type: none"> • Firefighting water storage, may be combined with raw water tank, depending on local regulations; • Firefighting pumps; • Fire water ring main system, including hydrants; • Fire protection systems; and • Fire alarm and detection system. ▪ The building / tunnel shall be subdivided into various fire areas, separated by approved fire resistant barriers and elements; ▪ Fire walls, ceilings and partitions shall have a fire resistance rate of not less than 2 hours; ▪ All penetrations for electrical cables or pipes in fire resistant walls or ceilings shall be sealed with approved seals; ▪ One electric motor driven fire pump and one electric motor driven stand-by fire pump, located in a pump house adjacent to the water storage tank, shall draw fire 		WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
		<p>fighting water from the tank and supply it through the fire service main to the hose stations and water spray fixed systems. One electric motor driven jockey pump with a capacity of approx. 3 l/s shall also be provided to keep the line pressure of 5 bars. The fire pump shall have a capacity of approx. 40 l/s at a delivery head of approx. 6 bars;</p> <ul style="list-style-type: none"> ▪ The water spray fixed systems shall be designed, installed and tested in accordance with NFPA15; ▪ The total flooding carbon dioxide extinguishing systems shall be designed in accordance with NFPA 12, standard on carbon Dioxide extinguishing systems (latest edition) and will be adopted for the fire protection of Attabad HPP generators; ▪ The selection, installation and testing of portable fire extinguisher shall be in accordance with NFPA-10 for initial firefighting. Portable fire extinguishers with capacities of 6 kg chemical dry powder, for rooms containing electrical equipment with capacities of 5 kg clean agent, shall be provided and placed in the rooms and buildings at strategic locations and next to exits; ▪ In addition to the portable extinguishers, two mobile 30 kg clean agent, and two mobile 50 kg dry powder extinguishers, mounted on wheeled hand carts and furnished with 6 m hoses, shall be provided and located in the machine hall of the powerhouse and GIS floor and diesel generator room; and 		

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
		<ul style="list-style-type: none"> All systems shall be subject to the approval of the insurance company. The system shall be complete with all necessary piping, pumps, safety valves, mobile equipment, and vehicles. The EPC Contractor shall prepare an Emergency Response Plan (ERP) to cope with the emergency situations. Fire protection system for Generator fire protection system is also recommended. 		
5	<p>Ambient Air Quality and Climate Change Aspect</p> <p>The air quality of the area will improve significantly in comparison to construction phase. Vegetation cover in the area will also increase after tree plantation. However, during operation phase, operation of stand-by generator and un-necessary idling of diesel run will also result in the emission of pollutants (CO, Smoke, NO₂, SO₂, PM_{2.5} and PM₁₀ etc.) into the air, thus deteriorating air quality. Ambient Air quality may also be affected during the maintenance works of subprojects. These emissions may adversely affect the health of the nearby residents and working staff. This impact is moderate in nature.</p>	<ul style="list-style-type: none"> Ensure the use of low Sulphur fuel; Ensure plantation of trees around the project area that will help in absorbing the emissions; The height of the generator stacks shall be enough to disperse the emissions in the air; and Ensure compliance with NEQS and provision of budget for regular monitoring of ambient air quality in accordance with the NEQS. 	WAPDA	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
6	<p>Noise and Vibration</p> <p>During operation phase, noise and vibration levels may be generated due to the operation of proposed project, standby generators and traffic which will be a constant source of nuisance for the staff and the nearby communities. Noise levels may also be increased during the maintenance works. The significance of this impact is considered to be low adverse.</p>	<ul style="list-style-type: none"> Ensure regular maintenance and periodic checking all parts of the standby generators, replacement in case of malfunctioning and periodic noting of noise levels; Installation signs to disallow the use of pressure horns; Plantation of trees will also help to attenuate the noise impacts to the surrounding area; Ensure compliance with NEQS and provision of budget for regular monitoring of noise levels in accordance with the NEQS and vibration (where applicable). 	WAPDA	
7	<p>Change in Land Use</p> <p>During the operational phase the land use pattern of the area will be changed to some extent. The commercial and recreational activities will also be increased which may affect ecosystem of the area and bring economic boom in the area. This impact is Site-specific, Long Term, Irreversible, and Likely, Medium Significant.</p>	<ul style="list-style-type: none"> The tree plantation will be carried out in and nearby the Study Area and will have positive impact on the eco system of the area. 	WAPDA	
8	<p>Flora</p>	<ul style="list-style-type: none"> The implementation of plantation plan recommends compensation for cutting of trees and work should be 	WAPDA	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	During operational stage of the Project, there will be minimal effect on flora or release of any significant pressure detrimental to flora. Low level impact is expected at operational phase on Flora due to the operation and maintenance activities. This impact is low Significant	<p>started during operational phase to ensure the ecological balance and to avoid any impact on local environment;</p> <ul style="list-style-type: none"> ▪ Large scale planting with suitable indigenous trees, shrubs and ornamental plants in the form of tree groves, and linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation; ▪ Proper check and balance for above activities is highly recommended. Plantations so raised must be maintained according to the Silvicultural practices which includes proper irrigation, cleaning, pruning, thinning at prescribed intensity, silt clearance and trench-opening, etc.; ▪ Maintenance and security of the plantation should be done for at-least four years (in consultation with the Forest department). Measures such as fencing, watch guards and fire protection should be considered; and ▪ All activities must be done under the technical supervision of forest department. 		
9	<p>Fauna</p> <p>There is no protected area, game reserve, game sanctuary or national park in the project area so no major impact on wildlife and livestock in the area is expected through noise, vibration and any type of normal</p>	<p>Strict control must be exercised for stoppage of killing/poaching of available wildlife species (if any) by enhancing protection practices; and</p> <p>The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area.</p>		WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	<p>activity in the project area. This impact is Insignificant.</p> <p>However, proposed reservoir area, which is nearly 8 km in length, shall not be available for grazing to livestock and other wildlife existing in the area, which is adverse impact on fauna.</p>	Improved micro climate and moisture conditions along the periphery of the reservoir will help in grass production and improved vegetation, which will be useful for livestock grazing and improve habitat for birds.		
10	<p>Aquatic Life</p> <p>Once the construction phase is completed and water diverted at the site of Flexible/ Rigid Overflow Structure will change the water flow regime from Flexible/ Rigid Overflow Structure to powerhouse. The adverse impact on aquatic life will be due to low flow in the Hunza River especially during low flow season. The minimum environmental flow needs proper follow-up.</p>	<ul style="list-style-type: none"> ▪ Annual restocking plan of fish fingerlings should be included in the said project to compensate the stock depletion due to decrease in fish breeding grounds. ▪ Fisheries research unit and a brown trout hatchery with research/management staff should be established at the project side for research purposes as well as impact assessment during operational phases of the project. ▪ To conserve the aquatic life of the river downstream of the Flexible/ Rigid Overflow Structure, minimum flow of 3 m³/s has been calculated as the environmental flow. It will be obligatory for project operating agency to release 3 m³/s in the river throughout the year as environmental flow. ▪ The design recommended measures should be implemented and maintained by the proponents. 		WAPDA
11	<p>Safety During Reservoir Operation</p>	Since the reservoir was formed in January 2010 as a result of massive land slide and no new area would be submerged.		WAPDA

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
	During operational stage of the Project, due to the impounding of the reservoir, the safety issues will arise. Main reservoir area is the major threat for accidents. Locals and workers can drown. This impact is site specific and high significant in nature.	However, during operational stage of the Project, a security plan should be prepared for the reservoir area to prohibit youths from using reservoir for bathing, swimming and other recreational activities. Boating should not be allowed without the provision of life saving jackets and presence of a lifeguard.		
12	<p>HSE Considerations</p> <p>During the operation phase, health and safety issues related to workers and communities may arise. Operation and maintenance activities may cause health and safety risks such as movement of machinery and manual handling during loading unloading operation, poor handling and storage of hazardous substances, injuries due to electric shocks, falling of objects, slips or trips, dust, noise, accidents, transmittable diseases etc. The impact is moderate to low adverse in nature.</p>	<ul style="list-style-type: none"> ▪ Ensure proper maintenance of machinery and equipment; ▪ Proper storage and handling of generator fuel, chemicals, solvents and other hazardous substances; ▪ Ensure emergency prevention, preparedness and response arrangements; ▪ Emergency numbers should be clearly posted and communicated to the staff and community (where applicable); ▪ Fire extinguishing equipment should be installed at adequate and appropriate locations; ▪ Ensure provision of PPEs to the skilled and unskilled labors and visitors; ▪ Proper training should be given to workers on health and safety measures; ▪ Hazardous materials should be well labeled and stored in their original containers; ▪ Ensure that the site will be restricted for the entry of irrelevant people; 	WAPDA	

Sr.	Impacts	Mitigation Measure	Responsibility	
			Implementation	Monitoring
		<ul style="list-style-type: none"> ▪ Ensure health awareness; education initiatives; training health workers in disease treatment and prevention; immunization program and providing health service; and ▪ Staff will strictly warned, not to involve in any unethical activities and to obey the local norms and cultural restrictions. 		

9.8 ENVIRONMENTAL MONITORING PLAN

9.8.1 General

The Environmental Monitoring along with implementation of the various plans already highlighted during the construction and operation stages will be carried out to meet the following objectives:

- Monitor the actual Project impact on the physical, ecological and socio-economic indicators, in compliance with the provisions of the EIA/ EMP.
- Recommend mitigation measures for any unforeseen impact or where the impact level exceeds than those anticipated.
- Ensure compliance with legal and community obligations including safety at the construction and operation stages.
- Monitor the rehabilitation of borrow areas and the restoration of the construction camp site(s) as described in the EMP.
- To ensure the safe disposal of excessive construction materials, solid waste and effluents etc.

The main emphasis of monitoring during the operation phase will be as follows:

- Appraise the adequacy of the EIA with respect to the Project's predicted long-term impacts on the area's physical, biological and socio-economic environment.
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend any improvements in the EMP, if so required.
- Compile periodic incidents/accidents data to support analysis that will help in minimizing the future risks.
- Monitor the survival rate of the proposed plantations.

WAPDA through the EMMC / MC will ensure two types of monitoring during the execution of the Project activities.

- Compliance Monitoring: to ensure that the proposed measures in the EMP are adhered to as per applicable guidelines/ NEQS etc.
- Effects Monitoring: to establish baseline values for the environmental parameters such as air quality, water quality and noise levels etc.

9.8.2 Monitoring Strategy

All the compliance monitoring will be executed by the EPC Contractor during construction stage of the Project. Supervision of environmental monitoring will be carried out by the MC and WAPDA during the construction stage while compliance and effects monitoring at operational and maintenance stage will be carried out by WAPDA as internal monitoring agency. The staff working under the WAPDA will oversee all the activities of the EPC contractor and MC in the field during the construction stage.

9.8.3 Implementation and Monitoring

EPC Contractor

Physical implementation of the EMP is the sole responsibility of the EPC Contractor during the construction stage. Contractor will be responsible for in-house monitoring to ensure that the construction activities are being carried out as specified in EMP.

Management Consultant (MC)

The MC will be responsible for supervision of the environmental monitoring and will perform the following activities:

- Monitoring of the environmental aspects of the Project during construction to ensure that the environmental requirements of the contract and the mitigation measures proposed in the EMP are implemented.
- Undertake critically important routine visual monitoring of construction, waste disposal and overall environmental management practices by the EPC Contractor and other contractor(s).
- A systematic check of the noise levels using a portable noise meter operated near major construction equipment and machinery.
- Visual checks of exhaust emissions from equipment and vehicles.
- Visual checks of airborne dust on temporary access roads, material stockpiles, disturbed soil, and haul tracks.
- Instrumental monitoring of water, ambient air and noise levels as per intensity and frequency specified in the environmental monitoring program.
- Maintaining the monitoring records and submit monthly reports to WAPDA, describing the details of environmental monitoring parameters, non-compliance (if any) by the Contractor and actions taken for rectification.

9.9 COMMUNICATION AND DOCUMENTATION (MONITORING PERIOD)

Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

9.9.1 Data Recording and Maintenance

All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base in to which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form.

9.9.2 Database

The database may include the following information:

- Training programs;
- Staff deployment;

- Non-compliances;
- Corrective actions
- List of environmental data; and
- List of environmental data to be maintained:
 - Soil and land pollution;
 - Disposal of waste;
 - Water resources;
 - Fuel oil and chemical spills;
 - Vegetation record;
 - Noise and vibration pollution;
 - Air and dust pollution;
 - Socio-economic data; and
 - Ecological sensitivities.

9.9.3 Meetings and Reporting

Monthly meetings will be held at site during the construction phase. The purpose of these meetings will be to discuss the routine activities, non-compliances and their remedial measures. Various reports will also be produced at periodic time intervals, as provided in **Table 9-2** along with information regarding persons responsible for report preparation and review process. Additionally, minutes of meeting will also be submitted as part of routine environmental reports.

Table 9-2: Periodic Reporting Mechanism

Sr. No.	Report Category	Prepared by	Submitted to and Reviewed by
1	Monthly	EPC Contractor	EMMC of WAPDA / MC
2	Quarterly	EPC Contractor	EMMC of WAPDA / MC
3	Quarterly	MC	EMMC of WAPDA / GBPEA
4	Annual Report	EPC Contractor	EMMC of WAPDA / MC
5	Completion Report	EPC Contractor	EMMC of WAPDA / MC

The system for monitoring compliance with environmental mitigation measures provides periodic inspection (at least biweekly), data compilation, and reporting of results. The MC will utilize a checklist to evaluate compliance with mitigation measures. Checklists serve primarily as guides for reviewing performance to determine general compliance with broad indicators, tentatively as follows:

- General conduct of work;
- Labor provisions and occupational / community health and safety;
- Noise and vibration control;
- Air quality, dust control and site cleanliness;
- Traffic management;
- Drainage and wastewater;
- Solid waste and spoil handling and disposal;
- Protection of community values; and
- Environmental monitoring and other indicators selected for the work at hand.

The MC will prepare and submit quarterly reports to WAPDA (and to GB EPA as per the conditions mentioned in the NOC /environmental approval) as part of the periodic project performance reporting requirement. Monitoring reports also will summarize the status of complaints under the GRM, as well as results of air, water and noise monitoring conducted by the third party.

9.9.4 Social Complaint Register

The Contractor will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

9.9.5 Photographic Records

Contractors will maintain photographic records during the implementation of the proposed Project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities, etc.

9.9.6 Non-Compliance of the EMP

The implementation of the proposed EMP involves inputs from various functionaries. The EPC Contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of Project, for which the Contractor will be paid on the basis of monthly compliance reports. However, if the Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the EPC Contractor claimed under the heads of environmental components.

9.9.7 Review of Recorded Data

All the data and communication recorded and maintained by the EPC Contractor will be periodically reviewed and checked by MC and EMMC, WAPDA and necessary action will be recommended to EPC Contractor to improve the recording and documentation. All the complaints in social complaint register shall be recorded in accordance with the Project GRM. Resident complaints will be responded to in a timely manner and action taken recorded in accordance with the GRM.

9.10 THIRD PARTY MONITORING

Third Party will be recruited by WAPDA to carry out independent monitoring regarding implementation of EMP. The Third Party shall carryout intermittent monitoring of the project. This will be done on bi-annual basis to evaluate the overall effectiveness of EMP implementation.

WAPDA will ensure the timely hiring and engaging a suitable consultant/firm. For this purpose, EMMC will be responsible for coordination; arranging site visits and providing necessary support to the Third Party. The objective of this Third Party will be to review the entire EMP implementation process and its effectiveness, to identify any environmental and/or social

issues caused by the project that may exist at site, and to frame recommendations for course correction and to improve EMP for implementation.

9.10.1 Objectives

Following are the main objectives of the Environmental Audit:

- To evaluate whether the monitoring done by MC is in compliance with the targets as set in the EIA/EMP.
- To determine the conformity of the environmental and social management plans with specified requirements and identify non-conformity in environmental and social parameters as per EIA/EMP.
- Meet regulatory requirements and commitments.

9.11 ENVIRONMENTAL TRAINING PROGRAM

9.11.1 Training Strategy

An environmental training program needs to be conducted in order for capacity building of different key staff and the community's capacity as shown in **Table 9-3** to effectively implement the Project-specific EMP. Initially, the training program will be imparted to the key staff directly associated with the Project and subsequently, separate training program(s) will be run for the community and for the Contractor's staff. Past experience has shown that the exclusion of the community from the indirect benefits due to the Project interventions has largely produced socio-political issues that hinder the success of the Project; therefore, the involvement of the community seems to provide a great incentive for the environmental protection of the area, to win their support for the proposed Project and also for skill development purposes.

The MC will be obligated to provide training to the EPC Contractor's staff, WAPDA and the Community. In addition to the above training, additional training will be imparted as and when required. The criteria to assess the need for additional training are based on the following:

- For preventive O&M rather than only responding to accidents;
- Start of any new process/activity;
- When a specified percentage of staff is newly inducted in the Project;
- When any non-compliance is repeatedly reported, refresher training will be provided;
- When any incident/accident of minor or major nature occurs; and
- Arrival of new contractors/sub-contractors.

9.11.2 Training Objectives

The overall objective of the training program is to create awareness and to train the concerned stakeholders to conserve and protect the ecological balance of the Project Area as much as possible at both the stages i.e. construction and operation and to ensure that the requirements of EMP are clearly understood and implemented throughout the Project life. The main training objectives can be summarized as follows:

- To implement the mitigation measure as given in the EMP.
- To train the supervisory staff for the protection of the health and safety of the workers/labour.
- To train the Project staff how to interact and involve the concerned communities.
- To define the roles and responsibilities of the concerned stakeholders according to this EMP.
- To train the stakeholders for the reporting mechanism.

9.11.3 Training Material

The MC will prepare and produce training materials/ manuals according to the training program, one for the key staff and the rest for the community and labor.

9.11.4 Training Program

The detailed training program is given in **Table 9-3**.

Table 9-3: Training Program

Sr. No.	Staff	Trainers	Contents	Timing / Frequency
1.	Project Director, Construction, Chief Resident Engineer Resident Engineers, staff of the WAPDA Environmental Management / Monitoring Cell.	MC	<ul style="list-style-type: none"> • Introduction to GB Environmental Protection Act, 2014. • Introduction to the applicable national environmental laws and regulations. • Roles and responsibilities of various stakeholders especially the Construction Contractors/ staff and Consultants. • Introduction to EMP and its contents and provisions/ limitations. • Introduction to the Environmental Monitoring Plan. • Documentation mechanism • Use of laboratory equipment for testing and monitoring water and air quality parameters etc. 	To be initiated soon after the start-up of the Project construction phase.

Sr. No.	Staff	Trainers	Contents	Timing / Frequency
2.	Construction Manager of the Contractor/ Contractor's staff.	MC	<ul style="list-style-type: none"> • Mitigation measures included in the EMP • Good construction practices • Wildlife and vegetation issues in the Study Area • EMP communication, documentation and monitoring requirements • Workers/labour Health and Safety measures • Community participation and consultations 	To be initiated at the start of the construction phase of the Project.
3.	Operational / Managerial Staff of WAPDA	MC	<ul style="list-style-type: none"> • Introduction to EMP • Related mitigation measures given in EMP • Safe handling, use and disposal of pesticides (fungicides, insecticides) fertilizers and hazardous wastes etc. • Introduction to the Environmental Monitoring Plan and its relevant clauses. 	Prior to the start of operation and at least one training session during the first year of operation
4.	Camp Staff/ Support Staff (Drivers, incharge of workers / labour, workshop force, kitchen staff etc.)	MC/ WAPDA EMMC	<ul style="list-style-type: none"> • Road safety and restrictions • Proper Vehicle maintenance • Defensive driving • Waste disposal • Emergency handling • Fire fighting • Sanitation • Camp(s) operation • Housekeeping 	Prior to the start of any construction activity and one training session during the operation stage.
5.	Contractor's Restoration and Clean-up team for borrow materials and camp areas	MC	<ul style="list-style-type: none"> • Site Restoration & Restoration requirements 	Prior to the start of restoration activity (one training session)

Sr. No.	Staff	Trainers	Contents	Timing / Frequency
6.	Community	MC / EMMC	<ul style="list-style-type: none"> • Introduction to the Project features and operations • Interaction mechanism with the Project owner and Project's key staff • Introduction of any negative impacts on wildlife, vegetation, water etc. due to Project interventions & mitigation measures adopted. • Benefits to the community by the Project / Positive outcomes • Mechanism of community participation in the Project activities • Complaints/ Grievance handling procedures 	To be initiated before the start-up of the Construction Activities under the Project.
7.	Contractor's Staff / Support Staff (Drivers, incharge of workers / labour, workshop force, kitchen staff etc.)	MC	<ul style="list-style-type: none"> • An "alleviation programme" with respect to HIV / AIDS and other infectious diseases. • Compulsory HIV / AIDS awareness and other infectious diseases prevention training. Educational campaigns to be conducted in the Project Area. 	To be started immediately after the start of the construction activities.

9.12 MANAGEMENT PLANS

Prior to mobilization, within 30 days of commencement, the EPC Contractor will develop site Specific Environmental Management Plan (SSESMP) and Site Specific Health and Safety Management Plan (SSHSM) which will be relevant to its chosen methodology and meet the requirement of this EMP. The Contract Agreement will have appropriate clauses to bind the EPC Contractor for the above obligations.

Various management plans have been prepared as a part of EMP for the better management and implementation of EMP during all phases of the proposed ALHPP. However, these plans will be updated by the EPC Contractor and approval from MC should be sought before start of construction activities. These plans are listed below:

- Tree Plantation Plan;
- HSE Management Plan;
- Emergency Preparedness and Response Framework;
- Borrow Areas Management / Rehabilitation Plan;
- Restoration and Rehabilitation Plan;
- Waste Management Plan;
- Traffic Management Plan; and
- Change Management Plan.

9.12.1 Tree Plantation Plan

The basic purpose of afforestation/plantation of suitable species in the project area is to reduce the risk been made due to cutting of trees for the proposed project and to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk been made but will also increase the carrying capacity of the area regarding many positive aspects.

Plantation will be done after the removal of trees during the construction work immediately. Plantation of indigenous trees species is highly important to maintain the biodiversity and ecological balance. It is also important to prevent global warming, soil erosion and pollution. Afforestation purifies the environment and helps in reducing the carbon dioxide level. A detailed Tree Plantation Plan has been provided as **Annex-II**.

9.12.2 HSE Management Plan

Health risks and work 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. Workers should be provided with safe and healthy working environment taking into account risks inherent to the particular sector and specific classes of hazards in project area. During the construction phase, the EPC Contractor will be responsible for all HSE related issues and to comply with national laws and international standards for occupational health and safety. Guideline for the EPC Contractor's Occupational Health and Safety Plan is attached as **Annex-IV**. The ultimate goal of the plan is to eliminate any injury to human and damage to facilities, materials and the environment.

The following measures are identified for health, safety, and environment protection during all activities of the proposed project to minimize risk of accidents, which could endanger the life of personnel, cause damage to properties and environment:

- All EPC contractor staff shall be well informed and trained on the HSE policies and guidelines;
- Contractor shall provide adequate health services as well as site first aid services for its workforce;
- The main priority of the contractor shall be to prevent accidents during mobilization, construction phase of the proposed Project. Prevention of workplace accidents during the construction activities will be achieved using approved work plan/instructions by the supervisors;

- Work safety measures and good workmanship practices shall be followed by the contractor to ensure no health risks for workers;
- Provision of adequate sanitation, washing, cooking and dormitory facilities;
- Proper maintenance of facilities for workers shall be monitored;
- Provision of protective clothing for laborers handling hazardous materials, e.g. helmet, adequate footwear for bituminous pavement works, protective goggles, etc. and contractor will ensure strict use of wearing these protective clothing during work activities;
- Elaboration of a contingency planning by the contractor at work site in case of major accidents shall be carried out;
- A site-specific fire-fighting plan also needs to be developed and implemented by the EPC Contractor during construction phase;
- Accidents shall be reported to and investigated by the EPC Contractor. All personnel shall be encouraged to report all accidents/incidents and to cooperate in the investigation of such occurrence;
- Adequate signage, lightning devices, barriers, and persons with flags during construction to manage traffic at haulage and access roads shall be conducted;
- The communicable disease of most concern during construction phase, like sexually-transmitted diseases such as HIV/AIDS, should be prevented by successful initiative typically involving health awareness, education initiatives, training health workers in disease treatment, immunization program and providing health service;
- Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease;
- All construction activities shall be properly managed through careful planning and the applicable and relevant HSE policies.

9.12.3 Emergency Preparedness and Response Framework

The framework provides an overview of the procedures to mitigate and control the impacts on community, on occupational health and safety, on the environment and on the Project in the event of emergency situations and to respond in life threatening situations usually occurring suddenly and unexpectedly during the construction and operational phases of the proposed project. This framework applies to all the processes of emergency responses to accidental calamities that can occur in an office, construction area and living area as well as first aids and emergency responses as per actual environmental situations during construction. This framework also provides a general reference and a basis for a detailed sub-plans and procedures that have to be developed by the Contractor before the initiation of the construction of the project and will be approved by the proponent. The framework needs to be developed with following objectives:

- Outline the applicable standards with regards to emergency preparedness and response;
- Define the emergency preparedness and response procedures utilized during the construction phase;
- Define persons and departments involved in emergency preparedness and their roles and responsibilities; and

- Define training requirements.

Various categories of risks can be envisaged in a working or construction environment. The response to each hazard will be different. A few types of emergencies/accidents will include the following:

- Natural risk: earthquake, flood, and other natural disaster;
- Political risk: civil strife, upheaval, riot, kidnap, and terrorist attack;
- Construction: fire, traffic accident, falling, hit and electric shock;
- Public health: dengue fever, malaria, food sanitation, high-temperature operation, insect sting, and
- Security: injury and property loss resulted from theft, robbery, and law case.

To minimize human suffering and financial losses, all personnel must know their responsibilities under the emergency preparedness and response plan. The plan should be used to set emergency procedures, implement and communicate the procedures and ensure that any required training has been completed. Planning for emergencies should include the following points:

- Hazard identification/assessment;
- Emergency resources;
- Communication systems;
- Administration of the plan;
- Emergency response procedure;
- Communication of the procedure; and
- Debriefing and post-traumatic stress procedure.

9.12.4 Borrow Areas Management / Rehabilitation Plan

There will be dire need to manage the borrow areas to avoid any environmental damage during the implementation phase of the Project. The EPC Contractor will develop a borrow area management/rehabilitation plan prior to start the extraction of material from each borrow area by using below guidelines.

- Site layout and boundaries with the following provisions:
 - Name, location and ownership of the borrow area;
 - Existing land use of the area;
 - Estimates of the resources to be extracted;
 - Stockpiling location;
 - Dust and noise consideration; and
 - Sequence of operation.

9.12.5 Restoration and Rehabilitation Plan

The implementation of the proposed Project would involve construction workers' camp for staff and laborers, establishment of fences around construction site, over usage of access roads for movement of heavy machinery/motor vehicles linking to various components of project,

offices, borrow/quarry areas, etc. During construction, these activities could also result in accumulation of large amount of unused or spoil material at various sites such as at access roads, muck dumping sites, quarry sites, colonies, offices, etc. which will change the existing land cover in the project area. After completion of the construction work, it is required to restore the disturbed area to its original conditions wherever it is possible that is the sole responsibility of the Contractor. Various engineering and biological measures have been suggested for the restoration of these areas:

- Top soil should be stored at designated areas before performing excavation activities at quarry sites (if these are agriculture land) and after the completion of all the construction activities, quarry sites (if applicable) and construction sites should be covered with the top soil to support the growth of plant species;
- The area should be planted with indigenous vegetation that would require the initial establishment of fast growing grasses along with annuals and perennials, nitrogen fixing herbaceous legumes and non-legume shrubs to increase the soil conditioning and to stabilize the project site;
- Material stockpiles shall be removed as soon as the construction work will be completed;
- All the construction, toxic and hazardous chemicals/materials shall be completely removed from the site;
- All fencing and gates shall be removed and pits shall be backfilled;
- The reconstruction of interrupted drainage channels and pipes shall be carried out;
- Rehabilitation of affected roads should be carried out to avoid any inconvenience to the road commuters; and
- A clearance certificate from the consultant has to be taken by Contractor in this regard.

9.12.6 Waste Management Plan

Management of solid and hazardous waste is one of the most important issues during construction phase of the Project.

The major components of the workers' camp waste are garbage, putrescible waste, rubbish and small portion of ashes and residues, wastewater from camps toilets and washing yards, etc. The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials, etc.). Insecure and unhygienic disposal of the wastes may cause degradation of soil, land and water resources. However, a criterion has been developed for the solid and hazardous waste management at site. The criterion is as follows:

- All the anticipated solid wastes should be collected through a properly designed solid waste management system. Enough number of containers should be placed inside the camps and within the construction area for the collection of various types of waste;
- These containers will help the component separation of various types of waste at source. Classification will be based on organic waste, recyclable waste, reusable waste (for resource and recovery) and waste for disposal site. Based on the

conditions of the region, organic waste should be frequently collected to avoid odor problems;

- Recyclable, reusable and waste for disposal site should be collected twice a week and on alternate days and should be transferred to a properly designed disposal site;
- The sewage system for camps shall be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters;
- Lined wash areas shall be constructed within the camp site or at site, for the receipt of wash waters from construction machinery;
- Medical waste and construction waste should be handled with care.;
- Construction waste i.e. waste concrete, bricks, cement, etc. should be disposed of at the designated areas; and
- Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste for disposal.

9.12.7 Traffic Management Plan

A comprehensive traffic management plan will be developed by the EPC Contractor mentioning routes to be followed for transportation of construction machinery and materials e.g. cement, steel, gravels, sand, etc. Traffic management plan will comprise following contents necessarily:

- Goals and objectives of plan;
- Purpose & Scope;
- Project specific traffic;
- Roles & responsibilities of contractors' environmental personnel;
- Routes to be followed along with necessary maps;
- Transportation timing; and
- Mechanism to address road accidents (if occurs).

9.12.8 Change Management Plan

The EIA and EMP have been prepared at feasibility phase of the proposed Project. Both are living documents and it has been foreseen that during the detailed design phase the documents may be updated and the EMP has to be refined. The EMP will be refined in the light of updated results of ambient air quality, noise, drinking water and surface water/wastewater. It will further be updated in the light of possible adverse environmental impacts and if necessary then any additional mitigation and enhancement measures will also be added to the EMP. Any sort of change in EMP has to be informed to all concerned personnel/departments.

9.12.9 Chance Find Procedure

In case of any chance find, the Contractor will immediately report through MC to Archaeology Department, GB and take further suitable action to preserve those antiques or sensitive remains. Representative of the Director will visit the site and observe the significance of the antique, artifact and cultural (religious) properties and significance of the Project. The report

will be prepared by representative and will be given to the Director. The documentation will be completed and if required suitable action will be taken to preserve those antiques and sensitive remains. In case any artifact, antiques and sensitive remains are discovered, chance find procedures should be adopted by construction contractor workers as follows:

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

9.13 CODES OF PRACTICE

The EPC Contractor should seek to develop codes of practice for its staff and employees in order to ensure that the intrusion of workers in the project area does not result in any social and environmental and social issues between the workers and locals which can harm the project by causing unnecessary delays.

These codes should be based on the principles of environmental protection, occupational health and safety, good engineering practices, respect, integrity and sound ethical values. Each code should include, at minimum, the purpose and objectives, a policy statement from the incharge explaining the importance of this code for the success of the project, and examples of such conduct. Guidelines for the code of practices are discussed below.

9.13.1 General

General code of conduct should be developed for the project and should include, at minimum, the following practices:

- Rules and guidelines will be given to the workers regarding the use of common resources such as wood, plants, water sources etc. to ensure their sustainable use;
- The code should also include provisions of the solid waste management plan to address solid waste collection and disposal in order to prevent unhygienic conditions and contamination of soil and water;
- The EPC Contractor will be made arrangements to avoid accidental risks such as traffic signs board and speed control measures for the safety of locals;
- In construction camps, amenities of life including clean food, water and sanitation facilities must be provided to these camps, and the workers should be provided with guidelines on how to dispose of their waste and maintain a sense of hygiene;

- The training of workers in the construction safety procedures, equipping all construction workers with Personnel Protective Equipment (PPEs) i.e. safety boots, helmets, gloves, ear plugs, and protective masks also and monitoring their proper and sustained usage;
- The Contractor should ensure that the construction labor is trained in safety procedures for all relevant aspects of construction;
- Formal emergency procedures should be developed for construction site in case of an accident. First aid kits and other necessary equipment should be kept available at site along with the list of emergency phone numbers at the construction site to be contacted in case of any accident; and
- The safety of the public at all stages of the construction and operation will be ensured by appropriate public education and safety measures such as use of sign boards, barriers and flags and use of proper illumination at night.

9.13.2 Good Engineering Practices

Good engineering practices should be developed for the project and should include, at minimum, the following practices;

- Standard Operating Procedures (SOP) for handling, storage and transportation of oil leakages, chemicals and other toxic materials should be strictly followed;
- Workers must be familiar with the Material Safety Data Sheets (MSDS) of each chemical used at site. MSDS are provided with each chemical drum. Chemicals will be stored as per their MSDS. Utmost care should be taken during the handling of these chemicals;
- Precautions should be taken to prevent spills and all workers should be trained in proper handling, storage and disposal of hazardous or toxic materials; and
- Proper disposal plans of excavated material.

9.13.3 Cultural Norms

Cultural Code of Practice should be developed for the project and should include, at minimum, the following practices:

- Self-respect and sensitivity to insult is an important trait of the locals. The poorest among them has his own sense of dignity and honour and he vehemently refuses to submit to any insult. In fact, every inhabitant considers himself equal if not better than his fellow tribesmen and an insult is, therefore, taken as scurrilous reflection on his character. So the contractor should be careful to avoid any unceremonious interaction with the locals and inform their staff to be humble and polite.
- The Contractor should also take care of the norms of local community and their sensitivity towards local customs and traditions;
- The Contractor should brief the staff about local culture and norms;
- As per local culture wearing of pant shirt, half shirts, and short trouser are considered inappropriate attire, therefore, the contractor inform the staff to avoid wearing short trousers and short shirt;

- Contractor will strictly warn the staff not to involve in any unethical activities and to obey the local norms and cultural restrictions particularly with reference to women;
- The Contractor will be required to maintain close liaison with the local elders and religious scholars of nearby local community to ensure that any potential conflicts related to common resource utilization for the project are resolved easily;
- Privacy of women is a major cause of concern for the communities of the project area. Due to the project activities local women may not be able to perform their daily outdoor chores. Women in the project are participate in other outdoor activities such as livestock rearing, bringing of potable water, collection of fire wood etc. that may be affected by the project activities;
- The EPC Contractor will have to select the specific timings for the construction activities so as to cause least disturbance to the local population particularly women considering their peak movement hours; and
- The EPC Contractor will warn the staff strictly not to indulge in any un-ethical activities and to obey the local norms and cultural restrictions particularly with reference to women.

9.14 ENVIRONMENTAL MITIGATION COST

Implementation of the recommendations of the EIA during the construction phase is the sole responsibility of the EPC Contractor and the monitoring activities will be carried out by the MC and WAPDA. Cost for environmental management and monitoring will be the part of the contract document with the Contractor.

The annual estimated cost for the implementation of environmental monitoring and management for the proposed Project is given in **Table 9-4**.

Table 9-4: Estimated Cost for the Implementation of Environmental Monitoring and Management

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
A	PRE- CONSTRUCTION PHASE						
A-1	Environmental Monitoring Cost						
1	Drinking Water Quality	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Once	35,000	6 Nos.	210,000	One time monitoring shall be carried out before the mobilization of Contractor.
2	Surface / Wastewater Monitoring	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Once	35,000	4 Nos.	140,000	
3	Noise Levels	dba Leq. as per NEQS 2010	Once	5,000	6 Nos	30,000	
4	Ambient Air Monitoring	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5} PM ₁₀ by EPA approved Laboratory	Once	50,000	6 Nos.	300,000	
Sub-Total (A-1)						680,000	
A-2	Tree Plantation Cost						
1	Tree Plantation Cost	The cost and maintenance of 5,750 plants for afforestation including cost of layout, digging, planting, carriage and watch and	Lump Sum		5,750 Nos.	11,109,000	Refer Annex-II Tree Plantation / Afforestation Plan

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		ward and its maintenance for five (05) years.					
Sub-Total (A-2)						11,109,000	
Sub-Total A = (A-1)+(A-2)						11,789,000	
B	CONSTRUCTION PHASE						
B-1	Environmental Monitoring Cost for one year						
1	Drinking Water Quality	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Quarterly	35,000	04 x 06 = 24 Nos	840,000	Quarterly monitoring cost for the one year construction period and will be updated each year based on latest rates during construction timeline of the proposed Project.
2	Surface/Wastewater Monitoring	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Quarterly	35,000	04 x 04 = 16 Nos	560,000	
3	Noise Levels	dBa Leq. as per NEQS 2010	Quarterly	5,000	06 x 04 = 24 Nos.	120,000	
4	Ambient Air Monitoring	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5} PM ₁₀ by EPA approved Laboratory	Quarterly	50,000	06 x 04 = 24 Nos.	1,200,000	
Sub-Total (B-1)						2,720,000	

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
B-2 Environmental and Social Management Cost							
1	HSE staff and Management Cost	Environment Personnel will monitor / conduct all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc.	Monthly	500,000 per month		6,000,000	This is the tentative monthly cost for one year period for Environment and HSE expert
			Breakup has been provided as Annex-V			10,010,000	Cost for PPEs, extinguishers, emergency lights, housekeeping equipment, safety signage and barricade, emergency preparedness kit, first aid kit, etc.
2	Ecological Monitoring & Management	Monitoring of disturbance due to construction activities.	Monthly	200,000 per month		2,400,000	This is the tentative monthly cost for one year period for one senior expert along with their monthly logistics.
3	Solid Waste Management	Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes	Monthly	200,000 per month		2,400,000	This is the tentative monthly cost for one year period for one senior expert along with their monthly logistics
			Lump sum			1,000,000	Cost for collection, segregation,

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
							transportation, disposal and management of domestic, commercial, construction wastes
4	Social Welfare Cost	Based on the regular consultations with stakeholders including affectees and nearby community, through basic need assessment by the EPC Contractor and verified by WAPDA coordinating the district social welfare department.		Lump sum		3,000,000	Different social welfare Projects i.e. easy loans for affectees, rehabilitation of roads, tracks, etc.
5	Training Cost	Literature preparation, printed material such as posters & pamphlets trainer(s), and venue, etc.	Monthly	150,000		1,800,000	This is the tentative monthly cost for one year period
6	Third Party Monitoring	Checklists & proformas	Bi-annual	750,000		1,500,000	This is the tentative biannual cost for one year period.
7	Communicable Diseases (as per advice of Environmental Specialist)	Tests should be performed by approved laboratory	Quarterly	500,000		2,000,000	This is the tentative quarterly cost for one year period for medical tests of kitchen staff at each camp site.
Sub-Total (B-2)						30,110,000	

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
Sub-Total B = (B-1)+(B-2)						32,830,000	Tentative Cost for One year Construction Period
						98,490,000	Tentative for whole construction period i.e. 36 months. The cost shall be updated based on the current market prices during construction phase.
C	OPERATION & MAINTENANCE PHASE (One Year Cost)						
C-1	Environmental Monitoring Cost						
1	Drinking Water Quality	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Biannually for One Year	35,000	06 Nos.	480,000	Biannually monitoring cost for the one year O&M Phase has been taken on current year basis, however, it will be reproduced for next years of O&M based on updated rates.
2	Surface/Wastewater Monitoring	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Biannually for One Year	35,000	04 Nos.	280,000	
3	Noise Levels	dBA Leq. as per NEQS 2010	Biannually for One Year	5,000	03 Nos.	30,000	
4	Ambient Air Monitoring	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5}	Biannually for One Year	50,000	03 Nos.	300,000	

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		PM ₁₀ by EPA approved Laboratory					
Sub-Total (C-1)						1,090,000	
C-2	Environmental and Social Management Cost						
1	HSE Activities	WAPDA	Monthly	300,000		3,600,000	This is the tentative monthly cost for one year period for one senior HSE staff.
Sub-Total (C-2)						3,600,000	
Sub-Total C = (C-1)+(C-2)						4,690,000	Tentative for (01) year project O&M phase. The cost shall be reproduced for next years of O&M Phase and updated based on the current market prices during O&M phase.
Grand Total (A+B+C)						114,969,000	
Contingency Charges			10% of Grand Total			11,496,900	
Grand Total with Contingencies (PKR)						126,465,900 (126.5 million)	Excluding Resettlement and Compensation Cost

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 CONCLUSIONS

Water and Power Development Authority (WAPDA) intends to develop 54 MW Attabad Lake Hydropower Project (ALHPP) on Attabad Lake situated in the Hunza Valley of GB, Pakistan. ALHPP (36°8'28.87"N and 74°49'19.44"E) has been identified on Hunza River on Attabad Lake. Attabad Lake was formed on January 4, 2010, when a huge mass from the right bank of Hunza River slid down near Attabad Village and blocked Hunza River. The inflow filled upstream valley and created a reservoir 14 km long till the end of May 2010. Attabad Lake is about 15 km upstream of Ganish Bridge and about 115 km upstream from Gilgit. Therefore, ALHPP will utilize the Attabad Lake water and head for the generation of the Hydel Electricity. Therefore, due to the implementation of ALHPP project, no major adverse impacts are anticipated.

Presently, there is a huge demand and supply gap of electricity in GB resulting in load shedding along with low voltage issues. Locals have no option for commercial and industrial demand to be partly fulfilled from diesel generators. Apart from the high cost of fuel, the use of these diesel generators is affecting the environment as well as tourism in the area.

This report has been prepared in accordance with the requirements of the GB Environmental Protection Act, 2014, Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000; Guidelines for Environmental Assessment (Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997, Guidelines for Sensitive and Critical Areas, 1997, Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997). In addition, this EIA addresses the requirements defined in the national and local regulations. Thus, to fulfil local (GB EPA) legal requirements, an EIA study was conducted for the proposed project.

This EIA study has been updated based on the available information at this stage of the Project as an additional scope of work. The proposed project will be implemented in EPC mode therefore, Detailed Engineering Design including Final Design will be available after the selection of the EPC Contractor.

Analysis of Alternatives such as No Project Option, Project Layout Alternatives, Headrace Alternatives, Penstock Alternatives and Powerhouse Location Alternatives have been considered during the preparation of the EIA study.

During the field surveys, significant efforts were made to identify the main physical, ecological, social, cultural and environmental issues related to the construction and operation of the proposed project. Various stakeholders including government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents.

Following are the major anticipated positive impacts:

- The Project not only reduces or replaces equivalent electricity generation sources with all the associated environmental benefits but it will also help to avoid all associated pollution caused through extraction, processing, storage and transportation of conventional fuels required for fossil fuel power generation plants.
- The sustainable power supply with the development of the proposed Project is likely to attract more tourists in the Project area and will increase the local business and recreational activities.
- The proposed Project will also provide skilled and unskilled jobs during the implementation phase and a limited number of jobs during operation and maintenance.
- Hunza and Nagar valleys have precious mineral resources which have remained unexploited. The availability of electricity will certainly develop a set-up on large scale to preserve fruits and for exploration of minerals.
- The requirements of electricity have increased in homes, both public and private offices, education institutions, hospitals, and health care centers in towns and habitats in the remote rural areas of valleys in Gilgit-Baltistan region, the electricity shortfall can be decreased with commissioning of this Project.
- Access roads will be built as part of the Project and will facilitate the people for goods and services accessibility. After completion of the Project, these facilities and infrastructure will be available to the general public. Moreover, health facilities created during the construction phase will be available to local communities.

Following is the list of potential adverse impact:

- Permanent Land acquisition;
- Temporary Land on rental/lease basis
- Cutting of trees/bushes falling within the proposed Project Boundary.
- Disturbance due to field activities;
- Temporary Landslide Hazards;
- Disturbance to aquatic fauna;
- Disturbance to infrastructure and public utilities;
- Disturbance to the public movement during construction;
- Noise and air pollution due to the working of construction machinery during construction and traffic during the O&M phases of the Project;
- Solid waste and wastewater generation during construction;
- Oil spillages from construction machinery, resulting in soil and water contamination;
- Occupational and community health and safety issues;
- Social and Cultural Conflicts;

Sedimentation, environmental flow, dam safety and emergencies etc. are the anticipated environmental impacts during the operation and maintenance phase of the proposed project.

The impact assessment, revealed that with the help of appropriate mitigation and control measures provided in this EIA Study, most of these potential impacts will either be avoided

altogether, or their likelihood of occurrence and severity will be reduced, thus making this project environmentally responsible and socially acceptable.

The environmental constraints will have to be monitored by concerned agencies, including Environment Specialist of Proponent and GB EPA. An EMP has been developed as part of the report which provides a detailed mitigation matrix that covers impacts, mitigation measures roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the project.

Project is socio-economically viable and environment friendly if EMP is implemented in true letter and spirit. The plantation will enhance the aesthetics; improve the landscape as well as the environmental conditions along the project area.

10.2 RECOMMENDATIONS

The EIA, EMP, mitigation and monitoring programs, contained herewith are recommended to include within the bidding documents for project works for all project components. The Bidding documents shall clearly state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP through his own SSEMP and SSHSMP, based on the guidelines provided in the EIA report, which will adopt all of the conditions of the EMP and add site specific elements as per advice of Environmental Specialist. This will ensure that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

Project affected persons must be compensated for their lost land, property or any other asset as per existing market rates. This step will reduce any future social impacts or political strains due to Project implementation. All personnel staff, employees and the EPC Contractor should undertake appropriate training prior to construction works to ensure they are aware of the on-site responsibilities in respect of all environmental and social issues.

The EIA, EMP and all its requirements should be added to the EPC Contractor's Contract, thereby making implementation of the EMP a legal requirement according to the Contract. Therefore, the EPC Contractor will prepare its SSEMP which will be approved and monitored by the Supervision Consultant. The Supervision Consultant shall note any non-conformance with the SSEMP and the conditions of environmental approval by GB EPA. The EPC Contractor should be held liable for breach of the contractual obligations of the EMP. In order ensure compliance with the SSEMP, the EPC Contractor will employ an Environmental Manager (or expert specified in EMP) to monitor and report project activities throughout the project construction phase.

The Project is found economically and financially feasible. The calculated economic internal rate of return (EIRR) is above 22.36% (the assumed opportunity cost of capital in Pakistan) and the financial internal rate of return (FIRR) comes out to be 19.17%. The proposed Project is found to be technically feasible, economically viable and environmentally acceptable and will fulfill electricity needs particularly for Hunza City and in general for Hunza, Gilgit and Ghizar Regions. It is suggested that the proposed Project should be implemented as soon as possible after all necessary approvals, design provisions and the implementation of EMP.

The tentative cost estimates to implement EMP is estimated as **PKR. 126.5 Million**. This tentative cost will be included in the overall project cost. This cost will be reviewed and firmed up periodically to ensure realism. The EPC Contractor, however, shall be paid against the actual execution with evidential proof of EMP activity.

ANNEXES

ANNEX-I: LIST OF PARTICIPANTS - COMMUNITY CONSULTATIONS

LIST OF PARTICIPANTS-COMMUNITY CONSULTATIONS

Sr. No.	Name of Participants	Occupation
1. Ganish Village		
1	Mubarak Hussain	President (Ganish Local Development Org.)
2	Sadaqat Hussain	Business
3	Tajir Hussain	Community Representative
4	Khadim Hussain	Advocate
5	Sherbaz	Govt. Employee
6	Ali	Shopkeeper
7	Akbar Hussain	Business
2. Gulmit Village		
1	Shair Ullah Baig	Vice Chairman
2	Salman Kareem	Society Member
3	Hadayat Shah	Society Member
4	Sultan Ayub	Numberdar
5	Sikandar Ahmad	Finance Secretary
6	Ahmad Baig	Finance Secretary
3. Attabad Village		
1	Dildar Khan	President Boat Association
2	Salman Ali	Vice President
3	Nawaz	Boat Owner
4	Naik Alam	Local Resident
5	Zafar Iqbal	Local Resident
6	Ahmad Khan	Boat Owner
7	Javed Iqbal	Supervisor
8	Agha Shahid	Shopkeeper
9	Ali Safdar	Shopkeeper
10	Zakawat Ali	Labor
11	Jan Muhammad	Labor
4. Passu Village		
1	Abdul Rasheed	Chairman PDO
2	Azeem Ali Shah	Community Stakeholder
3	Arman Ali	President Passu Conserving Committee
4	Salah Uddin	President Village Organization
5	M. Adab Khan	Community Stakeholder
6	Aman Ullah Khan	Social Activist
7	M. Ashraf Khan	Stakeholder

Sr. No.	Name of Participants	Occupation
8	Mullah Walli	President Thrift Society
9	Ali Madad	President Water Supply
10	M. Sharif Khan	Stakeholder
11	M. Iqbal	Stakeholder
12	Wahid Murad	Head Agriculture Society
13	Babar Majeed	President CBES
14	Arman Ali	President Passu Conserving Committee
15	Salah Uddin	President Village Organization
16	M. Adab Khan	Community Stakeholder
17	Aman Ullah Khan	Social Activist
18	M. Ashraf Khan	Stakeholder

ANNEX-II: TREE PLANTATION PLAN

TREE PLANTATION / AFFORESTATION PLAN

The basic purpose of afforestation/plantation of suitable species in the project area is to reduce the risk been made due to cutting of trees for the proposed project and to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk been made but will also increase the carrying capacity of the area regarding many positive aspects.

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

IMPORTANCE OF TREE PLANTATION

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

OBJECTIVES

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

STUDY AREA ENHANCEMENT / REHABILITATION PLAN

The project area is not rich in natural vegetation but some of planted and natural trees may be damaged.

In the project area will be raised on available spaces, in the Project area. Distance from the outer boundary of the ROW and between two plants will be kept as 4 meters. A total of 5,750 plants shall be planted in lieu of expected 575 effected plants, which is equal to 1:10 of the effected plants.

PLANTATION TECHNIQUE

Plantation of suitable broad leaved and pine species is to be carried out in the immediate vicinity of the project area. The project area can be afforested and vegetation cover can be improved by adopting standard afforestation technique of digging pits. The project area is suitable for plantation activities and can be managed thoroughly with care.

PITS

Pits should be dug in the project area at a spacing of 10' linearly. The pits should be of 1.5 feet dia at the top and 1 feet dia at the bottom with a depth of 1-3/4" ft. The earth taken out of the pits will be deposited below each pit in a crescent shape, so as to form a ridge with a clear berm of 9" in front. The consecutive crescents will be joined to catch the maximum quantity of moisture. Moreover, planting should be carried out in the pits and sowing on the berms, before or immediately after the first shower of rain. The choice of species Forest Department may change as per actual requirement and suitability.

Table: Recommended Species for Plantation in the Project Area

Sr. No.	Common Name	Scientific Name
1	Chinar	Platanus Orientalis
2	Tooth / Mulberry	Morus Alba / Nigra
3	Robenia	Robinia Pseudoacacia

WHEN TO PLANT

Planting should be completed early in the rains in as short a time as possible. The trees must be given time to become well established prior to the dry season. A good rule of thumb is to start planting when the soil is moist to a depth of 15-25 cm or to the bottom of the planting hole. Failures because planting is too late are more common than failures because of planting too early. To obtain good results and avoid labor shortage in these areas considerable preparatory planning is needed. The size of the plantation might have to be adapted to the availability of labor. If dry sites cannot be planted in time, planting should be postponed until the next season.

COST

The cost and maintenance of about 5,750 plants for afforestation in the project area has been estimated including cost of layout, digging, planting, carriage and watch and ward and its maintenance for four (04) years. **Table** shows the approximate cost of plantation including four (04) years' maintenance (Standard).

Note: These all activates of plantation plan should be implemented by Forest Department and they may change/update the standards and choice of species as per rule and approved rates.
Break-up of Expenditure per Avenue kilometer @ Rs. 1500/- per Diem.
Break-up of Expenditure per of 250 plants @ Rs. 1500/- per Diem.

FIRST YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Layout	1 Av.km	2 MD / Av.km	3000.00
2.	Digging of Pits 2.5 ft. each 2.5 x 250 = 625 cft.	625 cft.	5 MD / Av.km	7500.00
3.	Cost of Plants	250 No.	Rs. 100/- plant	25,000.00
4.	Cost of planting of plants	250 No.	Rs. 25/- plant	6250.00
5.	Carriage of plants from private nursery to site including loading and unloading	250 No.	Rs. 10/- plant	2500.00
6.	Cost of Manure and Bhall (silt) including carriage	1 Av. Km	-	20,000.00
7.	Watering 50 times (250 x 50) with water bowser, one driver and one coolie	12500 No.	5 MD per %	100,000.00
8.	Weeding twice (250 x 2)	500 No.	2 MD per %	15,000.00
9.	Reopening of Pits twice (250x2)/cft/pit	500 cft.	2 MD per %	15,000.00
10.	Unforeseen	-	-	5750.00
Total				200,000.00

SECOND YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plants 20% Restocking	50 No.	Rs.100/- plant	5,000.00
2.	Cost of planting	50 No.	Rs. 25/- plant	1250.00
3.	Carriage of plants	50 No.	Rs. 10/- plant	500.00
4.	Watering 50 times with water bowser, one driver and one coolie	12,500 No.	5 MD per %	100,000.00
5.	Reopening of Pits twice (250x2)	500 cft.	2 MD per %	1,5000.00
6.	Weeding twice 250x2	500 No.	2 MD per %	1,5000.00
7.	Unforeseen	-	-	1,250.00
Total				1,38,000.00

THIRD YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plants 10% Restocking 25 No.	25 No.	Rs.100/- plant	2500.00
2.	Cost of planting	25 No.	Rs. 25/- plant	625.00
3.	Carriage of plants	25 No.	Rs. 10/- plant	250.00
4.	H/watering 40 times x 250 no.	10,000 No.	5 MD per %	75000.00
5.	Reopening of Pits twice (250x2)	500 Nos.	5 MD per %	3750.00
6.	Unforeseen	-	-	2875.00
Total				85,000.00

FOURTH YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Watering 30 times	7,500 No.	5 MD per %	56,250.00
2.	Pruning and cleaning of plants	250 No.	5 MD per %	1,875.00
3.	Unforeseen	-	-	1,875.00
Total				60,000.00

Cost for raising 250 plants = Rs. 4,83,000/-

Total cost for 5,750 plants and their maintenance for four (4) years = **Rs. 11,109,000/-** or say

Total Cost = 11.109 Million PKR

Note: The above rates and calculations are approximate and tentative which will be updated according to the standard rates of concerned Forest and agriculture Departments / Implementing Agency, during implantation stage, as per updated and approved standards.

EXPECTED RESULTS

1. Extensive plantation, raised on both sides of the road will improve the ecological balance as both the flora and fauna are integral part of the ecosystem. Native tree species will be resorted which is playing pivotal role in carbon sequestration, which leads to reduce global warming and storing more carbon.
2. Local people will also get direct benefits in terms of fodder for cattle's, shade, job opportunities during plantations and maintenance for four years, clean air, and balanced temperature. Improved Green cover in the area will also attract the faunal species which are scared away due to construction activities. This shall reduce the noise and air pollution as well.
3. In many ways, fauna of a tract is dependent upon flora for its resting, nesting and roosting activities. With the improved flora of the project area, due to raising of large number of trees, the fauna and especially the avi-fauna shall be attracted to the area. The birds, which were scared away due to noise and degradation of their habitat, shall return to the area.
4. Plantation on both sides of the road shall not only reduce the noise and air pollution but will also be a source of attraction for the humans, and Wildlife like mammals, reptiles' birds and other dependents.

ANNEX-III: CHANCE FIND PROCEDURE

CHANCE FIND PROCEDURE

In case of any chance find procedure, the EPC Contractor will immediately report through supervision consultant to Archaeology Department of Astor and take further suitable action to preserve those antiques or sensitive remains. Representative of the Director will visit the site and observed the significance of the antique, arte fact and Cultural (religious) properties and significance of the Project. The report will be prepared by representative and will be given to the Director. The documentation will be completed and if required suitable action will be taken to preserved those antiques and sensitive remains.

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

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

ANNEX-IV: GUIDELINE OCCUPATIONAL HEALTH AND SAFETY PLAN

GUIDELINE OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

SCREENING AND REGULAR UNANNOUNCED CHECKING OF WORKERS

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as COVID-19, HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

MINIMIZING HAZARDS AND RISKS AT THE WORKPLACE

To ensure safety at all work sites, the following will be carried out:

- i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
- ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.
- iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
- iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than

- 6 feet high.
- v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.
 - vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;
 - vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.
 - viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.
 - ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.
 - x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.
 - xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

PROVISION OF PERSONAL PROTECTIVE EQUIPMENT

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

- i. High visibility clothing for all personnel during road works must be mandatory.
- ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.
- iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering.
- iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.
- v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.
- vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.
- vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.
- viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table: PPE Requirement List

Sr. No.	Type of Work	PPE
1.	Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
2.	Handling work safety	Helmet, leather safety shoes, work gloves.
3.	Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
4.	Grinding work	Dust respirator, earplugs, eye protectors.
5.	Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
6.	Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
7.	Blasting	Hard hat, eye and hearing protection.
8.	Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
9.	Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
10.	Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.

PROCEDURES TO DEAL WITH EMERGENCIES SUCH AS ACCIDENTS, SUDDEN ILLNESS AND DEATH OF WORKERS

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

- i. Provision of dispensaries by the individual EPC contractor.
- ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
- iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
- iv. Communication arrangements, such as provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

RECORD MAINTENANCE AND REMEDIAL ACTION

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

COMPENSATION FOR INJURIES AND DEATH

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws of Pakistan. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

AWARENESS PROGRAMS

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

- i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS, COVID-19), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
- ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

NOMINATION OF A HEALTH AND SAFETY FOCAL PERSON

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

- i. Function as the focal person/representative for all health and safety matters at the workplace;
- ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
- iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
- iv. Ensure that all workers are adequately informed on the requirement to use Personal

- Protective Equipment and its correct use;
- v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

SUGGESTED CONTENTS OF OCCUPATIONAL HEALTH AND SAFETY PLAN

The suggested contents of Occupational Health and Safety Plan to be developed by the Contractor(s) are described below:

- a. Purpose
- b. Scope of Application
- c. Complying Basis
- d. Occupational Health and Safety Objectives
- e. Organization and Responsibility
 - Contractor's Project Manager
 - HSE Management Department of the Contractor(s)
 - Medical Treatment Room of the Contractor(s)
 - Subcontractor's Project Manager
 - Subcontractor's HSE Managers
 - Occupational Health and Safety
 - Community Health and Safety
- f. Health Plan
 - Labour Protection
 - Sanitary Epidemic Prevention
- g. Safety Plan
 - Summary
 - Qualification Review
 - Safety Training
 - Construction Plans and Documents
 - Control Measures
 - Monitoring Measures
 - Management of the Key Safety Accidents
- h. Public Security Plan
- i. Local Community Health and Safety

ANNEX-V: BREAKUP OF HEALTH AND SAFETY COST

BREAKUP OF HEALTH AND SAFETY COST

Items	Quantity	Cost / Item (Rs.)	Total Cost (Rs.)	Rationale
(A) Personal Protective Equipment PPEs				
Dust masks	16,800	200	3,360,000	One dust mask per person to be used in a week by 350 labourer for 12 months the quantity will be 16,800 dust masks.
Safety Shoes	350	7,500	2,625,000	One safety shoe per person is supposed to be used for 12 months by 350 labourers.
Gloves	4,200	200	840,000	One pair of gloves is to be used per month per person and for 350 labourer for 12 months, 4,200 gloves are estimated
First Aid Box	6	10,000	60,000	Six First Aid Boxes are proposed for 12 months. The cost includes refilling expenses.
Ear Plugs	4,200	100	420,000	One set of ear plug is to be used per month per person and for 350 labourer for 12 months, 4,200 ear plugs are estimated
Safety Helmets	350	3,000	1,050,000	One safety helmet to be used by each of 350 labourer for 12 months.
Safety Jackets (Hi Vis)	700	1,500	1,050,000	Two safety Jacket (Hi Vis) to be used by each of 350 labourers for 12 months and total 700 safety jackets are required
Sub-Total (A)			9,405,000	
(B) Others				
Provision of Dust Bins	30	1,000	30,000	Thirty dust bins are proposed to be placed at construction site.
Warning Tape	50	500	25,000	---

Items	Quantity	Cost / Item (Rs.)	Total Cost (Rs.)	Rationale
Safety Cones	50	1000	50,000	Fifty safety cones are estimated to be placed at active construction site.
Safety Sign Boards	50	10,000	500,000	Fifty safety sign boards are proposed to be placed at active construction site.
Sub-Total (B)			605,000	
Grand Total (A + B)			10,010,000	

***Cost is estimated for 12 Months**

No. of labour required during construction = 350

PHOTOLOG



Photograph 1: Attabad Lake



Photograph 2: Attabad Land Slide Information



Photograph 3: Shamsal Nullah



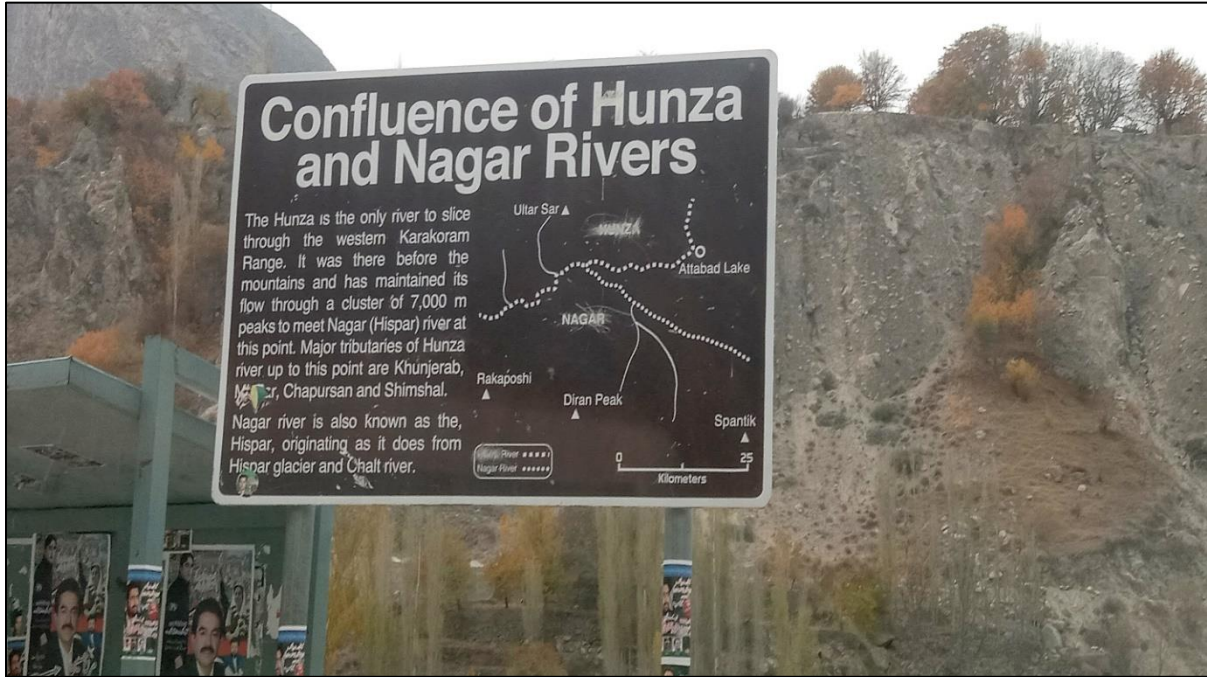
Photograph 4: Fine Sediment Deposits near Passu



Photograph 5: Powerhouse Site



Photograph 6: Hunza River Downstream of Powerhouse Site



Photograph 7: Hunza and Nagar Rivers Confluence Point near Ganish



Photograph 8: Civil Dispensary Gulmit



Photograph 9: Meeting with Director EPA Gilgit



Photograph 10: Meeting with Director KIU Hunza Campus



Photograph 11: Meeting with Assistant Commissionaire Gojal Hunza



Photograph 12: Meeting with Representative of Water & Power Dept. of GB



Photograph 13: Meeting with President Local Ismaili Council Gulmit



Photograph 14: Meeting with Director Forrest and Wildlife Department Hunza



Photograph 15: Meeting District Health Officer Hunza



Photograph 16: Meeting with Director Agricultural Department



Photograph 17: Meeting with District Education Office Hunza



Photograph 18: Meeting with Principal Al-Amin Model School Gulmit



Photograph 19: Visit of Bulbulik Music School Gojal



Photograph 20: Socio-Economic Survey of Local Cummunity Gulmit



Photograph 21: Bulbulik Music School Gojal



Photograph 22: Socio-Economic Survey of Locals near Attabad Lake Site



Photograph 23: Socio-Economic Survey of Local Community Shishkat



Photograph 24: Socio-Economic Survey of Locals Gulkin



Photograph 25: Socio-Economic Survey of Locals Sarat



Photograph 26: Socio-Economic Survey of Locals Salman Abad



Photograph 27: Socio-Economic Survey of Locals Gulmit



Photograph 28: Socio-Economic Survey of Locals Gulmit



Photograph 29: Socio-Economic Survey of Locals near Attabad Lake Site Shishkat



Photograph 30: Environmental & Socio-Economic Survey Team



Photograph 31: Collection of Water Sample from Attabad Lake



Photograph 32: Collection of Water Sample from Gulmit Glacier Melt



Photograph 33: Agriculture Seed Farm/Nursery Shishkat Gojal



Photograph 34: Government Middle School Shishkat Gojal Hunza



Photograph 35: Testing of Lake Water with Portable TDS Meter



Photograph 36: Testing of Lake Water with Portable PH Meter



Consultation in process with Forest Department



Consultation in process with Agriculture Department



View of Departmental Consultation with Fisheries Department



Meeting with Fisheries Department





View of Public Consultations