Rural Electrification Project

Environmental and Social Impact Assessment (Final)

Sebzor Hydropower Plant, Tajikistan

AUGUST 2019

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Acronyms and Abbreviations

Acronym	*Description*
CLO	Community Liaison Officer
E&S	Environmental & Social
EMF	Electromagnetic Field
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standard of the 2018 World Bank ESF
GBAO	Gorno-Badakhshan Autonomous Region (VMKB in Tajik)
GRC	Grievance Resolution Committee (1 and 2)
GRM	Grievance Redress Mechanism
HSE	Health, and Safety, Social, and Environment
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
kV	Kilovolt
Masl	Meters above sea level
NGO	Non-Governmental Organization
PAP	Project-Affected Person (or Project-Affected Party)
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SEP	Stakeholder Engagement Plan
WB	World Bank

1. Introduction

Pamir Energy is planning to construct and operate the Sebzor Hydropower Plant (HPP) on the Shokhdara River near Khorog in Gorno-Badakhshan Autonomous Oblast (GBAO) in Tajikistan (Figure 1). KfW and the European Union are considering providing financing for the project.

The Sebzor HPP will generate over 70 gigawatt-hours of electricity per year, enough to provide power to over 600,000 people in GBAO and Afghanistan. An associated transmission line financed by the Switzerland State Secretariat for Economic Affairs (SECO) will connect the HPP to the Tajikistan grid at Khorog, and another line, with financing yet to be determined will be extended to southern

Figure 1. Location of Gorno-Badakhshan Autonomous Oblast and Khatlon Region

GBAO. An additional connector line may be constructed in the future to transmit power to non-electrified areas in northern Afghanistan.

1.1. Background

The Sebzor HPP is one component of a larger multi-donor program to provide electricity access to selected settlements in GBAO and the Khatlon Province and to improve the reliability of electricity supply in GBAO.

The program includes several components:

- Construction and operation of a run-of-river 11-megawatt (MW) Sebzor hydropower plant (Sebzor HPP) on the Shokhdara River and an associated 6.6/35kiloVolt (kV) substation, to be financed by KfW and the European Union.
- Construction and operation of an 18km 110kV transmission line will carry power generated by the new Sebzor HPP to a 110/35kV substation in Khorog, with the line and substation to be financed by the Switzerland State Secretariat for Economic Affairs (SECO).

- Off-grid solutions for electrification of 105 villages located in GBAO and Khatlon, comprising provision of electricity services to target settlements through construction of small hydro (SHPP), solar and wind individual projects, and "last mile grid connections" which will involve constructing short distances of low-voltage distribution lines to connect currently unelectrified settlements in GBAO and to the national grid, to be financed under the World Bank's Tajikistan Rural Electrification Project (TREP).
- Construction and operation of a 63km 110kV transmission line between Khorog substation and a 35/110kV substation near Qozideh, to be financed by the Switzerland State Secretariat for Economic Affairs (SECO).

Under Tajikistan law, the potential environmental impacts of the various components of the program must be evaluated in an Environmental Impact Assessment. In addition, as part of their decisionmaking processes, the World Bank and other co-financiers require that proposed projects be evaluated in Environmental and Social Assessments.

The World Bank is providing financing for the environmental and social assessments and other planning documents that are needed for the various subprojects to meet the requirements of the World Bank's Environmental and Social Framework (ESF) and other requirements related to environmental and social performance. The various assessments will include:

- *Environmental impact assessments*. The Sebzor hydropower project, the associated 18km transmission line, and the associated 63km transmission line will each be assessed in separate Environmental and Social Impact Assessments (ESIAs). Final feasibility studies are complete or in preparation. The environmental and social impacts of the Sebzor project has previously been subject to a desktop environmental and social evaluation and a full feasibility study. The off-grid solutions projects will have preliminary assessments in Environmental and Social Management Frameworks (ESMFs) that will establish criteria for future evaluations of individual electrification projects.
- *Stakeholder Engagement Plans*. Each project component will have a tailored program to engage affected people and other stakeholders, with the Sebzor HPP and transmission lines sharing a single SEP since they are contiguous projects with many local common stakeholders.
- *Resettlement Policy Frameworks (RPFs)*. Each project component will require the temporary and permanent use of land that is currently allocated to other people and so will result in physical and/or economic displacement of some households. Each will require one or more separate Resettlement Action Plans in the future, but the principles and objectives of the program will be the same for all subprojects. For that reason, a single RPF has been prepared to cover all subprojects.

This report presents the ***Environmental and Social Impact Assessment (ESIA)*** for the Sebzor HPP subproject in GBAO. Documents required for each component of the overall program are identified in Table 1.

Table 1. Environmental and social documentation for overall electrification subprojects

Document	*Sebzor HPP & substation*	*18km Sebzor-to-Khorog 110kV t-line*	*63km Khorog-to-Qozideh t-line*	*GBAO off-grid solutions*	*Khatlon last-mile solutions*

Document	*Sebzor HPP & substation*	*18km Sebzor-to-Khorog 110kV t-line*	*63km Khorog-to-Qozideh t-line*	*GBAO off-grid solutions*	*Khatlon last-mile solutions*
ESIA	✓	✓	✓		
ESMF				✓	
SEP	✓			✓	✓
RPF	✓				

ESIA: Environmental & Social Impact Assessment
ESMF: Environmental and Social Management Framework
SEP: Stakeholder Engagement Plan
RPF: Resettlement Policy Framework
✓ indicates separate E&S document to be prepared to meet ESF and other applicable requirements
✓ identifies present document

Pamir Energy will be responsible for construction and operation of all the subprojects except the Khatlon last-mile solutions, which will be implemented by Barqi Tojik. Pamir Energy was formed in 2002 by the Aga Khan Fund for Economic Development (AKFED) in partnership with the Government of Tajikistan and the International Finance Corporation. Under a public-private partnership agreement with the Government of Tajikistan, the company has assumed the operational management of all power generation, transmission and distribution facilities in GBAO. Barqi Tojik is the state-owned company responsible for power generation and transmission in other provinces of Tajikistan.

Pamir Energy will appoint one or more contractors to complete the final designs and then one or more contractors to construct the hydropower project, transmission lines, and substations. Pamir Energy will also hire a third company to serve as the supervising engineer (also known as the Supervision Consultant, or Owner's Engineer), to be responsible for overseeing the contractors' design and construction.

In April 2019, a draft of this ESIA and the associated SEP and RPF were disclosed for review and comment by project stakeholders and the public in compliance with World Bank guidelines and Tajikistan law, as were environmental documents for the other components of the larger program. All stakeholder and public comments on the draft ESIA have been considered in developing this final ESIA, and will be considered in the final decisions made by Pamir Energy and the financial institutions that will provide financing.

1.2. Scope and organization of the ESIA

This ESIA is intended to meet requirements established by Tajikistan for Category B(II) projects and the World Bank for projects determined to present substantial environmental and social risks. Applicable requirements are described in Chapter 2. Prior to making decisions on proceeding with the project, the Government of Tajikistan, the World Bank, the other donors, and Pamir Energy will have to be satisfied that:

- The project will meet Tajikistan national requirements and World Bank requirements, as described in section 2.

- The project includes such measures as are necessary to avoid or minimize significant adverse impacts to environmental, health and safety, and socioeconomic conditions.
- Appropriate public consultation and disclosure has been undertaken in line with the World Bank Environmental and Social Framework (World Bank 2018) and Tajikistan law, thus ensuring that all reasonable public and other opinions are adequately considered prior to a commitment for proceeding with the project.

1.3. Organization of the ESIA

The ESIA is organized as follows:

- Chapter 2 describes the legal and other requirements that will apply to the project.
- Chapter 3 provides a description of the proposed project, including both the infrastructure to be constructed and the construction process, and of alternatives to the project.
- Chapter 4 identifies and describes alternatives to the proposed project components.
- Chapter 5 describes the methodology by which potential impacts are evaluated.
- Chapter 6 describes baseline conditions of the environmental resources that could be affected and the socioeconomic conditions in the area.
- Chapter 7 describes how the project could affect environmental resources, infrastructure, people, and social conditions, and measures that are needed in order to avoid, reduce, or otherwise mitigate those potential impacts.
- Chapter 8 summarizes how environmental and social performance of the project will be managed and monitored.
- Chapter 9 summarizes how the ESIA will be disclosed to the public and how Pamir Energy has received and will receive comments and other input from affected people and other interested stakeholders.
- Chapter 10 lists references consulted during preparation of this ESIA.

2. Legal and Regulatory Framework

This chapter describes the national and international legal framework that will apply to construction and operation of the Sebzor HPP , including standards and policies applicable to the project.

2.1. National legal and regulatory framework

The Law on Environment Protection, the so-called “framework environment law”, was adopted in 2011 (21 July 2011, № 208). The previous Law on Nature protection was adopted in 1993 and amended in 1996, 2002, 2004 and 2007. In 2011 it was replaced by the new Law. The new Law stipulates that Tajikistan's environmental policy should give priority to environmental actions based on scientifically proven principles to combine economic and other activities that have an impact on the environment with nature preservation and the sustainable use of resources. The Law defines the applicable legal principles, the protected objects, the competencies and roles of the Government, the State Committee for Environment, the local authorities, public organizations and individuals. The Law also defines measures to secure public and individual rights to a safe and healthy environment and requires a combined system of ecological expertise and environmental impact assessment of

any decision on an activity that could have a negative impact on the environment. The Law defines environmental emergencies and ecological disasters and prescribes the order of actions in such situations, defines the obligations of officials and enterprises to prevent and eliminate the consequences, as well as the liabilities of the persons or organizations that caused damage to the environment or otherwise violated the Law. The Law establishes several types of controls over compliance with environmental legislation: State control, ministerial control, enterprise control, and public control. State control is affected by the Committee for Environment Protection, the Sanitary Inspectorate of the Ministry of Health, the Inspectorate for Industrial Safety and the Mining Inspectorate. Public control is carried out by public organizations or trade unions and can be exercised with respect to any governmental body, enterprise, entity or individual.

2.1.1. Environmental and social impact assessment in Tajikistan

Two laws establish requirements for impact assessment: the ***Law on Environment Protection*** and the ***Law on Ecological Expertise***. Chapter V, Articles 35-39 of the Law on Environment Protection (2012), introduces the concept of state ecological review (literally, "state ecological expertise" – SEE), the purpose of which is to examine the compliance of proposed activities and projects with the requirements of environmental legislation and standards and with the ecological security of society. These laws emphasize the cross-sectoral nature of SEE, which must be scientifically justified, comprehensive, and objective and which should lead to conclusions in accordance with the law. SEE precedes decision-making about activities that may have a negative impact on the environment. Financing of programs and projects is allowed only after a positive SEE finding has been issued. Among activities and projects subject to state ecological review are construction and reconstruction of various types of facilities irrespective of their ownership.

The laws require that all types of economic and other activities be implemented in accordance with existing environmental standards and norms and have sufficient environmental protection and mitigation measures to prevent and avoid pollution and enhance environmental quality. Environmental impact studies analyzing the short- and long-term environmental, genetic, economic, and demographic impacts and consequences have to be evaluated prior to making decisions on the sitting, construction, or reconstruction of facilities, irrespective of their ownership.

The legal and regulatory system for EIAs also include:

- Procedure of Environmental Impact Assessment, adopted by the Resolution of the Government of the Republic of Tajikistan No. 509 as of 01.08.2014
- Procedure to implement State Ecological Expertise, approved by the Resolution of the Government of the Republic of Tajikistan No. 697 as of December 3, 2012
- Guidelines on the composition and order of development of content and structure of documentation to be submitted for review as part of SEE
- List of objects and types of activity for which preparation of documentation on Environment Impact Assessment is mandatory, adopted by the Resolution of the Government of the Republic of Tajikistan No. 253 as of June 3, 2013. This extensive list contains 180 types of activities that are grouped according to four environmental impact categories (from (I) "high risk" to (IV) "local impact"). If the facility is not included in the list, then it is not required to pass an EIA or a SEE.

EIA responsibilities. Conducting the EIA study is the responsibility of the project proponent. The Procedure for carrying out the EIA (Government Resolution No. 509 of 2014) establishes general requirements for contents of the EIA documentation. The State Ecological Expertise for all investment projects is the responsibility of the Committee for Environmental Protection under the Government of Tajikistan (CEP) and its regional offices. The 2012 Law on the State Ecological Expertise requires that all civil works, including rehabilitation, should be assessed for their environmental impacts and the proposed mitigation measures reviewed and monitored by the CEP.

Screening categories. The law on Environment Protection and the Law on Environmental Expertise stipulate that the Government is to approve a list of activities for which the complete EIA is mandatory. The current guidelines for EIAs do not provide for any preliminary assessment of the project to decide on the need for an EIA (screening) or define the scope of the EIA's contents. This is because the list of objects and activities for which the development of EIA materials is required is already very detailed. Therefore, although the CSP will not be required to prepare an EIA per existing legislation, upon its approval it will be necessary to consult with the CEP experts for further guidance on compliance with the SEE.

According to the Law on Environment Impact Assessment and the Law on Ecological Expertise, small hydropower stations with a capacity of less than 30MW are considered to be in Category B (II). Category B projects are economic and other planned activities that have a predictable impact on the environment. Required documentation includes an assessment of the various types of environmental impact, such as air emissions and discharges into water sources, the formation and disposal of solid and liquid wastes, noise, and other types of impacts.

The Law on Environmental Expertise provides for the rights of citizens to conduct Public Environmental Expertise (art. 7). Tajikistan is also party to the 1998 Aarhus Convention (July 17, 2001) that contains provisions for public EE. The 2014 Procedure (Order) for Conducting an EIA also describes procedures for public participation. Public participation procedures are envisaged for all categories of projects, although in practice they are mainly applied to Category I projects. The Procedure (Order) for conducting the EIA of 2014 changed the focus and timing of public discussions. Compared to the 2006 version of the Procedure for preparing EIAs which provided the opportunity for public inputs during the scoping stage while drafting the technical task, the 2014 version of the Procedure provides space for public discussions only after the preparation of the EIA report.

2.1.2. Other relevant legislation on environmental and social issues

Other key laws and requirements will also apply to the project or be relevant for design or operation.

A number of legal acts establish liability for violation of environmental laws, which can be enforced by several State bodies. In particular, the 2010 ***Code of Administrative Violations*** establishes administrative liability for organizations, their officers and individuals for a range of violations, including careless treatment of land, violation of rules for water use or water protection or failure to comply with a SEE. Administrative sanctions for environment related violations can be imposed by the administrative commissions of Khoukumats, courts, CEP inspectors, the Veterinary Inspectors of the Ministry of Agriculture, and the State Committee for Land Management and Geodesy. The most common administrative sanction is a fine of up to 10 minimal monthly salaries for individuals and up to 15 minimal salaries to officers of organizations. The 1998 Criminal Code also covers crimes against ecological safety and the environment, such as violations of ecological safety at work, poaching and

spoiling land, as well as violation of rules for the protection and use of underground resources. The maximum fine is up to 2,000 minimal monthly salaries and the maximum sentence is up to eight years in prison.

The ***Law on Environmental Information*** (2011) is underpinned by Article 25 of the Constitution, which states that governmental agencies, social associations, and officials are required to provide each person with the possibility of receiving and becoming acquainted with documents that affect her or his rights and interests, except in cases anticipated by law. The Law defines the legal, organizational, economic, and social bases for providing environmental information and establishes the right of individuals and legal entities to receive complete, reliable, and timely environmental information. Article 4 provides the right of access to environmental information and Article 8 defines the conditions for restricting access to environmental information (none of which should be relevant here).

The ***Water Code*** (2000, last amended 2012) establishes policies on water management, permitting, dispute resolution, usage planning and cadaster. It promotes rational use and protection of water resources exercised by all beneficiaries and defines the types of water use rights, authority and roles of regional and local governments for water allocations among various users, collection of fees, water use planning, water use rights and dispute resolution. The Code provides Water User Associations with the mandate to operate and maintain on-farm irrigation and drainage infrastructure.

Two articles of the Water Code are directly relevant to the project. Article 83 ("Using water resources for energy consumption") and Article 84 ("The rights and responsibilities of hydropower companies on water usage") provide that energy companies are authorized to use water to produce electricity based on approval of the project, to organize better uses of reservoirs, taking into account water protection measures, and to require individuals to comply with the rules of normal use of reservoirs for hydropower purposes. Hydropower systems are in turn required to control the level of the reservoir, ensure the project does not affect water quality, to include a fish pass in the design, and to ensure the structure withstands floods and other natural disasters and that other measures are taken in case of floods.

The Constitution of the Republic of Tajikistan establishes exclusive state ownership of land. The ***Land Code*** (1996, last amended 2016) establishes the rules that control the assignment and termination of the rights to use (or lease) land. Rights to use land can be primary or secondary. Primary use rights include perpetual use, limited or fixed-term use up to 20 years, life-long inheritable tenure. The only secondary use/right is the right to lease, again up to 20 years. The Land Code establishes seven categories of land uses, including agricultural, urban/populated, industrial and other infrastructure, conservation and other protected land, national forest/wood reserves, water reserves, and state land reserves. Of most concern here are the first three, plus water reserves. In GBAO, most issues of land relations are under the jurisdiction of the region itself. Districts (jamoats) and cities have authority to provide land allotments for agricultural land and to withdraw land for nonagricultural uses (Land Code, Article 7). They are also responsible for protecting users' rights, terminating rights to use land, registering the rights to use land plots, and generally controlling land use and protection. They specifically approve land tenure documents dealing with works of regional importance.

Article 48 of the Land Code outlines the rules for state "confiscation" of land plots for state and public needs. Requirements include assignment of an equivalent land plot ("if desired"),

construction of equivalent house and structures, and "full compensation for all other losses, including loss of profits…." These provisions apply only to those who have the legal right to use the land by virtue of possession of a "certificate on the legal right to use the land." The Regulation concerning compensation of land users' losses and losses of agricultural production was approved by Resolution of the Government of the Republic of Tajikistan # 641 (30 December 2011). It establishes the detailed order of reimbursement of land users' losses. The amount of compensation is determined by an interdepartmental commission established at the district level where the acquisition is to take place (that is, at the GBAO level). If the land user does not agree with the amount or type of compensation for losses and damages, the land user can apply to the court with a request for additional compensation, or may appeal the decision to terminate the rights.

This law is directly relevant since it will control the termination of rights of current users and issuance of certificates of rights to Pamir Energy to use the land for the hydropower project.

The ***Law on Land Administra*tion** (2008, last amended 2016) obliges the authorities to map and monitor the quality of land, including soil contamination, erosion and water logging.

The ***Law on Sanitary and Epidemiological Safety of the Population*** (2003, last amended 2011) introduced the concept of sanitary and epidemiological expertise that establishes the compliance of project documentation and economic activities with the state sanitary and epidemiological norms and rules, as well as strengthened provisions on sanitary-hygienic, anti-epidemic and information measures. These include limits for noise that will apply to the project.

The ***Law on Subsoil*** (1994) establishes the legal basis for the study, protection, and use of subsoil. Common minerals such as sand, clay, gravel, and others, may be used in their natural form with little processing and cleaning, to meet local economic needs without other permission. Article 15 provides the owners of land rights to extract common minerals to a depth of five meters, without blasting. Thus, the contractors will not require permits or other permissions to extract sand and gravel (for construction purposes) from land where Pamir Energy has the rights. If the contractor requires additional materials, it will have to be purchased from other sources or the contractor (or Pamir Energy) will need to acquire the rights to other land.

The ***Law on Pastures*** (2013) defines the basic principles of pasture use, including protection of pastures and the environment, and attraction of investments for more effective use and protection of pastures. The Law specifies the powers of local administrations to control environmental safety and pasture use in accordance with state regulations and standards. The law prohibits the implementation of a few activities in pastures, such as cutting down trees or bushes, building roads, misuse of grazing land, pollution of the environment with waste, and grazing of livestock beyond the established rate. The law requires users to ensure effective use of pastures, including protection of pastures against degradation and pollution.

The ***Law on Dekhkan Farms*** (2016) provides the legislative basis for the establishment and operation of private dekhkan farms. While, according to the Law of 2009, dekhkan farms were subjects of economic activities that carry out activities without the formation of a legal entity, the new Law allows dekhkan farms to obtain the status of legal entities. It also clarifies and fixes the rights of members of dekhkan farms as land users. The law improves the management of dekhkan farms and defines the rights and duties of their members. It allows farmers to legally erect field camps on land as temporary buildings, which makes it possible to significantly improve productivity at the agricultural season. The law requires dekhkan farms to take measures to improve soil fertility and

improve the ecological status of lands, make timely payments for water and electricity, and provide statistical information to government agencies.

Protection of cultural heritage is grounded in paragraph 44 of the Constitution, which requires all citizens to respect and protect historical and cultural monuments. The ***Law about Culture*** (1997) establishes rights concerning cultural activities, including non-material cultural heritage, and requires protection, management, and monitoring of historical and cultural monuments. Material heritage is found in archaeological sites, sites of ancient settlement, tumuli, remnants of ancient settlements, castles, industries, channels, roads, ancient burial places, stone sculptures, graven images, antiquity items, and places of ancient settlements. The Ministry of Culture and its local representative offices are primarily responsible for protecting cultural heritage. The ***Law on Regulating Traditions, Celebrations, and Rituals*** (2007, last amended 2018) limits expenditures and activities related to religious and family observances and festivities.

The ***Forest Code*** (2011) regulates forest relations and is aimed at creating conditions for the rational use of forests, including their conservation and protection. The Forest Code requires coordination with the Forestry Agency for construction sites that will affect forests, which are defined as forested areas that cover least 0.5 hectares and are at least 10 meters wide which have environmental, social and economic interest for state. Projects must take measures to protect forests from sewage, waste, emission, etc. The project will not affect an area large enough to be considered a "forest" within the meaning of the law.

The ***Labor Code*** prohibits forced labor and adult labor. Article 8 of the 1997 Labor Code prohibits forced labor. The Labor Code sets the minimum age at which a child can be employed as well as the conditions under which children can work (Articles 113, 67, and 174). The minimum employment age is 15, however, in certain cases of vocational training, mild work may be allowed for 14-year-olds (Article 174). In addition, there are some labor restrictions on what type of work can be done, and what hours of work are permissible by workers under the age of 18. Examples of labor restrictions include that those between 14 and 15 cannot work more than 24 hours per week while those under 18 cannot work more than 35 hours per week; during the academic year, the maximum number of hours is half of this, 12 and 17.5 hours, respectively.

The ***Law on Occupational Safety*** (No. 517, 19 May 2009, as amended) establishes the right of workers to work in places that are protected from exposure to dangerous and harmful factors. Employers are required to specify in the labor agreement (contract) indicators and characteristics of working conditions, benefits and compensation for hazardous and harmful working conditions, personal protective equipment, the possibility of occupational disease, and measures of responsibility for noncompliance (by employer and employee) with the requirements in the labor contract. Employers are required to provide compulsory social insurance against accidents, disease, or injuries associated with their jobs. The law gives workers the right to refuse to undertake work that violates labor protection requirements. In addition, workers engaged in hazardous working conditions are entitled to free medial and preventative care, additional paid leave and other benefits and compensation. In case of disability or death, employers must provide compensation in multiples of average annual earnings. Employers must train workers in performing their work safety and must provide for collective and personal protection of workers. Accidents must be investigated. Finally, there must be a "labor protection service" if there are more than 100 employees

Under the ***Law on Public Associations*** (2007, last amended 2019), a public association may be formed in one of the following organizational and legal forms: public organization, public

movement, or a body of public initiative. Article 4 of this law establishes the right of citizens to found associations for the protection of common interests and the achievement of common goals. It outlines the voluntary nature of associations and defines citizens' rights to restrain from joining and withdrawing from an organization. This legislation requires NGOs to notify the Ministry of Justice about all funds received from international sources prior to using the funds and to post financial information on their websites.

The 2014 ***Law on Public Meetings, Demonstrations and Rallies*** (Article 10) bans persons with a record of administrative offenses (i.e. non-criminal infractions) under Articles 106, 460, 479 and 480 of the Code for Administrative Offences from organizing gatherings. Article 12 of the law establishes that organizers must obtain permission fifteen days prior to organizing a mass gathering.

The ***Law on Self-Government Bodies in Towns and Villages*** (1994) and the ***Law on Local Public Administration*** provide the legal basis for local government. The former law assigns to Jamoats a broad range of competencies and the mandate to support community efforts to address local socioeconomic needs. The 2009 amendment aims to strengthen local self-governance and accountability by delegating budget authority to Jamoat councils, and introducing a system of direct election for Jamoat councilors. The 2017 amendment allows Jamoat councils to retain non-tax revenues earned through the provision of administrative services and a percentage of local property taxes. The 2017 amendment suggests a seriousness on the part of national government to enact policies that empower Jamoat councils with authorities and resources needed to support local development and problem-solving.

The ***2010 Law on the Safety of Hydrotechnical Infrastructure*** applies to infrastructure for hydropower and flow regulation, and flood protection. The Law places the responsibility for safety of hydrotechnical infrastructure on the owners and users of such facilities, who must ensure compliance with safety rules during construction and exploitation, perform regular inspection and safety assessment, take measures to ensure safe operation, ensure development and updating of safety criteria, and keep local warning systems operational. The Law introduces such instruments such as a declaration of safety that has to be completed by the owners or users at various stages of the installation's life. In 2015, the Government enacted subsidiary legislation, "Procedures for development and operation of state expertise for declaring the safety of hydrotechnical infrastructure", "Procedures for establishment and maintenance of the State Register of Hydrotechnical Facilities", and "Procedures for defining the financial limits of civil liability for damage caused as a result of an accident at a hydrotechnical facility" (2015 ***Resolution of the Government No. 436***).

Other Tajikistan legislation that could apply to project-related activities are listed in Table 2.

Table 2. Other potentially relevant legislation

Law of Republic of Tajikistan on Appeals of Individuals and Legal Entities
Law on Protection of Atmospheric Air (will require permit for emissions)
Law on Hydrometeorological Activity (no specific requirements)
Law on Land Administration
Law on Land Valuation
Law on Environmental Audit (may be required by Environmental Protection Committee)
Law on Securing Sanitary and Epidemiological Safety of the Population

Law on Radiation Safety
Law on Production and Consumption of Waste (permit will be required)
The Law on Environmental Education
The Law on Environmental Monitoring
The Law on Specially Protected Natural Areas (none could be affected)
Law on Protection of Fauna (will require permission if take fauna)
Law on Protection of Flora (will require permission if cut flora)
Water Codex (permission for water usage required)

2.2. International obligations

In addition to national legislation and regulations on environmental issues, Tajikistan is also party to several international treaties focused on environmental issues:

- Vienna Convention for the Protection of the Ozone Layer, 1996, as updated
- UN Convention to Combat Desertification (CCD), 1997
- UN Convention on Biological Diversity (CBD), 1997, as updated by Cartagena and Nagoya protocols
- Ramsar Convention (joined 2000)
- Bonn Convention on the Conservation of Migratory Species of Wild Animals (joined 2001), as updated by Bukhara Deer Memorandum, 2002
- UN Framework Convention on Climate Change, 1998, with related update Kyoto Protocol, accessed on December 29, 2008, and entered into force on March 29, 2009
- Stockholm Convention on Persistent Organic Pollutants (ratified 2007), as updated
- Aarhus Convention (UNECE Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters) (joined 2001), as updated by Kiev Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, on May 21, 2003
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, 2016
- UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (joined 1992)
- Rotterdam Convention on Prior Informed Consent (PIC) procedure on September 28, 1998, ratification pending
- The United Nations Convention to Combat Desertification (1997);
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (2016)

In addition, Tajikistan has ratified a number of core labor standards of the International Labour Organisation, including the following:

- Forced Labor (C029) and Abolition of Forced Labor (C105)
- Minimum Age (C138) and Worst Forms of Child Labour (C182)

- Discrimination (C111)
- Freedom of Association and the Right to Organize (C087)
- Right to Organize and Collective Bargaining (C098)
- Equal Remuneration (C100)

2.3. World Bank environmental and social standards

2.3.1. Environmental and Social Framework

Pamir Energy is seeking financing for the project from the World Bank, which requires that the project meet the Bank's environmental and social standards, as well as relevant Tajikistan legislation if it is more stringent. The World Bank's Environmental and Social Framework (ESF) includes the Environmental and Social Policy for Investment Project Financing, which describes the requirements the Bank must follow for projects it supports through Investment Project Financing, and 10 Environmental and Social Standards (ESSs), which establish requirements for Borrowers and grantees such as Pamir Energy to identify, assess, and control environmental and social risks and impacts of Bank-supported projects. Applicable ESSs include:

- ESS1: *Assessment and Management of Environmental and Social Risks and Impacts*: identification, control, and monitoring of risks and impacts, including identification of applicable requirements and monitoring outcomes.
- ESS2: *Labor and Working Conditions*: labor relations, rules of employment, occupational health and safety, workforce protection, worker grievance mechanism, with specific requirements for contractor and subcontractor employees.
- ESS3: *Resource Efficiency and Pollution Prevention and Management*: conservation of resources and control/prevention of wastes and pollution.
- ESS4: *Community Health and Safety*: avoidance and control of risks and impacts on communities from project activities and workers, emergencies, security, and other factors. ESS4 includes an annex outlining procedures for Safety of Dams.
- ESS5: *Land Acquisition, Restrictions on Land Use and Involuntary Resettlement*: identification, planning, avoidance/response to the need for physical and/or economic displacement due to project activities, including information disclosure and consultation.
- ESS6: *Biodiversity Conservation and Sustainable Management of Living Natural Resources*: protection and conservation of biodiversity and habitats, support livelihood of local communities
- ESS8: *Cultural Heritage*: protection of tangible and intangible cultural heritage.
- ESS10: *Stakeholder Engagement and Information Disclosure*: identification and engagement of local and other stakeholders throughout the project life cycle, disclosure of project information, grievance redress mechanism for external stakeholders.

ESS7 (*Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities*) does not apply since no such communities or people could be affected by the project. Similarly, ESS9 (Financial *Intermediaries)* does not apply since Bank funding is not being provided to financial institutions for further on-lending.

The World Bank classifies proposed projects into one of four risk categories, and has classified the Environmental Risk Rating of the overall program as Substantial because the project involves construction of the Sebzor run-of-river HPP in the remote GBAO province and construction of greenfield power transmission lines in the same remote area.

The World Bank also classified the Social Risk Rating as Substantial. Risks and impacts due to the type, location, sensitivity and scale of the Project are not considered to be significant. The Substantial classification was due to contextual risks -- that is, risks due to the diverse regions, common fragility, the remoteness and extremely difficult access to the project area, the border vulnerability, the absence of sustainable job opportunities and income-generating activities, which in turn lead to unemployment and poverty, migration and remittances (and consequently increased number of female headed households). In addition, risks due to client capacity are considered Substantial. As a result, security risks to contractors and laborers as well as migrant laborers and community safety will warrant serious attention. Table 3 provides a high-level summary of key gaps between the Bank's requirements and Tajikistan's requirements. As noted, the more stringent of the requirements will apply.

2.3.2. World Bank Operational Policy 7.5, Projects on International Waterways

In addition to the Environmental and Social Framework, Operational Policy 7.50 applies to projects on international waterways, which includes rivers that form boundaries between countries, or their tributaries, The Policy requires notification of all countries of the project details. The Shokhdara River is a tributary to the Panj River, which forms the boundary between Tajikistan and Afghanistan. However, the river is wholly within Tajikistan and will have no effect on the Panj.

2.3.3. World Bank Group Environmental, Health, and Safety Guidelines

The World Bank Group has promulgated a number of Environmental, Health, and Safety Guidelines (EHS Guidelines). One is applicable to this project: The *General EHS Guidelines* (April 30, 2007) includes guidelines for environmental controls during facility operation (air and water emissions, hazardous materials management, noise, contaminated land, etc.) and occupational and community health and safety during operation. This guideline also covers the same topics for construction.

Although not directly applicable to the Sebzor HPP, the *Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution* include requirements for the associated transmission lines. These guidelines will apply to the associated transmission lines that will carry power from the hydropower project to the grid, and thence to other parts of GBAO.

Table 3. Summary of World Bank requirements and key gaps with Tajikistan legal requirements

ESS &Topic	*Major requirements*	*Key requirements/gaps in Tajikistan legal framework*
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts		
Scope of application	ESSs apply to Associated Facilities to extent of Borrower's control/influence	Associated facilities not covered by Tajikistan law as such, except to the extent that all activities in Tajikistan are subject to laws
Borrower's E&S Framework	May use Borrower's framework if can meet objectives of ESSs. This is not the case here, which requires application of World Bank requirements.	No provision for alternative requirements except that international standards take precedence if agreements are in place
A. E&S Assessment	- Conduct E&S assessment, including stakeholder engagement - Retain international expert(s) for high-risk projects - Apply national framework, ESSs, EHSGs/GIIP - Apply mitigation hierarchy - Offset significant residual impacts - Differential measures for vulnerable or disadvantaged people - Consider primary suppliers - Assess cumulative impacts	- ESIA law has much less emphasis on social conditions and impacts, but other laws partly fill gaps, but with less specificity concerning community impacts - No distinction between international and Tajikistan experts - No reference to EHSGs or GIIP - No equivalent provision for offsets - No equivalent provisions for vulnerable and disadvantaged people - No coverage of primary suppliers - No requirement for assessment of cumulative impacts
B. ESCP	ESCP includes specific requirements that must be met within a specified time, and also can and should be updated during implementation as conditions and risks change.	No provision in permits/approvals for delayed compliance or for updating requirements.
C. project monitoring & reporting	- Monitor proportionate to nature of project, risks and impacts, and compliance requirements - Reports to World Bank	Monitoring required but less emphasis
D. Stakeholder engagement and information disclosure	Engage stakeholders through life cycle	Generally consistent but no requirement for project-specific stakeholder engagement plan
ESS2: Labor and Working Conditions		
Scope of application	ESS2 applies to workers employed by Pamir Energy who work on the project and to contracted workers, primary supply workers, and community workers	- Labor Code applies to all workers in Tajikistan, including foreign workers - Requirements apply to employer but do not extend to prime contractor
A. Working conditions and	- Written labor management procedures	Generally consistent

ESS &Topic	*Major requirements*	*Key requirements/gaps in Tajikistan legal framework*
management of labor relations	- Terms and conditions of employment - Nondiscrimination and equal opportunity - Worker's organizations	
B. Protecting the work force	- Child labor - Forced labor	- Minimum employment age is 14, with other limits consistent with ILO, but no work that could "cause health or moral damage" if under 18 - Forced labor prohibited
C. Grievance mechanism	- Grievance mechanism has to be provided for - all direct and contracted workers	No specific requirement for grievance mechanism for workers
D. Occupational Health and Safety (OHS)	Measures relating to occupational health and safety will be applied to the project: - Apply World Bank Group General and sector-specific EHS Guidelines - Requirements to protect workers, train workers, document incidents, emergency preparation, addressing issues - Provide safe working environment - Workers allowed to report safety issues and refuse to work under certain circumstances - Provide appropriate facilities (canteens, toilets, etc.) and ensure accommodations meet needs of workers - All employers to collaborate on applying OSH requirements - Monitor OSH performance	- Generally consistent but less detailed -
E. Contracted workers	- Reasonable efforts to verify contractors have labor management procedures to meet requirements of ESS2 (except those that apply to community and primary supply workers) - Procedures for managing and monitoring performance - Access to grievance mechanism	Safety requirements apply to all employers, including contractors, but no obligation for developers to verify compliance
F. Community workers	Requirements for working conditions and OHS applied to community labor	Labor Code applies to employers and employees, not volunteers
G. Primary supply workers	Depending on level of Pamir Energy/contractor control/influence, assess risk of child labor, forced labor, and safety issues and require suppliers to address significant	- Tajikistan law applies if work is done in Tajikistan - No obligation on employers in other countries - No requirements for prime contractor

ESS &Topic	*Major requirements*	*Key requirements/gaps in Tajikistan legal framework*
	risks	
ESS3: Resource Efficiency and Pollution Prevention and Management		
Resource Efficiency		
Scope of application	Borrowers must apply feasible resource efficiency and pollution prevention measures in accordance with mitigation hierarchy	Some requirements
A. Energy use	Adopt measures in EHSGs if project is significant energy use	No specific limits. No significant energy usage.
B. Water use	Assess water use and impacts and communities and adopt mitigation measures as needed	Permits required for water usage
C. Raw material use	Use GIIP to reduce significant resource usage	Resource usage requires permits
Pollution prevention and management		
General requirements	- Avoid, minimize, and control release of pollutants, apply the more stringent of EHSGs and national law - Historic pollution and non-degradation requirements	Specific numeric requirements
A. Management of air pollution	Requires assessment of potential air emissions and implementation of technically and financially feasible and cost-effective options to minimize emissions	Emissions limits. Project will have only minor emissions.
B. Management of hazardous and nonhazardous wastes	- Apply mitigation hierarchy to waste management - National and international conventions for hazardous waste management and movement - Verify hazardous waste management contractors are licensed and disposal sites operate to meet standards	- Detailed requirements for hazardous and other wastes - Signatory to international conventions - No requirements to verify haulers/contractors
C. Management of chemicals and hazardous materials	- Minimize use of hazardous materials - Avoid use of internationally controlled materials	- Regulations on hazardous materials - Signatory to international conventions
D. Management of pesticides	Requirements for pesticide use: Not applicable to this project	Not applicable
ESS4: Community Health and Safety		
Community health and safety		
A. Community health and safety	- Evaluate risks to community health and safety and apply mitigation hierarchy and GIIP to reduce risks - Consider third-party safety risks in designing	General requirements to minimize risk, no specific requirements for services, ecosystem services, emergencies, etc.

ESS &Topic	*Major requirements*	*Key requirements/gaps in Tajikistan legal framework*
	infrastructure and equipment, with regard to high-risk locations - Ensure safety of services provided to communities - Identify traffic/road risks, assess risks if needed, consider safety in fleet decisions, take measures to protect public - Assess and avoid impacts on provisioning and regulating ecosystem services as appropriate - Avoid or minimize potential for disease transmission and communication (including HIV/AIDs and sexually transmitted diseases), including due to labor influx - Consider and provide necessary protections for vulnerable groups - Address risks to community of hazardous materials management - Prepare for and respond to emergencies, consider in EIAs, prepare response plans	
B. Security personnel	- Assess and address risks of security arrangements - Apply principles of proportionality, GIIP, and law - Verify contracted workers are not implicated in past abuses and are trained - Investigate incidents, report unlawful acts to authorities	No specific requirements
Annex 1. Safety of Dams	- Design and construction of new dams to be supervised by experienced professionals - Dam safety measures to be adopted and implemented during design, tendering, construction, operation, and maintenance - Dam does not fall into categories of paragraph 2, thus most of annex does not apply - Safety measures designed by qualified engineers to be adopted in accordance with GIIP (paragraph 5) - Confirmation of no or negligible risks to communities due to failure of dam (footnote 123)	No equivalent requirements
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement		
Applicability	- Assess need during ESIA process - Applies to permanent and temporary displacement,	- All land in state ownership - Rights to use land granted with legal certificates

ESS &Topic	*Major requirements*	*Key requirements/gaps in Tajikistan legal framework*
	listing types of infringements - Limitations on applicability - Applies to land users and owners	- May be used only as authorized - Legal users may lease land for authorized uses
A. General	- Affected people: land owners, users with legal claims, and users with no legal claims - Design project to avoid/minimize displacement - Provide replacement cost and assistance, disclose standards, offer land-for-land where possible, pay compensation before displacing people where possible - Engaged with affected communities, including women - Grievance mechanism - Census, cut-off dates, notices; detailed plan and monitoring required; require audit if significant displacement	- Only those with legal rights eligible for replacement land or compensation - Replacement land preferred option - No requirement for assistance - Detailed requirements for committee memberships and actions - Compensation based on established rates for trees or other items lost
B. Displacement	- Detailed requirements for physical displacement - Detailed requirements for economic displacement, including livelihood restoration	- Replacement with equivalent land and houses preferred over compensation - Compensation for lost profits required, but not livelihood restoration
C. Collaboration with other responsible agencies or subnational jurisdiction	Collaborate with other involved agencies, provide support as needed; include arrangements in Plan	Committee membership and responsibilities defined in Land Code
D. Technical and Financial Assistance	World Bank may provide support to resettlement planning	
Annex 1: Involuntary resettlement instruments	Detailed requirements for resettlement plans, resettlement frameworks, and process frameworks	No detailed requirements
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources		
A. General	- Consider direct, indirect, & cumulative impacts in ESS1 EIA - Characterize baseline conditions - Manage risks with mitigation hierarchy and GIIP, including adaptive management - Differentiated habitats, ESS applies to all, provides for offsets - ESS applies to modified habitat with significant biodiversity value	Requires protection of biodiversity but less detailed requirements

ESS &Topic	*Major requirements*	*Key requirements/gaps in Tajikistan legal framework*
	- Avoid natural habitats unless no feasible alternative; if affected achieve no net loss of biodiversity Critical habitat - Requirements if a project will affect legally protected and international recognized areas of high biodiversity value - Strict conditions on affecting critical habitats, requires BMP - No introduction of spreading of invasive species - Requirements for projects involving primary production and harvesting	
B. Primary suppliers	Requirements when Borrower purchases natural resource commodities	No equivalent requirements
ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities		
	Not relevant for the project	
ESS8: Cultural Heritage		
Application	Covers tangible and intangible (limited) cultural heritage, whether legally protected or not and whether previously identified or not	- Law covers non-material (language, customs, ceremonies and celebrations, knowledge and skills, traditional crafts, dancing, music, art, etc.) and material cultural heritage - Some legal limits on weddings, funerals, and other activities
A. General	- Assess and avoid impacts on cultural heritage - Follow chance find procedure if a find is encountered - Involve experts if needed	- General requirements to protect cultural heritage and not to disturb sites of interest - No specific requirement for chance find procedure
B. Stakeholder consultation and identification of cultural heritage	- Identify and consult with affected and interested stakeholders - Maintain confidentiality if needed - Allow continued access to affected sites	- No requirement for consultations except with Ministry of Culture representatives - Must provide access
C. Legally protected cultural heritage areas	Comply with regulations and plans, consult with sponsors	Generally consistent
D. Provisions for specific types of cultural heritage	- Desk-based and expert consultation to identify archaeological sites and specify protections - Mitigate impacts on built heritage, preserve physical and visual context of structures - Identify and protect treasured natural features	Less detailed requirements but generally consistent

ESS &Topic	*Major requirements*	*Key requirements/gaps in Tajikistan legal framework*
	- Identify and protect movable cultural heritage	
E. Commercial use of cultural heritage	Not relevant for this project	n/a
ESS9: Financial Intermediaries		
Not applicable for the project		
ESS10: Stakeholder Engagement and Information Disclosure		
Requirements	- Engage stakeholders throughout project life cycle, determine how they wish to be engaged - Provide stakeholders with information, - Maintain documented record of engagements	Generally consistent but less detailed
A. Engagement during project preparation	- Identify and analyze stakeholders, including disadvantaged or vulnerable - Stakeholder Engagement Plan (SEP) required, with detailed requirements for disclosure, timing of consultations, measures for disadvantaged or vulnerable, etc. - Disclosure of information early to allow consultation on design - Consultation to allow ongoing two-way communication throughout project life cycle	- No requirement to analyze stakeholders - No formal plan required - Early disclosure required
B. Engagement during project implementation and external reporting	Engagement and disclosure of information to continue throughout implementation, following Plan	No specific requirement for continuing engagement
C. Grievance mechanism	- Establish and implement prompt, effective, culturally appropriate, and discreet grievance mechanism - No limit on legal remedies	Tajikistan law provides channels for filing complaints, requests, and appeals
D. Organizational capacity and commitment	Define roles & responsibilities, assign personnel to implement stakeholder engagement activities	No specific requirement for assigning roles and responsibilities
Annex 1: Grievance mechanism	Options for managing mechanism: ways of submission, log, advertised procedures, appeals process, mediation	

3. Project Description

The proposed project is located on the right bank of the Shokhdara River about 20 kilometers southeast of Khorog (Figure 2. Location of Sebzor HPP). The powerhouse will be connected to a Pamir Energy substation in Khorog through an 18-kilometer 110 kV overhead transmission line (see Figure 3). As noted in section 1, this transmission line is being financed by another donor and will be constructed in advance of the HPP; as a result, it will be assessed in a separate ESIA.

Key project parameters are summarized in Table 4

Table 4. Key project parameters

Type of plant	Run-of-river
River	Shokhdara
Dam/weir	
Weir height	5m (3m above grade)
Weir length	70m
Desander	Surface, 65m x 16m
Reservoir	
Length (dam to upstream)	700m
Maximum depth	3m
Volume	
Penstock	
Pipes (2 buried)	1.2m diameter
Width of excavation	3m
Length	2800m
Power plant	
Installed capacity	10.5MW (3 x 3.5)
Design discharge	10.5m^3/s
Design head	120m
Energy generation	72.3 GWh/a
Turbine type	Francis
Number of units	3
Substation	6.6/110kV stepup
Tailrace	
Pipes (2 buried)	1.2m diameter
Length	75m
Road	
Surface	Asphalt
Length	≈3km
Width	6.5-7m
Bridge	
Spans	Single
Width	≈4m

Length	100m
Tailrace	
Type	Buried
Source: SWECO 2016a	

In addition, there will a work camp and storage area located approximately halfway between Barjingal and Sebzor villages. This area will be used for construction workers accommodation and storage of construction materials and construction equipment. It will cover an area of 1.5 hectares and include workshops, warehouses, fabrication areas, sanitary facilities, parking, worker accommodations, and associated facilities (sanitary, recreation, kitchen, etc.).

The length of the construction period is anticipated to be between two and four years, depending on the length of the construction season, which typically extends from April through November but will depend on weather. An international consultant (SWECO) is currently in the process of finalizing the design, following which Pamir Energy will select construction contractors via open tender. There will be at least two main construction contractors, one for electromechanical works at the powerhouse and substation and one for civil works for the dam, penstock, and powerhouse. Contractors will employ about 250-300 workers, many or most of them from local communities. Construction activities will involve construction of a cofferdam while the dam is being constructed, land clearance and leveling, earthworks, drilling and possibly limited blasting, concrete works, excavations (for

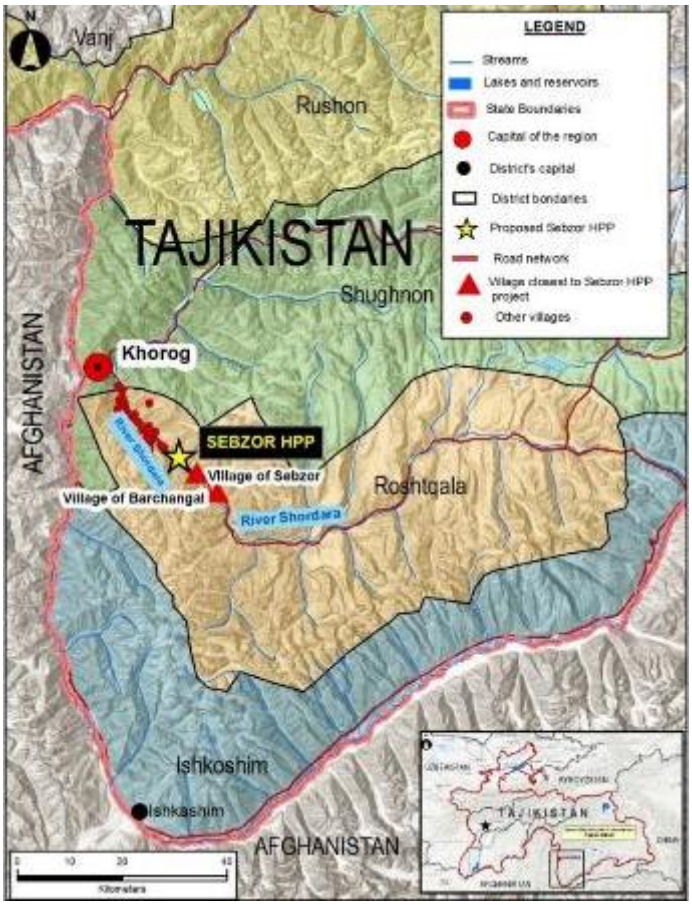

Figure 2. Location of Sebzor HPP

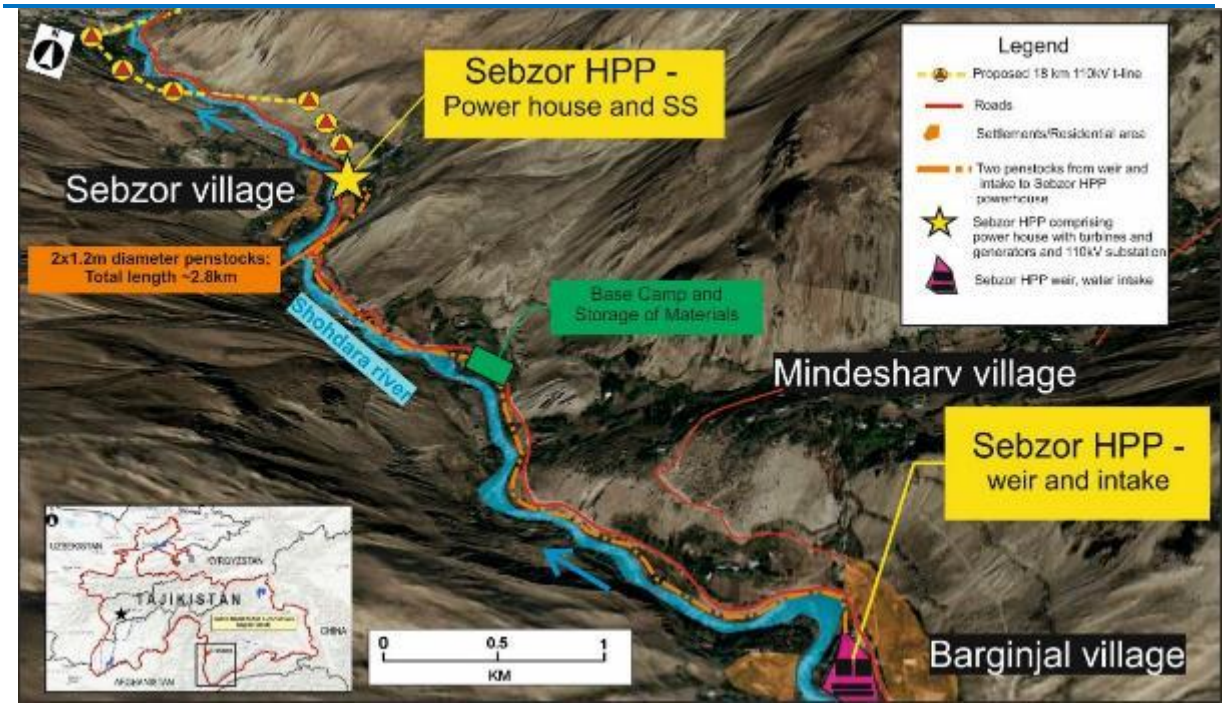

Figure 3.Spatial context of Sebzor HPP

foundations, channel for buried penstock), welding works, installation of electrical equipment,

transportation/storage of various pieces of equipment, and others. Construction will be supervised by a Supervision Consultant (also known as the Owner's Engineer or Supervising Engineer) to be selected by Pamir Energy.

Major components are described in more detail in the following subsections. The site is situated on an elevation of about 2,500masl, and the project sites are immediately adjacent to road AH66, so only a few tens of meters of access roads will be necessary.

3.1. Weir and reservoir

The weir infrastructure, as well as the confined nature of the reservoir, are shown on Figure 4. The location and design of the weir profile was based on spatial analysis and an evaluation of alternatives, both performed during preliminarily design works and the feasibility study. The design of the weir structure took into account stream morphology and relevant technical requirements, which were based on proposed locations of the intake and sand trap structures. For the intake structure in particular, it was necessary to ensure the favorable inlet conditions. Further it was necessary to take into account the existing spatial layout in the area along the bank and examine potential locations for where a sand trap (variously referred to as a desilting chamber/basin, desander, or other terms) could be placed.

Figure 4. Sebzor HPP weir and associated infrastructure and reservoir

(Source: SWECO 2016a)

The weir has been designed as a fixed structure with a direct spillway, routed perpendicularly to the stream axis. The overflow surface is divided by weir pillar into three spans. The inlet structure is located on the right-hand side of the weir profile, in place of the concave bank line apex. In the right-hand side part of the weir profile further the fish pass and two gravel sluices have been designed, which form part of the weir structure. The weir has been designed as a massive concrete structure, terminated by stilling basin. The weir structure is bounded to the ground in place at the both banks by side pillars. The bottom sealing element of the weir will be formed by the diaphragm or a pile wall. With respect to assumed geological conditions under the foundations, that proposed bottom sealing element will perform the static function. The river bottom upstream of the spillway will be lined by wedge stone-pitching and downstream the closing threshold of the stilling basin will be lined by heavy rock-stone rip-rap. The water level of the finished bottom upstream of the weir structure and downstream the stilling basin will be 2,525masl.

Sediment sluices. Two sediment sluices will be constructed on the edge of the weir profile on the same side as the intake structure. Each sediment sluice will be 5.0 meters and they will allow accumulated sediment to be discharged. The gravel sluices will be barred by a roller gate of 5.0 x 5.3m dimensions. The roller gates will be able to dam flowing water. They will also prevent the intake from being blocked by sediment.

Stilling basin. The stilling basin is designed as a massive concrete structure that will link to the spillway body. Downstream, the closing threshold of the stilling basin will be lined with heavy rock-stone rip-rap.

Fish Passage. The fish passage will be located between the river bank and the gravel sediment sluices supported by a sluice gate. A vertical slot fish passage was considered for installation. The design flow rate for the fish passage is estimated as being 1.25 m^3/s, which is intended to be

sufficient to allow fish to pass upstream and downstream. The fish pass will be 2.5 meters wide and about 44 meters long, not accounting for the lengths of inlet and mouth. The downstream pool will be 1.90 meters long and be at least 1.60 meters deep. Maximum water velocity will be 1.35 meters per second.

Intake structure. The intake structure is located on the weir profile at the beginning of the power waterway. he basic requirement for the intake structure is assurance of a sufficient capacity of water supply for power production. The intake structure is designed for a maximum flow capacity 10.5m^3/s. At the same time, the structure has been designed to minimize risk of silting by debris and suspended sediments, within the given morphological conditions. A key aspect of the intake structure design is ensuring continued operation under climatically unfavorable conditions such as dry period frazil ice conditions or ice phenomena in general.

Table 5 summarizes the dimensions of the proposed intake structure:

Table 5. Intake structure dimensions

Total length of intake	18.5 m
Concrete bottom part length	13.5 m
Intake width	2x 4.75 m
Intake depth	5.5 m
Intake walls safety height excess	1.5 m
Intake bottom altitude	2,525 masl
Intake design capacity	10.5m^3/s

Desander/Desilting chamber. The desander serves for trapping and settling of suspended solids (fine sediment) in the water column. By widening the area through which the water flows, the trap slows the speed of the flow. The slower flow is less able to maintain suspended solids, which begin to settle out. The sand trap structure will be 99 meters long, with 65 meters serving as the settling basin and this will allow settling of sand with a grain size larger than 0.3 millimeters.

Table 6 provides details of the desander. An alternative sand trap structure on the left bank would have similar technical parameters.

Table 6. Desander details

Total length of the sand trap	99.0 m
Length of the transitional intake part	10.0 m
Length of the sedimentation area	65.0 m
Length of the transitional outlet part	24m
Width of the sand trap	15.2 m
Depth of the sand trap	5.8 ÷ 6.8 m
Safety height of the sand trap walls	0.8 ÷ 1.5 m
Trapped grain size	Min 0.3 mm
Sand trap beginning bottom altitude	2,525.50 masl

Sand trap end bottom altitude	2,525.45 masl
Designed capacity of the sand trap	10.5 m^3/s

Reservoir. The weir will impound a small reservoir that will extend about 700 meters upstream and cover an area of about five hectares. The reservoir will have a maximum depth of three meters at the weir, and will generally be confined to the incised river rather than spreading over a wider area.

Ice-blocking dams. A potential problem that could cause damage to individual mechanisms of the weir, intake, and sand trap structures is freezing of water in the reservoir and transport of frazil ice from the upstream river. Based on experience of local experts and hydropower plant operators it was agreed to propose a system of temporary structures of a rather operating character. Hence a system of frazil ice blocking dams has been designed within the section above the weir profile. The design is based on local experience. One or more permeable stone dams of local material (big boulders) will be used each winter to break the water flow in order to reduce/accumulation of frazil ice in the reservoir and prevent clogging of the intake. After the danger of frazil ice passes, the dams will be dismantled again.

Baseflow/Ecological and maximum (extreme) flow considerations. The project will be true run-of river, with no hydropeaking. River flows are naturally highly variable, at their lowest in winter and highest in summer. The average annual flow is itself highly variable, ranging from 24m^3/sec to 48m^3/sec, with the lowest monthly average in February (10.4m^3/sec) and the highest in July (112.6m^3/sec). As noted previously, up to 10.5m^3/sec will be diverted from the river into the intake and used to generate power before being returned to the river about three kilometers downstream. Flows in the river between the intake and the tailrace will thus be reduced by up to 10.5 m^3/sec. However, to ensure that sufficient water remains in the river, a minimum flow rate was established as 10 percent of the annual average, or 3m^3/sec. This was not based on conditions in the river, but rather as a percentage of average flow. The river does not support aquatic species of conservation concern, fishing is not an important source of food or income, there is only very minor use of water in the reduced-flow river reach (and this during summer high flows), and the affected reach will be only three kilometers long. In addition, there are only two fish species that migrate upstream and downstream, and the fish pass will be designed to allow their passage in each direction; also, flows from May through August or September are much higher than 13.5 m^3/sec (3m^3/sec minimum flow left in the river plus 10.5 m^3/sec diverted to the powerhouse), which ensures that much more water than the minimum flow will remain in the river during key periods. For all these reasons, this minimum "environmental flow" is considered adequate and it was not considered necessary to conduct quantitative modeling to arrive at a more precise estimate of required environmental flows.

The three turbines are capable of generating power down to about 50 percent of their rated capacity, so power can be generated when flows in the river are as low as 4.75m^3/sec (including 1.75m^3/sec as 50 percent of the rated capacity of one turbine plus the 3m^3/sec environmental flow). This would occur only rarely, since hydrologic studies conducted by SWECO estimated that river flows exceed 10.4 m^3/sec over 75 percent of the time. When total flows are over 13.5 m^3/sec, the plant will operate at full capacity, and this would occur between 50 and 60 percent of the time (SWECO 2015a). Releases of environmental flow over the weir will include flows of 1.25m^3/sec through the fish pass and 1.75m^3/sec over the central portion of the spillway crest, which can be adjusted to ensure flows remain at or above the proper level. Fish pass flows were intended to be

sufficient to allow upstream and downstream passage of the two potadromous fish species that inhabit the river. In addition, some water will pass through gravel sediment sluices, which will add to the overall flow but will not be counted as part of the environmental flow.

Flooding. The weir has been designed to withstand a 1,000-year flood, which is estimated to be about 450m^3/sec (and which is also approximately the flow rate that could occur if the glacial lake at the headwaters of the river were to experience a catastrophic failure). To prevent floods from the normal high-water levels in summer, a system of dykes will be constructed on either side of the river to prevent water from affecting houses or other buildings. [1] The dykes will be about 130 meters long and 1.5 meters high, construction of clay-loam with the top at 2531masl, the elevation of the water from a 1,000-year return flood event. Complete dam failure due to earthquake or other causes would not be catastrophic since the water is only three meters deep at the dam and the crest would decline rapidly downstream; any such failure would not occur instantaneously but would occur over some period of time (likely to be over hours or even days) so the maximum crest would not be close to three meters.

3.2. Power Waterway (Headrace)

Overall, three alternatives for power water (headrace) were examined during the feasibility study. These alternatives considered included construction of an open canal, water pipelines (penstock) and a tunnel. The final layout was selected to be a double penstock on the right bank of Shokhdara River, mostly alongside the existing road (more details in Section 4).

3.3. Base Camp, Material Storage Areas, Roads

The proposed base camp and material storage areas will be located approximately 1.5 kilometers downstream of the weir, which is about half-way between the intake and the powerhouse. Figure 5 shows the proposed layout for the base camp and material storage areas, and the penstock corridor (SWECO 2016a).

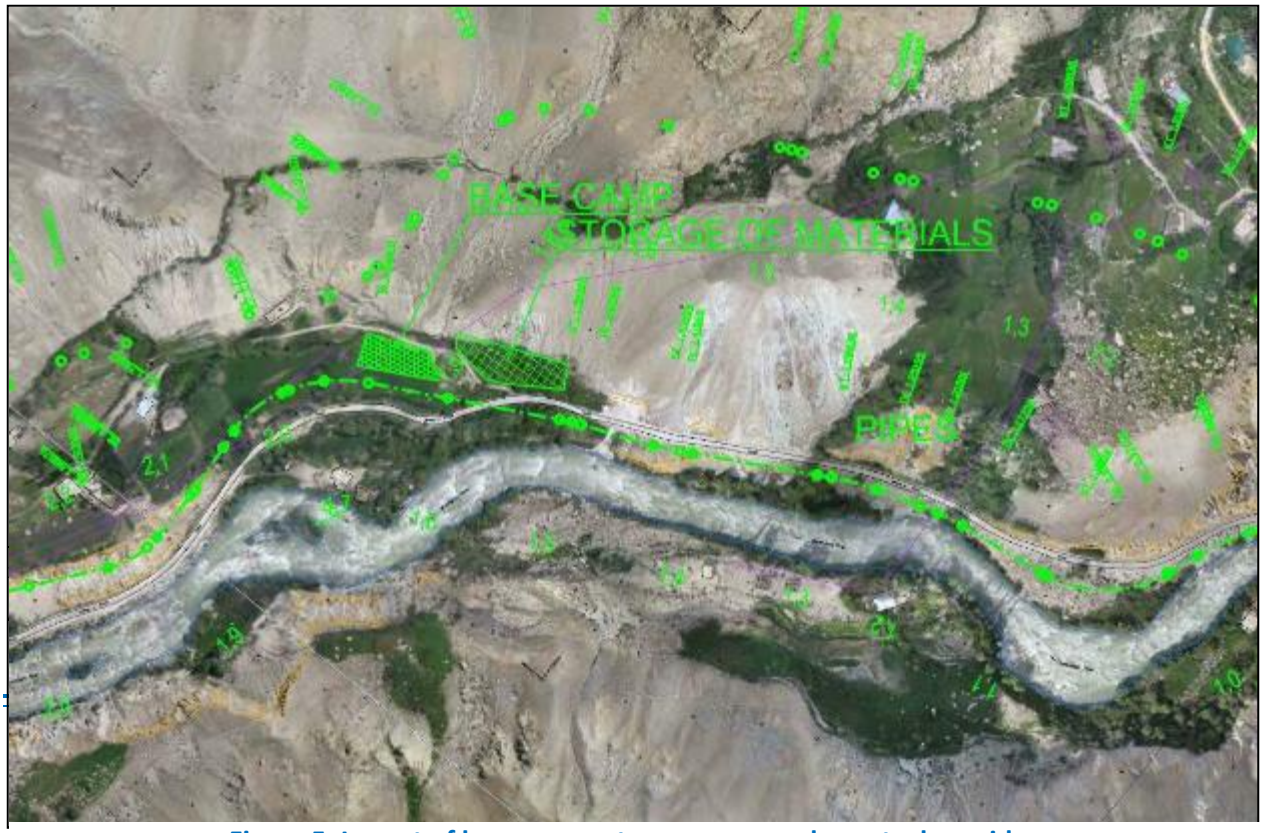

Figure 5. Layout of base camp, storage area, and penstock corridor

The base camp will consist of a number of workshops, warehouses, fabrication areas, sanitary facilities and so forth. Worker accommodations are also expected to be located within the base camp area. Nonlocal workers (perhaps 75-150) from the total of 250-300 workers will be housed here, where there will also be offices, storage buildings/warehouses, stops, kitchen, clinic, and sanitary facilities. A storage yard next to the base camp will be used for storing topsoil, subsoil, sand, gravel and other construction materials and equipment. The total area occupied by the base camp and storage yard will be around 4-5 hectares.

A small (about six hectares) quarry, located just downstream of the powerhouse, has been acquired by Pamir Energy and will be operated in accordance with authorizations. This quarry exploits surficial and shallow-depth rock and gravel with no need for blasting, and will be used for the primary gravel supply source for the construction site. A mobile crusher has already been installed at the location and is in standby mode at present. If additional materials are required, they will be acquired from authorized sources.

3.4. Powerhouse and substation

Powerhouse. Figure 6 (SWECO 2016a) shows where the power house will be located near the village of Sebzor on the right bank of Shokhdara River.

Figure 6. Layout of powerhouse, substation, and penstock corridor

Powerhouse parameters were designed based on the installation of are based on requirements given by the following conditions: three Francis turbines with design flow rates of 3.5 m^3/s, water head of 120 metres, and impeller axis at 2,408 meters above sea level. The turbines will be

connected directly to vertical synchronous generators. Other considerations were dimensions of the intake conduit, spiral and draught tube; location and arrangement of the electrical and technological equipment; areas for inspection and possible repairs of the equipment; elevation (about 2,418 meters above sea level);, and the geological and topographical conditions.

These parameters determined the optimal area for the powerhouse would be 19.0 x 20.5 meters. The powerhouse building will be divided into two areas: the first will contain the main production area of 11.5 x 20.5 metres, where the turbines with generators will be located and the second areas of 7.1 x 20.5 metres will contain the auxiliary and electrical equipment.

The powerhouse will comprise three vertical Francis turbine-generator units each equipped with a main inlet valve. The turbine-generator sets will each be designed for a turbine discharge of 3.5m^3/sec respectively, 10.5 m^3/sec in total. With 120 meters of net head, this corresponds to a nominal power of 3.7 MW per unit and 11.1MW in total installed capacity. The units will have a rotational speed of 750 revolutions per minute.

Substation. Output from the generators will be at 6.6kV, which will be stepped up to 110kV in a new substation about 150 meters from the powerhouse. The substation will occupy an area of about 0.6 hectares, with mixed concrete and gravel paving. The substation will be connected to a substation in Khorog via the 18-kilometer 110kV transmission line that will be the subject of another ESIA.

3.5. Tentative Implementation Schedule

Project implementation will be completed in the following phases:

- Phase 1 – Preparatory Works. This will include the design and preparatory work, including preparation of feasibility-level studies, including environmental and social documentation, and financial arrangements.
- Phase 2 – Procurement Phase. This phase includes the finalization of Tender Documents, Call for Tenders, Tender Evaluation, Contract Negotiations and signing of Contract(s). Depending on the contractual set-up of the Sebzor project, the Scope of Works can be divided into a number of Lots. The Procurement Phase does also include approval of the financing of the Project from the financiers. The Procurement Phase will last for at least 8-12 months depending on the nature of the project and the contractual set-ups. For the Sebzor HPP this phase is expected to last at least 8 months. Contracts for the construction contractors and the Supervision Consultant will use World Bank Standard Procurement Documents, which include requirements for environmental and social performance.
- Phase 3 – Implementation Phase. This phase includes the detailed design of civil and electromechanical works, electrical works, manufacturing and testing of equipment, construction and installation works, site works and commissioning. Some of these activities are typically performed in parallel to reduce the time schedule. It is expected this phase will last about 24 months for Sebzor HPP.
- Phase 4 – Warranty Phase. This phase follows the successful commissioning and handover of the project to Pamir Energy. During this period, major defects are the responsibility of the constructors. A normal warranty period is 24 months.

3.6. Construction stage

3.6.1. Construction stage (Sebzor HPP)

Construction will take two to four years, which typically extends from April through November but will depend on weather. Prime contractor for construction works will be selected upon the completion of tender placed by Pamir Energy. It is anticipated that the scope of work will include two major contractors: one for civil works and one for electrical, mechanical, and installation works. It is anticipated around 250-300 workers will be employed in construction, many or most of them from local communities (likely to be 150-200 local). Construction activities will involve earthworks, land clearance and leveling, drilling and possibly limited blasting, concrete works, welding works, transportation/storage of various pieces of equipment and others.

The project also includes rehabilitation and reconstruction of the road that runs about 3 kilometers between the Barjingal and Sebzor villages (about 3 kilometers of road), which will likely be completed by another civil works contractor. The road, which is current degraded and only partly paved, will be expanded to a consistent 6.5-7 meters in width and paved with asphalt. Work will include removal of the old surface, installation of sand and gravel layers for drainage and foundation, and paving. In some places, the road will need to be moved a few meters to the west to make room for the penstock, which will be buried in a corridor immediately beside the road.

Additionally, Pamir Energy will construct a new bridge across the Shokhdara river at the village of Sebzor. The bridge will connect the parts of the village on the two sides of the river and allow passage of project traffic, which existing bridges cannot support. The bridge will be a single span between concrete pillars and will be five meters wide and paved with asphalt. This bridge will likely be designed and constructed by a separate contractor, possibly as part of the same package as the road reconstruction. Construction of the bridge will require an environmental impact assessment that meets the requirements of World Bank Environmental and Social Standard 1 and of Tajikistan law.

3.6.2. Operation stage

Once commissioned, the project will reach its maximum generation capacity of 72.5 GWh per year within about six to eight years of commissioning by gradually increasing its annual generation capacity by up to about 10GWh per year.

The dam will not require continuous staffing, but will be inspected daily by Pamir Energy, with maintenance works as needed to maintain efficient operation. Releases of environmental flow in the river will be monitored continuously in the fish passage and in the downstream river channel. The powerhouse will require continuous 24-hour staffing, which could be at the powerhouse or at a control center in Khorog.

4. Alternatives

In 2012, Pamir Energy completed a Prefeasibility Study (PFS) for the Sebzor HPP that described topography, geology, and geotechnics as well as hydrology, environmental, socioeconomic considerations.

The prefeasibility study identified a possible conceptual design, which was for a basic, run-of-river model with a 2.8-kilometer canal culminating in two 220-meter penstocks feeding into a powerhouse with two or three generating units. With an installed capacity of 10MW, the project was tentatively expected to generate 72.5 GWh annually, and was to be connected to Pamir Energy's GBAO grid via a 110kV line to a new substation in Khorog.

In July 2015, Pamir Energy contracted SWECO International to complete a Feasibility Study for the Sebzor HPP. The study was completed in September 2016. SWECO evaluated of alternatives to intake, weir, headrace and powerhouse to determine whether they were reasonable and environmentally and socially preferable to the preliminary corridor and line. Key alternatives included:

- Not building the Sebzor hydrological power plant, substation and line (section 4.1 below)
- Alternative intake/weir and power house locations (sections 4.2-4.3).

4.1. No-action Alternative

Under the no-action alternative, the Sebzor HPP, substation and associated transmission line would not be constructed. This would avoid all the environmental and social impacts associated with construction and operation of the Sebzor HPP and associated facilities. Not building the power plant and substation would not achieve any of the goals described in Chapter 1. Realization of a no-action alternative would not ensure sufficient generation capacity to meet projected electricity demand for GBAO and also would not allow electricity exports of surplus generation to Afghanistan during the summer months.

Not constructing the HPP would also have another significant adverse effect by increasing deforestation of an area that has already been largely deforested. Residents of small and mid-size mountain villages burn wood ('tugai' forest wood) for heating in winter and for cooking. With availability of electrical power, people will use less firewood and therefore contribute to saving precious wood resources in such areas. Without the project, other supply options would be sought, either through construction of another hydropower plant in another location, by supplying from other sources, or importing from another grid system. Among alternative sources would be solar, wind, and fossil-fuel powered generation plants.

Another hydropower station within a reasonable distance is likely to have similar impacts as the present project, and so would only shift them to another location, possibly one with more sensitive environmental or social conditions. It is also likely that this location would be less feasible for hydropower production for the Pamir Energy network.

Importing from generation sources in other networks is presently not possible, since the Tajikistan state network suffers similar constraints as the Pamir Energy network in GBAO, and has even greater deficits that lead to restricted supply, especially in the winter time. No other network with surplus electricity is available in the region.

Solar energy is not likely to be sufficient in winter months, either as solar heating or as solar electricity. It is also doubtful that solar electricity would have enough capacity to replace the heavy electricity use for cooking and heating even in the summer months. Potential for wind generation in

the immediate area is poorly studied, but it is not likely to be possible to provide firm capacity and continuous only from wind power. Even with good conditions, wind power would require a source of balancing power due to the intermittent nature of wind conditions.

Diesel generation or petrol, while relatively cheap in initial investment, would be forbiddingly expensive to operate and not financially sustainable. Diesel would be somewhat cheaper but would still be unaffordable, and would also to emissions of pollution and greenhouse gases. Coal as a resource is not available in this region and would need to be brought in from other part of the country, which would make electricity prohibitively expensive.

Overall, if the no-action alternative were implemented, there will be a deficit in the energy supply in the amount of approximately 94.5 million kilowatt hours of energy per year, about 60 percent of which would be consumed in GBAO, primarily by consumers already connected to the network, and the remainder exported to Afghanistan. This is about the total generation of Sebzor HPP if it were able to generate at full capacity, which will not be possible. For these reasons as discussed above, this alternative is not preferred.

4.2. Spatial Alternatives

Two major alternatives for Sebzor HPP weir, intake, reservoir, and penstocks were considered and examined: “left bank alternative’ and “right bank alternative”. These comprise an option of building the main project structures (headrace, powerhouse, substation) either on the right bank or on the left bank (right and left facing downstream) of the Shokhdara River. Figure 8~~Figure 7~~ and Figure 8Figure 8~~Figure 8~~ show the alternatives and **Ошибка! Источник ссылки не найден.**~~Figure 9~~ provides a schematic that clearly shows the major components of the alternatives.

Figure 7. Alternatives locations for weir and intake structures: left bank (left) and right bank (right)

Figure 8. Alternative powerhouse locations: left bank (left) and right bank (right)

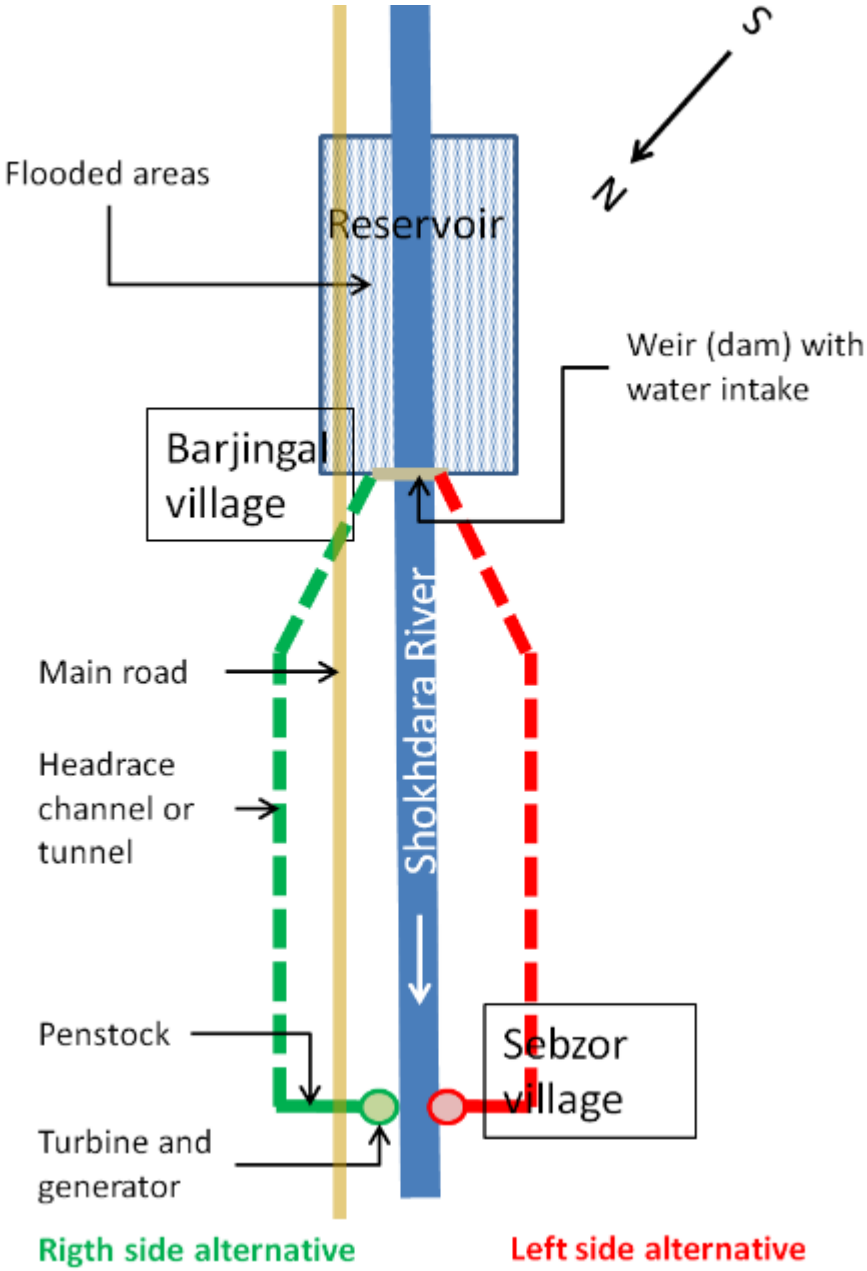

Figure 9. Project components and primary alternatives

(Courtesy SWECO 2010a)

Several factors were taken into consideration while examining advantages, disadvantage, weak and strong points of each alternative. Among these were economic, technical and geotechnical considerations, all based on field surveys completed during feasibility study.

The right-bank alternative the advantage of slightly more stable geological conditions, but the drawback of a larger interference with the main road from Khorog to Roshtqala. There would be restrictions to traffic and some technical challenges when the penstock crossed the road. On the other hand, it would have the advantage of simpler transport of material and equipment, since the road is nearby. If this solution were selected, the main technical alternatives would be to excavate a tunnel for the penstock through the hillside or to bury the pipe along the roadside.

Building on the left-hand side of the river would not interfere so much with traffic on the main road, but would require the construction of a new bridge at Chagev village and a service road over three kilometers long on the left bank to transport material and equipment for the construction of the headrace/penstock. While a new bridge with higher capacity would be welcome by villagers, this option together with the service road on the left bank would add considerably to the cost of the project and add significant complexity as well (as it turned out, a new bridge is needed to support construction of the left-bank end of the weir, but this bridge can be at Sebzor and require no additional roads).

4.3. Design Schemes Alternatives

Different hydropower plant design schemes were evaluated during the feasibility study. These included different weir types and various technologies for headrace solutions. Thus, different types of headrace were considered, including construction of an open channel, a pipe (or multiple pipes), and a sealed tunnel. The open channel would be challenging from a space and location perspective, require more space and more concrete, and would also present a safety hazard. The tunnel would be more expensive and generate large amounts of spoil that would have to be managed. A buried penstock was selected, with two pipes of 1.2-meter diameter, to be laid side-by-side in an excavation about three meters wide and about 2.5 meters deep. The corridor will be immediately alongside the existing (actually, the reconstructed) road. Spoil will be removed from penstock excavation, stored, and then will be reused to backfill the excavation, used in other construction (e.g., in concrete), or placed in a permanently stable configuration in a suitable location that will be selected by the contractor and approved by Pamir Energy.

The preferred technical solution is the right-bank alternative with a buried penstock running alongside the road.

5. ESIA Methodology

This ESIA evaluates potential environmental and social impacts from construction and operation of the Sebzor HPP and substation. The evaluation of impacts is based on an assessment of their extent (local, regional, national), duration (short, medium, long-term) and reversibility (temporary or irreversible effects).

The final design is not yet complete, so all details of the infrastructure construction and operation are not known. However, the design is sufficiently progressed to allow an accurate assessment of potential impacts, and identification of measures to avoid or control such impacts. If there are major changes in designs that could result in significantly different or greater potential impacts, the potential impacts will be assessed in an updated ESIA or a separate assessment.

5.1. Methodology for screening and scoping process

The following methodology was applied for initial screening and collection of baseline information important for the project:

- Screening of the project by the World Bank for perms of project categorization and the level of impact assessment needed.
- Preliminary screening of key receptors and potential impacts during the feasibility study and associated impact assessment carried out in 2015-2016 by SWECO.
- The most recent scoping was carried out through a series of meetings with governmental and nongovernmental institutions in Dushanbe and Khorog in February 2019 and discussions with local residents in 2018 and 2019.
- More detailed assessment of baseline environmental conditions within and adjacent to the project area conducted in 2019.

5.2. Public participation

As described in section 2.1, current Tajikistan law requires consultation with potential stakeholders so that potential concerns and impacts can be identified at an early stage and at disclosure of the ESIA documentation. The draft ESIA was disclosed in April and a public meeting was held in Sebzor on 26 April, 2019. Chapter 9 describes the public consultation process and summarizes comments received from stakeholders.

5.3. Methodology for baseline study

Baseline data was collected by visiting and observing most of the area likely to be significantly affected by the project. The following methods were used to characterize baseline conditions:

- National and local agencies with an interest and jurisdiction were contacted to collect information and sources of information on baseline conditions.
- Local institutions who have surveyed the area for decades were contacted to collect information on local biodiversity and other topics.

- Scientific and other literature sources were reviewed and brief visits were conducted to gain an understanding of environmental and social resources in and near the corridor, and of the wider region.

Data sources that were reviewed included scientific literature/publications, open data sources and specific reports such as the "Feasibility Study for Sebzor Hydro Power Plant" (SWECO 2016), which include an "Environmental Impact Assessment".

Relevant information from the baseline studies and surveys were digitized and included in a GIS database to allow the environmental and social project components.

Desk studies were conducted in 2016 and in 2019. Pamir Energy staff have collected information, including consultations with local residents, continuously since planning began in 2015. The ESIA reconnaissance team visited the areas to be occupied or temporarily used by the project in early 2019 and observed environmental features, general environmental sensitivity, social conditions and settlements, and other attributes of the area. The corridor was also evaluated by examining aerial imagery acquired by drone, which gave the opportunity to study other details of the area and more precisely if there were areas of particular concern.

A spatial analysis was conducted in order to characterize potentially affected environmental and social conditions and assess potential impacts. For the analysis, a detailed GIS database was developed with Google Earth and drone imagery as the base. Finally, handheld GPS instruments and other geo-positioning tools were used during reconnaissance visits.

The thematic layers developed in the GIS database for the corridor included data "layers" for administrative boundaries, topography, land use, and various other categories of social information.

5.4. Methodology for assessing potential environmental and social impacts

Chapter 7 identifies the potential environmental and socioeconomic impacts that may result from project construction and operation, determines whether the potential impacts are likely to be significant, and compares the potential impacts for the two alternatives. A number of criteria were used to determine whether or not a potential impact of the proposed project could be considered "significant." These are outlined with reference to specific environmental and social issues in this ESIA.

Wherever possible, a quantitative assessment of the impacts was undertaken. In most cases, this was not possible, in which case a qualitative assessment of impacts was undertaken, based on existing information and experience with other hydropower projects. The ESIA covers the direct impacts and any indirect, secondary, cumulative, short-term medium-term, and long-term, permanent and temporary, reversible and irreversible, beneficial and adverse impacts of the proposed scheme.

Where relevant, the anticipated impacts were compared against applicable legal requirements and standards. Where no such standards exist, assessment methods involving interpretation and the application of professional judgement were employed. The assessment of significance in all cases took into account the changes that would occur to the established baseline conditions, considering the sensitivity of the environment.

For impacts considered to be significant (that is, "moderate" or "major" in Table 5.4.1) and for many lesser impacts, the assessment identified a variety of measures that Pamir Energy will have to take in order to avoid, reduce, or otherwise mitigate the impacts, as discussed in Chapters 7 and 8.

5.4.1. Methodology for assessing environmental impacts

A general method for grading the significance of environmental impacts was adopted to ensure consistency in the terminology of significance, whether for a beneficial or an adverse impact. The two principal criteria used to determine significance were the sensitivity of the receptor and the magnitude of the change arising from the scheme, as shown in Table 7.

The table shows that the significance of impacts was classed as major, moderate, minor, or none; and either positive (beneficial) or negative (adverse). This categorization is widely recognized and accepted in the field of environmental impact assessment. Where appropriate, topic-specific assessment methods and criteria for determining significance are described in Chapter 7.

Table 7. Determination of environmental impact significance

Magnitude of change/impact	*Sensitivity of receptor*		
	High *(e.g. international, national protection, rarely found)*	***Medium*** *(e.g. regional, local protection, uncommonly found)*	***Low*** *(e.g. no protection, common)*
High *All or significant proportion affected*	Major (H,H)	Major (H, M)	Moderate (H, L)
Medium *Substantial amount affected*	Major (M, H)	Moderate (M, M)	Minor (M, L)
Low *Relatively small proportion affected*	Moderate (L, H)	Minor (L, M)	Negligible (L, L)
Very Low *Very small amount affected*	Minor (VL, H)	Negligible (VL, M)	Negligible (VL, L)
No Change	None (NC, H)	None (NC, M)	None (NC, L)

Another consideration was the duration of the impact -- whether the impact would be temporary or permanent -- and if they were temporary whether short-, medium-, or-long term. It is recognized that defining the duration of the impact can be subjective, depending on the receptor. For instance, following construction, it may then take some time for vegetation to become fully re-established. Although in ecological terms, this period may not be a long time, for the people who use the land for orchards or pasture the period could be significant in relation to their lifetime, and could therefore be considered permanent. Similarly, a person's initial reaction to the new presence of major infrastructure in a landscape could be very negative, but over time the reaction would be subdued until there was little or no reaction at all. Table 8 sets out how the duration of impact was defined.

In general, shorter-term impacts were considered to be less significant and longer-term and permanent ones to be more significant.

Table 8. Duration of impacts

Nature of change	*Duration*	*Definition/ Description*
Temporary	Short-term	Impact continues during construction (1-2 years) and up to 1 year following construction
	Medium-term	Impact continues 1-5 years following construction
	Long-term	Impact continues 5-10 years after construction
Permanent	-	Due to the length of time period for human beings, impacts over 15 years defined as permanent.

5.4.2. Methodology for assessing social impacts

The objective of the social impact assessment was to identify major risks to social and economic conditions in the area of the proposed hydropower project and substation and to assess the impacts of construction and operation on those conditions. As with environmental impacts, the impacts can be direct and indirect, intended and unintended, positive and negative. For significant impacts, Pamir Energy will be required to implement a variety of mitigation measures, and these are discussed in Chapters 7 and 8.

Generally, the social impact assessment process involved the following major tasks:

- Identifying types of adverse and beneficial impacts of the proposed transmission line.
- Assessing the level of socioeconomic risks in terms of frequency (how likely is it to happen) and consequences.
- Assessing the acceptability of the risks.
- Introducing mitigation measures to reduce risks to acceptable levels.

The social impact assessment typically addressed the following issues:

- Demographics, including changes in local population size, emigration/immigration in the area, migration of people in search of work, and other issues.
- Economic issues, including supply chain impacts, local sourcing opportunities, potential impacts on local markets for goods and services, employment opportunities for construction, operation and decommissioning phases of the project.
- Health issues, including risks of new diseases to local communities, impacts on health and safety of workers and local communities, impact of local diseases on workers.

- Social infrastructure, including adequacy of health care and education facilities, transport and roads, power supply, fresh water supply to support project activities and personnel as well as the local communities.
- Resources, including land use changes, increased access to rural or remote areas, and use of natural resources.
- Cultural, including issues associated with sites that have archaeological, historical, religious, cultural, or aesthetic values.
- Social equity, including local social groups who might gain or lose as a result of the project or operation.

As with environmental impacts, a general method for grading the significance of socioeconomic impacts was adopted to ensure consistency in the terminology of significance, whether for a beneficial or adverse impact. The two principal criteria used were the nature of the impact and the magnitude of the change arising from the scheme, as shown in Table 9.

Table 9. Determination of social impact significance

Magnitude of change	*Nature of impact*		
	Avoidance	*Disruption/Habituation*	*Permanence*
Negligible	No avoidance needed	Not noticeable under normal conditions	Not noticeable
Minor	Mitigation or design change prevents impact(s)	Possible initial change on daily life/routine, rapid habituation reduces to below nuisance level	Ephemeral: <1 year
Moderate	Mitigation or design change reduces impact	Definite change to daily life, habituation reduces disruption over time	Temporary: recovery to pre-existing conditions after one or a few years (e.g., after construction)
Major	Mitigation or design change cannot significantly reduce impact(s)	Requires major change to daily life or routine activities	Permanent: >15 years

5.4.3. Environmental and social impact mitigation and enhancement

Where potential impacts could be significant (that is, moderate or major), measures to avoid, reduce, or mitigate the impacts were developed by applying the mitigation hierarchy, as outlined in the text box.

> "The environmental and social assessment will apply a mitigation hierarchy, which will:
> "(a) Anticipate and avoid risks and impacts;
> "(b) Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels;
> "(c) Once risks and impacts have been minimized or reduced, mitigate; and
> "d) Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible."
>
> *World Bank ESS1, paragraph 27*

These measures are intended to avoid, reduce, compensate, and/or remediate adverse impacts, or to enhance potentially beneficial impacts. Wherever possible,

mitigation is undertaken was part of the project design, so the measures could feed back into impact assessment.

The mitigation and enhancement which should be undertaken as part of the project are set out as an Environmental and Social Management Plan which can then be applied in order to manage different phases of the project. For this project, the plan is presented in Chapter 8.

Table 7 and Table 9 show that impact significance has been classed as major, moderate, minor, or negligible (none). As noted, impacts can be either positive (beneficial) or negative (adverse). Where appropriate, topic-specific assessment methods and criteria for determining significance are described in relevant sections of Chapter 7.

5.4.4. Environmental and social monitoring

The success of most mitigation measures is necessarily uncertain and must be monitored to verify it is being implemented and is working as planned. Various monitoring results will need to be reported by the contractor to the Supervision Consultant, by the Consultant to Pamir Energy, and by Pamir Energy to Tajikistan authorities, the World Bank, and others. The Environmental and Social Monitoring Plan for this project is presented in Chapter 8.

6. Baseline Conditions

This section describes the baseline conditions of the project area at a regional scale and in the Roshtqala District in terms of their biophysical environments as well as socioeconomic conditions.

6.1. Environmental Baseline Conditions

6.1.1. Climate

The climate of Tajikistan is characterized by interaction of geographic location and topography, atmospheric circulation, and incoming solar radiation. Due to the country's diverse topography and its location in the heart of Central Asia, the climate in Tajikistan is overall continental and dry. However, some regions of the country are subtropical intracontinental. In the plains around Dushanbe (central and western parts) and Khujand (northern), the climate is more temperate: summers are hot and dry, and winters in Dushanbe have much precipitation; in the north of the country, in Khujand, it snows less in winters. On the other hand, since 93 percent of the territory of the country is above 1000 meters (3280 feet), a polar climate dominates in the mountains over 3000 meters (9483 feet) in winters.

In January, average temperature in Tajikistan ranges between 0 degrees Celsius (32°F) in the plains to minus 20 degrees Celsius (minus 4°F) in the mountains. In July, the average temperature in the plains is 30 degrees Celsius (86°F), and from 0 to 15 degrees Celsius (32 to 59°F) in the mountains, depending on the altitude. The lowest temperature recorded in Tajikistan was minus 63 degrees Celsius (minus 81.4°F) at Lake Bulunkul in GBAO region. The highest temperature recorded was plus 48 degrees Celsius (118.4°F) in the town of Nizhny Panj (Khatlon region). In winters, it snows heavily in the western part of Tajikistan, which closes mountain passes, such as the Anzob Pass connecting Dushanbe and Khujand.

Climate in the project area

The Pamir Mountains have the most extreme climate in Tajikistan. The Pamir Mountains take up a very large area and the elevation ranges between 1,000 and 7,495 meters (3,281 to 24,590 feet), thus weather in the region is extremely variable depending on the elevation and location.

As indicated on Figure 10, the climate of the Pamirs is high mountainous and extremely continental, and polar in more severe places. Winters are long, lasting from October to April. Summers are only in July and August. The average temperature in January is minus 18°C (minus 0.4°F) and in July, the average is plus 20°C (68°F). The precipitation rate also differs: in Khorog it is 276 millimeters a year (10.87 inches), 416 millimeters (16.38 inches) in Ishkashim, and only 72 millimeters (2.83 inches) in Murghab.

Climatic conditions within the Shokhdara river valley are extremely continental and displays large seasonal variation. Average daily temperatures in Khorog, which is located at 2,000 meters (6,500 feet), range from minus 6°C (21°F) in January to 23°C (73°F) in July and August. The mean annual ambient temperature is 8.9°C. Mean monthly precipitation in Khorog (1981-2010) ranges from 23 to 26.2 millimeters (280-315 millimeters average annual total) with typical annual minimums in August-September (2.4 to 2.5 millimeters) and maximums occurring during February-April (42.7 to 49.6 millimeters).

Figure 10. Climatic zones of Tajikistan

(ref. Atlas of Tajikistan)

First snow usually appears in late September-mid-October and lasts in the river valleys until May, while being present all summer long higher in the mountains. The mean annual thickness of snow cover is 40 centimeters. The average number of days with snow cover is 117 per annum.

Wind in the project area is primarily from the west and northwest. The mean annual wind speed is 2.4 meters per second (m/s and average monthly winds are relatively constant over the year. The strongest winds (between 10-12m/s) occur during the summer months (July to August), whereas the spring months (April through May) are the calmest time, with the strongest winds ranging between 2 to 4m/s. The mean annual atmospheric pressure (mmHg) which is 596 mmHg and variation of average relative humidity (annual average of 55 percent is shown on Figure 12.

Air quality

There are no sources of industrial emissions in the project area. The primary sources of emissions are likely to be vehicle emissions, dust from vehicle passage, and burning wood for heat in winter. In general, emissions are very low in comparison to populated areas of Tajikistan.

Climate Change

According to the *World Bank report (2009*), Tajikistan is the most climate-vulnerable country in the region and least able to adapt. Thus, climate change may have a considerable impact on both the ecosystem's condition and the population's livelihood. Agriculture, power engineering and transport are considered the most vulnerable sectors, but all economic sectors may experience substantial negative impacts. Over the period 1940–2000 ("*Overview of Climate Change Activities for Tajikistan", World Bank, 2013*), ground air temperature in most of Tajikistan's districts and high altitude zones increased between 0.5 and 1°C, with some districts experiencing an increase above 1°C (Figure 11)[2].

[2] Second National Communication of Tajikistan to the United Nations Framework Convention for Climate Change (UNFCCC), 2008.

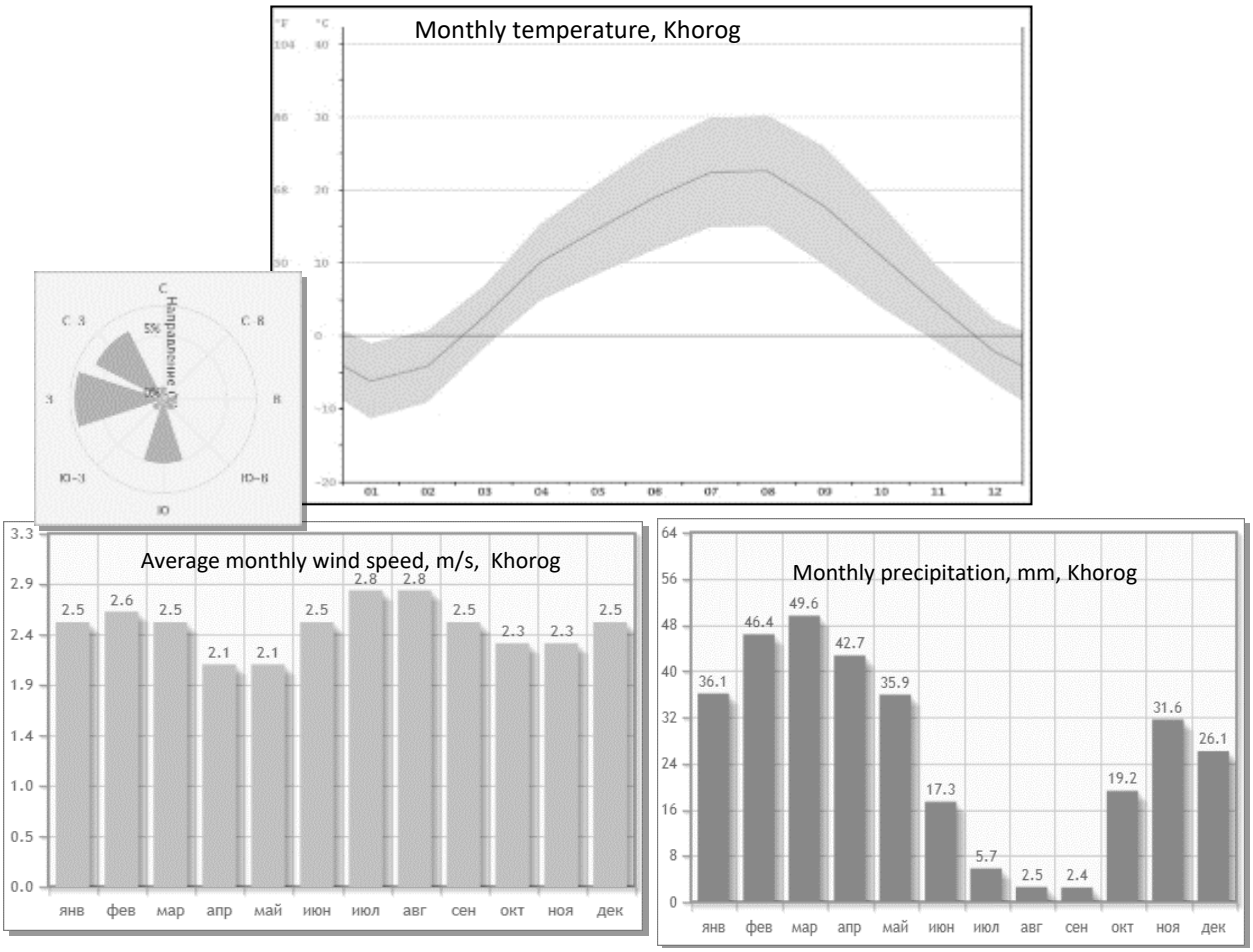

Figure 12. Climatic data for Khorog

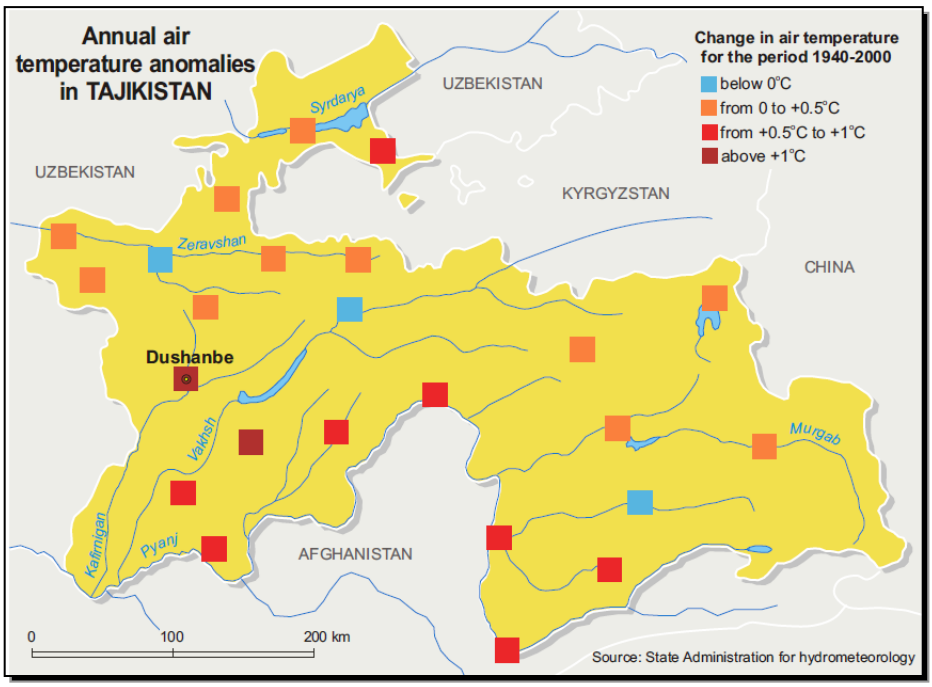

Figure 11. Changes in air temperature in Tajikistan, 1940-2000

Tajikistan is considered the main glacial center of Central Asia, and its glaciers occupy about six percent of the country's total area (see Figure 13). The glaciers not only retain water, they also regulate river flows and climate, and play an important role in forming the Amudarya River, the biggest water "artery" of the Central Asia and Aral Sea Basin. Together with permafrost, glaciers are the main source of water replenishing the Aral Sea river basins, and water resources formed in Tajikistan are critical for downstream countries. The snow pack in Tajikistan varies greatly from year to year and on the elevation of the area: from 100 to 135 days with snow cover in the high mountains to 45 days in the Eastern Pamir and 245 days in the Gissar mountain range. Altitudes over 4,000 meters have permanent snow and ice. The current warming rates in the high-altitude areas of Tajikistan are already causing significant changes to glaciers, one of the most vulnerable ecosystems. For instance, remote observations showed that within the period 1966–2000, the Fedchenko Glacier system (in the northwestern Pamir) was reduced by 44 square kilometers, or six percent of its total

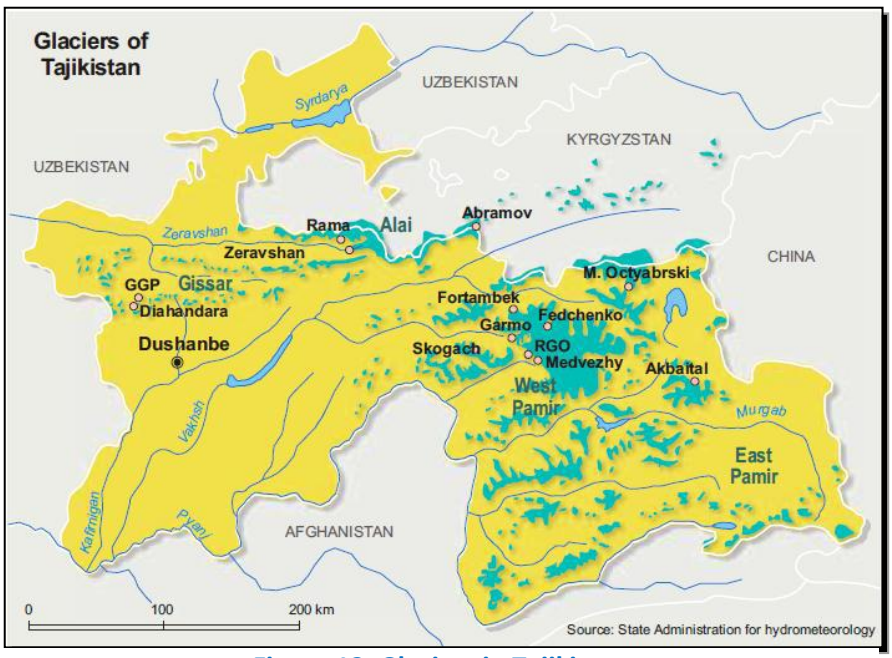

Figure 13. Glaciers in Tajikistan

area.

The intensive melting of glaciers in Tajikistan caused by global warming may result in a catastrophic drop in water content in many Central Asia's rivers. The effect of climate change on water resources is particularly critical in in Tajikistan. In this region, water resources are crucial for a wide range of issues related to national and regional security, as they are consumed by all sectors of the regional economy. Any changes affecting Central Asia's water resources imply a high multiplicative aftereffect on various social and economic aspects of these countries' development. The situation is aggravated by increasing water consumption, which is connected with population growth and intensive development of the regional economies.

Annual precipitation has increased by about 8 percent on average on territory up to 2500 meters and decreased by about 3 percent at higher elevations. The most considerable increase in annual precipitation, by from 37 to 90 percent, has occurred in summer and autumn up to 2500 meters,

primarily caused by an increase in precipitation intensity. The increase in the number of days with precipitations from 0 to 5 mm has decreased across much of the country.

Insignificant changes in precipitation patterns are reported for the Khorog area, as can be seen on Figure 14.

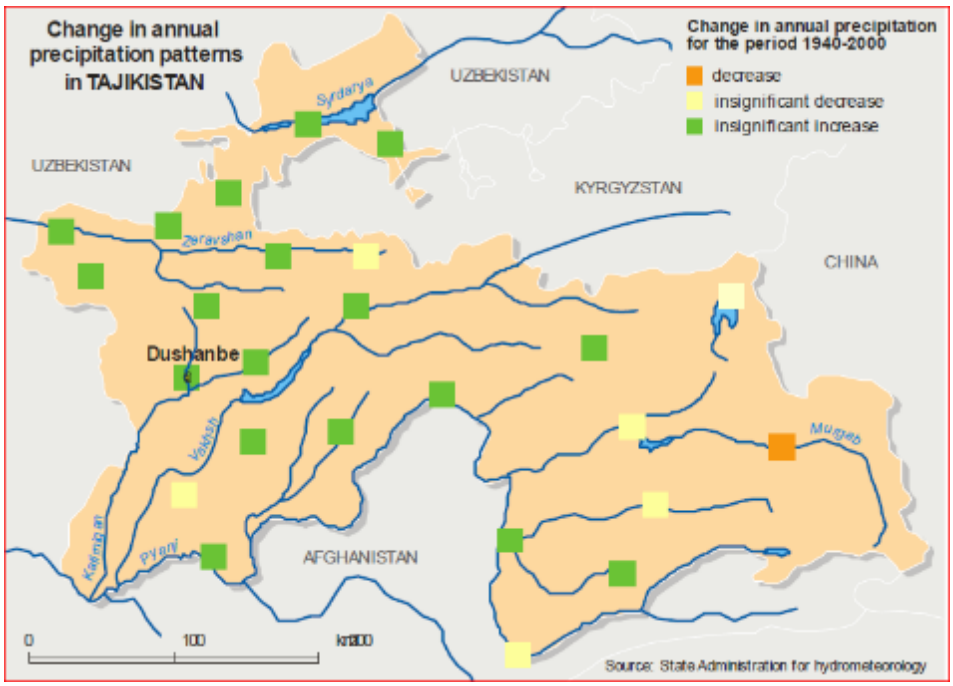

Figure 14. Changes in precipitation patterns in Tajikistan, 1940-2000

Climate Projections for Tajikistan

Tajikistan ranks first among European and Central Asian countries in terms of a simplified index of vulnerability to climate change and it is particularly sensitive to climate change due to low adaptive capacity. According to the Second National Communication of Tajikistan to the United Nations Framework Convention on Climate Change (UNFCCC), climate change is expected to result in increased air temperature, more variable precipitation and snow cover, increased rate of ice melt, and more extreme and frequent weather events and climate-related hazard have been observed to be occurring. As noted above, all of the above Climate trends and projections for Tajikistan include:

- An increase in mean annual temperature by 0.2–0.4°C is expected in most areas of Tajikistan by 2030 in comparison with the period 1961–1990. This trend coincides with the tendencies predominant in the country for the last 15–20 years. The maximum increase of temperature is expected in winter, by 2°C and more.
- Projected future rainfall is expected to show large variations in terms of change, intensity, and geographical distribution. While the irregularity and increase in intensity of precipitation is expected to continue in the future, climate models do not reach consensus with regard to future rainfall projections. However, summers are expected to be wetter, while winters are expected to be drier, which could result in both floods and longer droughts.

- Many small glaciers of Tajikistan are expected to completely disappear in 30–40 years if the present rate of glacial degradation continues. The glacial area may be reduced by 15–20 percent compared with the present, resulting in a decrease in water stocks.

6.1.2. Geology and Topography

Tajikistan has an extremely complex geological structure. As a result of intensive demonstration of Caledonian, Hercynian and Alpine phases of diastrophism the principal tectonic structures had repeatedly renewed with the territory, whereby the structure of the territory acquired a mosaic block-folded structure. The rocks that are composing the territory of the country are very diverse in age, composition and structure. There are set of sedimentary- metamorphic rocks that have very ancient Archaic age. The most widely developed geological formations include Phanerozoic age.

The southeast of Tajikistan (Pamir) occupies the extreme southeastern part of mountainous Tajikistan, a total area of 67,000 km2. Pamir is bordered on the east by China, on the south and west, with Afghanistan in the northwest, with the Tajik depression, and in the north, with the Alai valley. The Pamir Mountains are the country's highest, with some peaks reaching beyond 6,000 and even 7,000: Peak Somoni in the northwestern Pamirs is 7,495 meters and Lenin Peak in the Transalai Range is 7,134 meters.

The Project area lies within the Karakoram fold system, which is separated from the North -Pamir zone by Vanj – Tanimasskiy thrust (Figure 15). The elevation ranges between 2,100 meters near Khorog to about 4,500 meters upstream Shohdara watershed in the mountains.

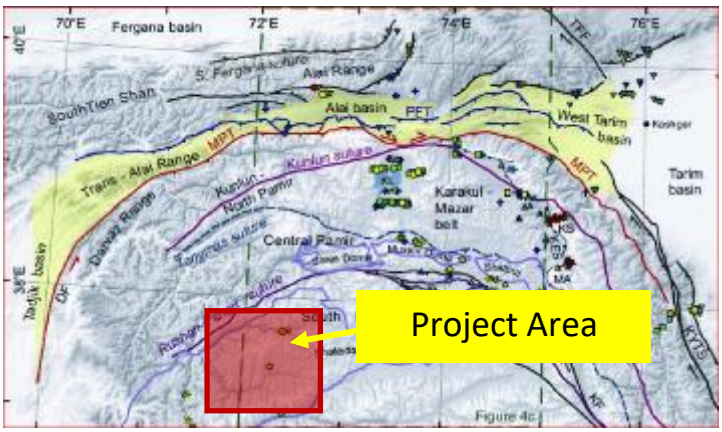

Figure 15.Regional geologic structures

The Rushan-Pshart zone is composed mainly of geosynclinal complex of clastic- carbonate deposits of the Carboniferous - Permian, similar in composition to miogeosynclinal coeval deposits of the area of South - Eastern Pamirs. Upper Permian - Triassic deposits are composed of carbonate- siliceous-volcanogenic (sodic basalts, up to 1,500 m) formation. In both zones at the end of the Triassic apparent folding stage, accompanied by the formation in the axial zone of the South- Eastern Pamirs gray-colored and red-colored crude molasses (up to 600 m) and the formation in both areas of high-potassium intrusive masses of granite.

Basic geological conditions are described according the provided geological map of scale 1:200 000. They are given by occurrence of Cretaceous granite igneous rocks covered by various quaternary deposits, especially glacial, fluvial and smaller in scale, lacustrine formations (Figure 16).

Igneous and metamorphic rocks

The Pamir-Shugnan intrusion is a consonant, interstratal body lying in the northern wing of the Vakhkan anticlinorium, the rocks of which have a matured monoclinal dip to the north. Pamir - Shugnan granite intrudes Archean gneisses. The intrusion is spread in latitudinal direction of about 220 km with a width of 8-25 km. Intrusion strike - north-east, length - 50 km, width (bedrock exposure) – 15 - 20 km, area – approximately 900 km.

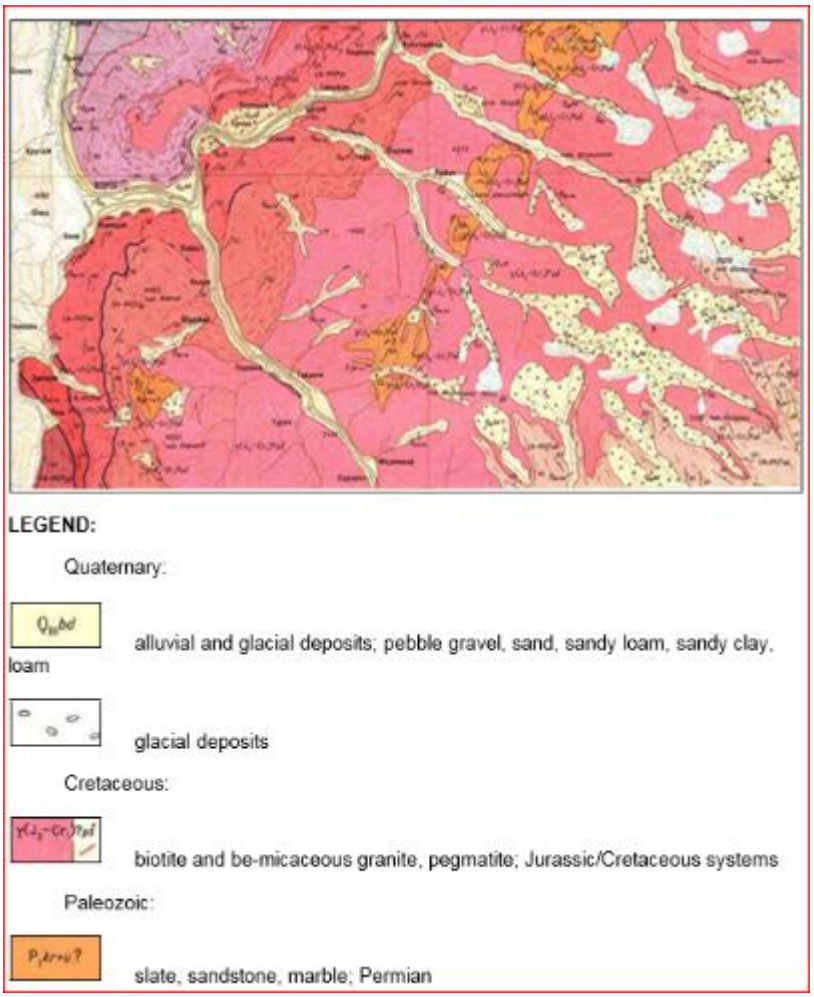

Figure 16. Major geologic formations and structures of the project area

Igneous and metamorphic rocks

The Pamir-Shugnan intrusion is a consonant, interstratal body lying in the northern wing of the Vakhkan anticlinorium, the rocks of which have a matured monoclinal dip to the north. Pamir - Shugnan granite intrudes Archean gneisses. The intrusion is spread in latitudinal direction of about 220 km with a width of 8 - 25 km. Intrusion strike - north-east, length - 50 km, width (bedrock exposure) – 15 - 20 km, area – approximately 900 km.

Host of rocks are metamorphic rock masses. Intrusion is composed of biotite granite and be-micaceous granite. The granite is medium and fine-grained, often inequigranular, light grey and almost white in color. The texture of granite is massive, gneissose and parallel in near-contact parts. The structure of granite is hypidiomorphic, granoblastic in some areas, poikilitic, slightly blastogranitic. Mineral composition of granite: albite-oligoclase, potassium feldspar, biotite and

muscovite. In contact zone, granite veins cut through the enclosing gneisses. Slates are metamorphosed with formation of biotite, garnet, muscovite, sillimanite.

Quaternary deposits

Upper Quaternary deposits (Q3) are represented by glacial, fluvial and lacustrine formations. Glacial deposits form moraines developed in lateral tributaries and intruded in more ancient moraines up to 3600 meters above sea level. The moraines are composed of piles of debris of various sizes. In the villages Tavda and Medenshar, moraines are on the bed of the Shokhdara River. They are composed of angular fragments of granite, gneiss cemented by sand and loamy material. The relative elevation over the water edge of the Shokhdara River is 200 meters.

Alluvial deposits form accumulative terraces. Composition of the first (lower) terrace at the mouth of the Gunt River is sand and gravel at 2100 m above sea level. The second terrace with capacity of 4-5 m is at an altitude of 2200 meters. It is made of sand and gravel with rare inequigranular sand lenses. The structure of terraces along the Shokhdara River is presented by rounded, slightly rounded pebbles and boulders.

Upper and modern undifferentiated deposits (Q3 +4) are moraine, alluvial, diluvial-colluvial and lacustrine formations. Moraines are in middle and upper parts of tributaries. They are represented by heaps of fragments of different sizes with weak sandy-loam cementation. Currently, the river deepened its bed in moraines at 25-30 meters. Alluvial deposits can be traced along the river beds by a narrow strip and are represented by poorly sorted sand and gravel material with capacity of 1-2 meters.

Diluvial-colluvial deposits form isolated brownish-grey spots. They consist of angular fragments of 3-8 centimeters in diameter cemented by microfragmental material, coarsely- stratified and have a slope towards the river.

Lacustrine deposits in the Shokhdara River near the village Parzudzh are formed by moraine which dammed the river from lateral tributaries. At the bottom of the cut (capacity 3 meters), angular fragments of sizes from crushed rock to boulders (1-2 meters) are observed. Higher in the succession, sandy clay bands occur (0.3-0.4 meters). Modern deposits (Q4) are glacial, alluvial, proluvial, diluvial-colluvial, colluvial (landslides) and eluvial formations. Modern moraine fills the bed of fossil kars and circuses in head rivers as well as modern glaciers tongues, not cemented formations, piling on each other in the form of benches and swells. Capacity does not exceed 40-50 meters. Alluvial deposits occur mainly along the main river bed. In the V-shaped Shokhdara River permanent alluvium is weak, as the material deposited in low-flow period is carried away during flood.

Proluvial deposits are common in the mouths of lateral tributaries. They form a steeply inclined alluvial cone with peaks tending up the river. Alluvial cone is composed of boulder, pebble and rubbly material without any sorting and cementation.

Diluvial-colluvial deposits are largely developed at the foot of valley slopes in the form of slide-rocks. Some slide-rocks reach the water-divide part of ridges. Alluvial fan at the base of slopes forms a massive trail. Eluvial deposits are very low and occur in shallow water divides forming small flat caps with capacity of 0.2-0.5 m.

The project area and surrounding mountains and hills are of mixed material, and show evidence of ancient as well as recent erosion.

The topography is extreme except in the narrow river valley, which ranges from a few 10s to 100s of meters wide, giving way to steep or even vertical slopes on both sides. The 3D images shown on Figure 17 illustrate the steepness of the valley and surrounding terrain within the project area:

Upstream Shokhdara River valley near Barjingal village, with location of intake and weir infrastructure

Shokhdara River valley with location of HPP work camp and material storage area

Downstream Shohdara River valley near Sebzor village, with location of powerhouse and substation

Figure 17. GoogleEarth images showing the Shokhdara valley and topography

6.1.3. Seismicity

As shown on Figure 18, the project area is located in an area where there is a 10 percent probability that an earthquake would occur within 50 years that could cause peak ground acceleration to exceed 4.8 to 6.0m/s^2; this is above the threshold considered as being a high risk zone

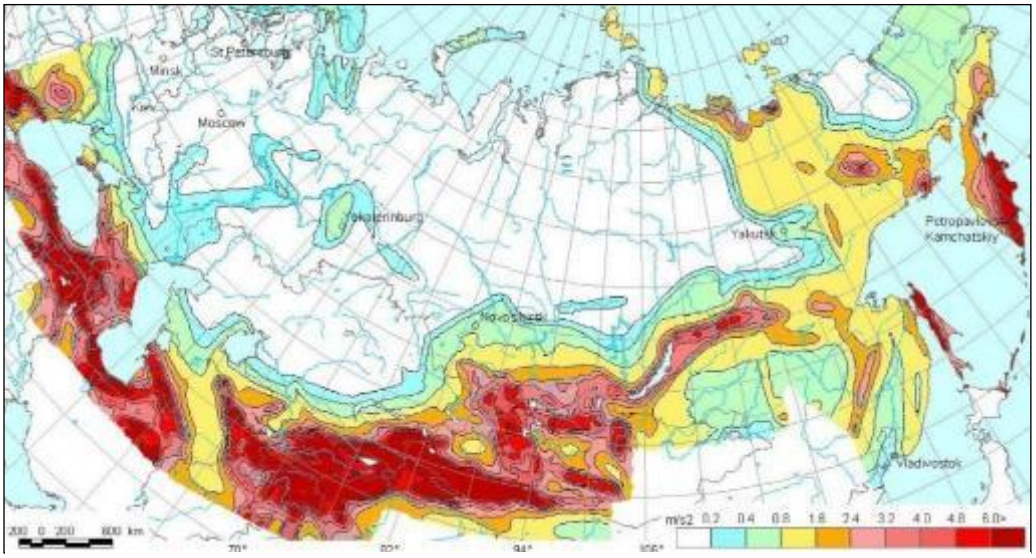

Figure 18. Peak ground acceleration with 10% probability of exceedance in 50 years

(Source: US Geological Survey Earthquake Hazard Program, 2009)

6.1.4. Geomorphological hazards

The area is situated within a zone of high risk for avalanches, rockfalls, and debris flows. Avalanches occur on snow-covered slopes due to slope failure (slip, slide) or snow accumulation by moving snow ("snowball" effect). Avalanches occur typically near the end of the winter. Sudden avalanches can lead to loss of lives and infrastructure damages.

In the feasibility study, some areas around the Sebzor intake and weir were assessed as being at high risk of avalanche, but the risk is on the left bank of the river) (Figure 19). The topographic features of the slopes surrounding Sebzor village are not the type of slopes that commonly lead to avalanches and debris flows.

Figure 19. Areas considered at high risk of avalanche and rockfall

Although rockfalls are common in the general area, only one area with potentially high risk of rockfall was identified during the feasibility study, and this area is located downstream of the HPP and powerhouse, closer to Khorog. Mudflows generally occur very infrequently in the valley so this is considered a low risk.

6.1.5. Water resources

Surface water

The Shokhdara River watershed and the project area are located within the Panj River basin (shaded in green on Figure 20. Local hydrography is characterized by the presence of the Shokhdara river and a number of small mountain streams that flow under the road and enter the Shokhdara channel. The catchment of the Shokhdara River is 4190 square kilometers (km^2). The catchment area at the intake location is 3794km^2 (Figure 21). The basin has a wide range of elevation, from 4500 metres above sea level (masl) at the headwaters to about 2,110 masl. There is a hydrological gauge station located downstream in the river at Khabost. Hydrological parameters, such as velocity and water

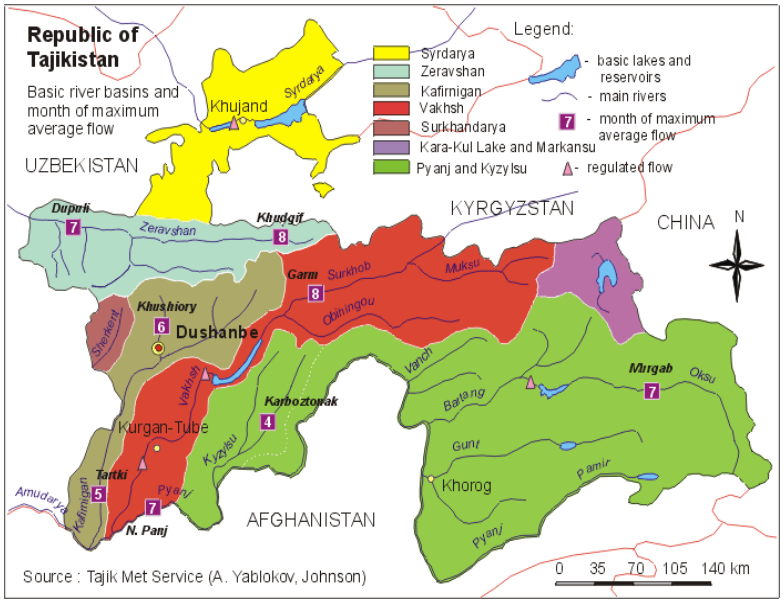

Figure 20. River basins of Tajikistan

levels, have been measured at this station since 1940s.

Figure 22 below presents a hydrograph of Shokhdara River discharges, which is based on the mean monthly discharge measurements at the Khabost station for the period from 1940 to 1987. The hydrograph shows a clear division in base flow seasonality: winter low flows from November to April and a summer high flows from May to October, with a significant peak in June and July.

The average flow is also variable from year to year, with mean annual discharge ranging from 24 m^3/s to 48 m^3/s (Figure 23). Average flows are generally in the range of 30-35 m^3/s up to 1960, with a reduction to a range of 25-30 m^3/s since that time.

As Khabost is located downstream of Sebzor, flow variations at Khabost are likely to be slightly less than at the intake location. This effect could be expected to be very small as there are no large

tributaries that discharge into the river in that stretch of river. SWECO considered the dampening effect on the flow of the river reach between the intake and Khabost station to be insignificant.

The firm power potential was calculated based on the duration curve. The duration curve shown on **Ошибка! Источник ссылки не найден.**~~Figure 24~~ can be read as showing a river discharge of 10 m^3/s for more than 80 percent of the time and 7.7 m^3/s for more than 99 percent of the time. SWECO considered that this made a station design discharge of 9-11 m^3/s reasonable, since it would allow firm generation throughout the year and at the same time limit the size of the plant for cost

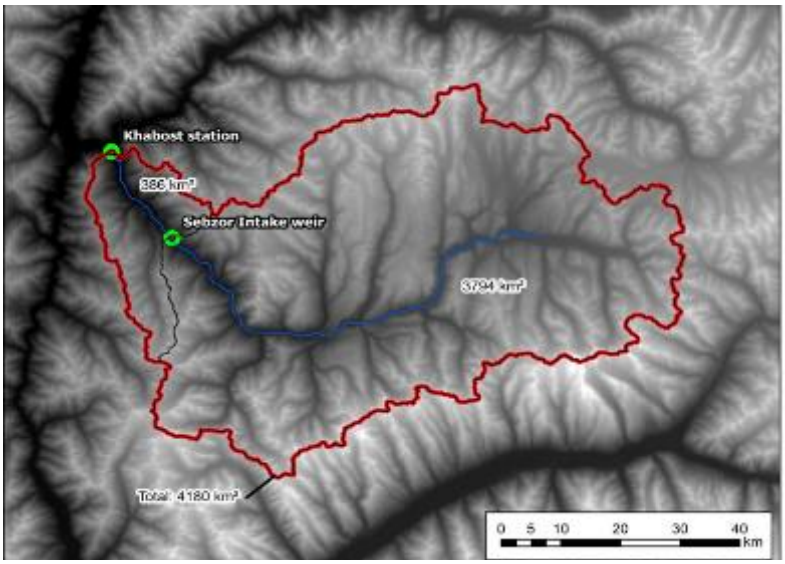

Figure 22~~21~~. Shokhdara River catchment (based on Khabost hydrometric station)

and complexity reasons.

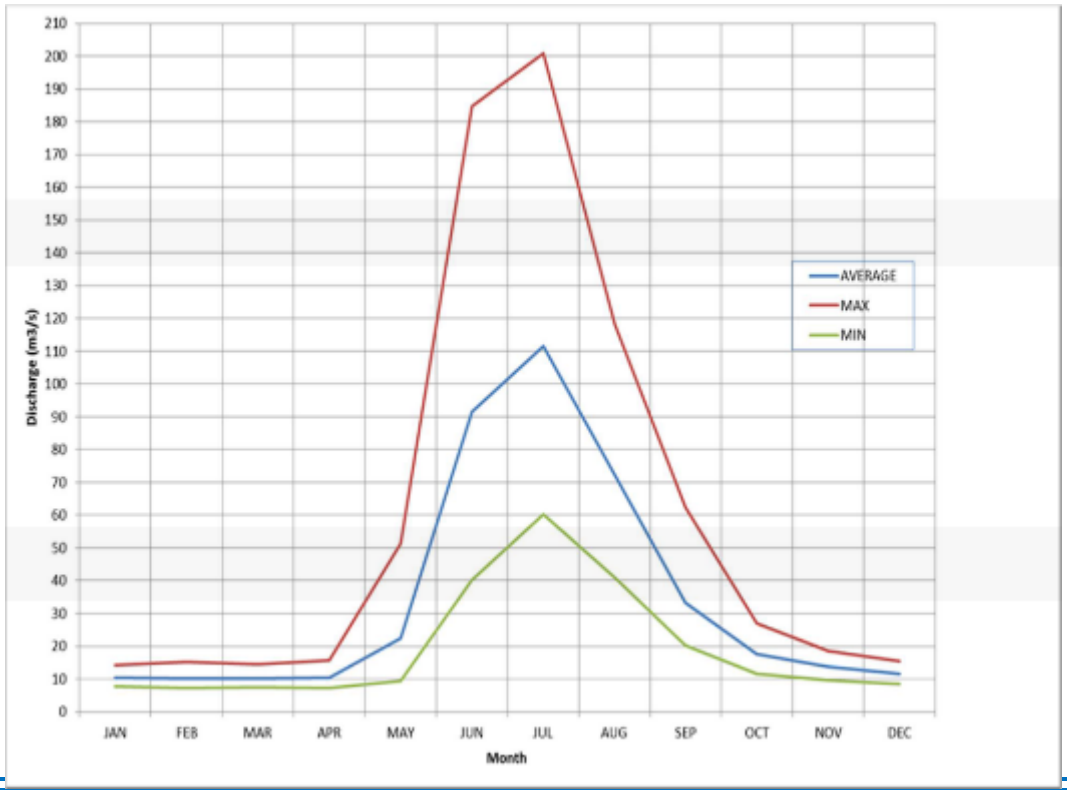

Figure 21~~22~~. Monthly average discharge of the Shokhdara River at Khabost station, 1940-1987 (except 1979)

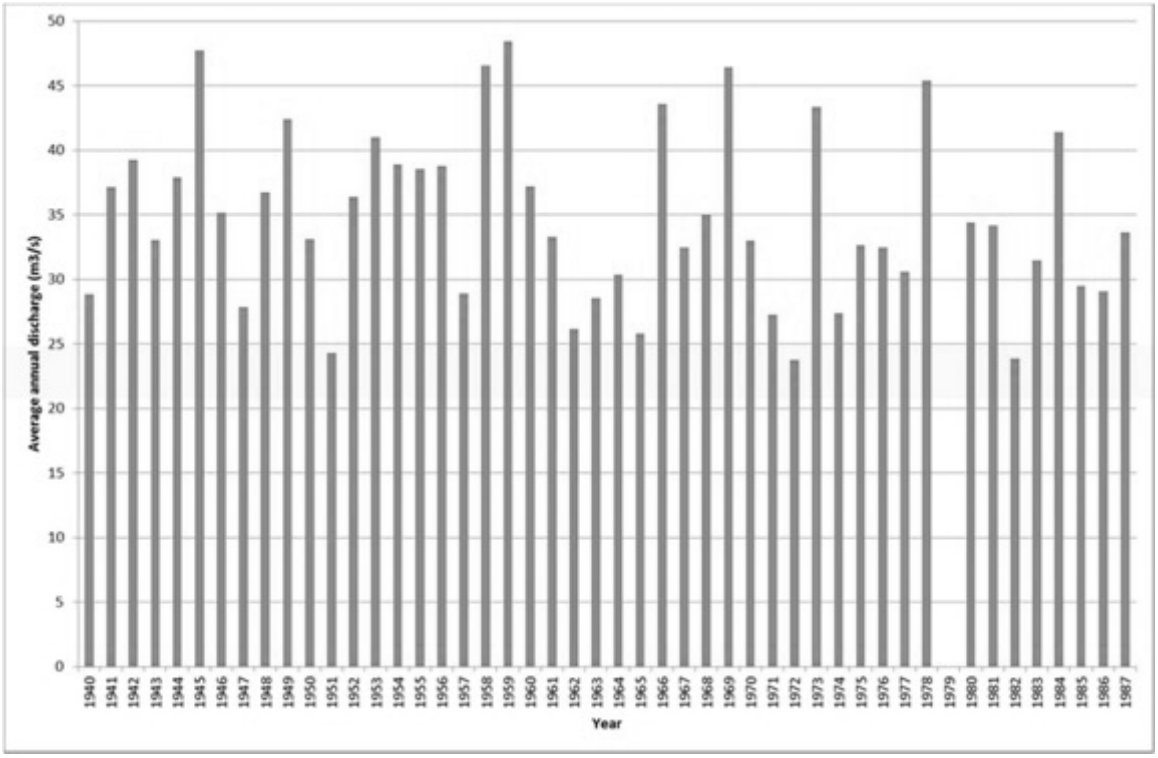

Figure 23. Mean annual discharge of Shokhdara river at Khabost, 1940-1987

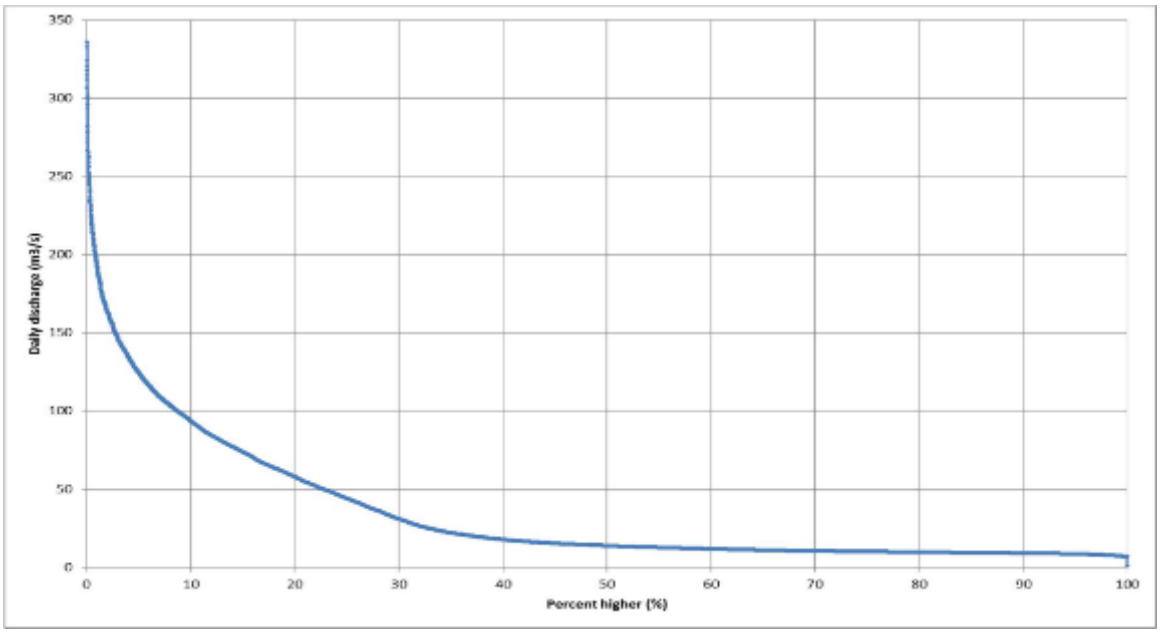

Figure 24. Flow duration curve (1947-1989)

Table 10 shows the engineering calculations for electricity generation potential for various plant discharges (it must be remembered that the actual plant design discharge will have to be 3m^3/sec less than river discharge since that amount has to pass the weir as environmental flow).

Table 10. Generation potential by plant design discharge

Design discharge [m3/s]	*Annual Generation potential [GWh]*
7	65
8	74
9	83
10	91
11	98
12	104
13	110
14	114
15	119

Surface water quality

There are no known sources of pollution in the upstream Shokhdara River other than settlements that use septic systems and wastes from animal husbandry. A limited sampling program was initiated in 2018 and 2019, with results shown in Table 11. Results were variable, as could be expected due to changing flow rates. Although the data are limited, it could be expected that water quality would be high, with perhaps some level of coliforms, especially in warm weather, and with low levels of inorganic nutrients. As noted elsewhere, water from the river is not used for household purposes, and the river reach between the intake and powerhouse is not diverted for irrigation or other uses and there are no discharges of wastewater into this reach from industries or households. A more comprehensive sampling program is being initiated to verify the high quality of river water.

Table 11. Results of water quality sampling in Shokhdara River at Sebzor

Date	*Depth (m)*	*Mg/l*					
		HCO_3	*Ca*	*Mg*	*Cl*	*SO_4*	*Na+K*
12.06.2019	0.5	3.0	1.2	2.0	6.2	0.07	6.07
13.05.2019	0.5	3.6	0.76	0.62	0.3	1.44	3.958
29.01.2019	0.5	5.2	0.8	0.4	0.6	0.7	5.3
12.24.2018	0.5	2.6	0.8	1.2	0.8	0.5	1.9
14.02.2018	0.5	4.6	1.0	0.6	0.2	0.4	3.6

Groundwater quality

Groundwater from mountain springs is widely used by local communities, including large cities such as Khorog, as their primary source of drinking water supply. The quality of the groundwater is reported as clean for drinking supply purposes, as shown in Table 12 (data are from Khorog sanitary inspection).

Table 12. Groundwater quality in springs serving Khorog

#	*Chemical parameters*		*Maximum allowable concentration (MPC) mg/m3*	*1 quarter Concentration, mg/m3*	*2 quarter Concentration, mg/m3*	*3 quarter Concentration, mg/m3*	*4 quarter Concentration, mg/m3*
1	PH		6-9	6,8	6,5	7,0	6,0
3	transparency			30,0	30,0	30,0	30,0
4	color, gradient		20	transparent	transparent	transparent	transparent
5	sediment			not found	not found	not found	not found
6	alkalinity			2,2	2,0	2,0	2,5
7	chlorides		350	3,0	5,0	6,0	2,0
8	nitrogen	ammonia	0,39	0	0	0,2	0
		nitrates	10	3,0	5,0	3,0	0
		nitrites	0,02	0	0	0	0
9	hardness		7-10	1,0	1,5	1,8	1,2

10	Iron	0,3	0,25	0,05	0,1	0,25
11	Ca		1,8	0,6	2,2	2,0
12	oxidation mg/l		0,24	2,0	1,28	0,8
13	magnesium		0,8	0,9	1,5	0,8

6.1.6. Ecosystems and flora

The description of wildlife and flora in the project and surrounding areas is included within the following sub-sections that focus on specific habitat types. Figure 26~~Figure 25~~ shows that the Project area is situated in within the Mid-Mountain Mesophyllic Forest Ecosystem zone, predominantly characterized by floodplain, small leaf and forms-meadow ecosystem groups (numbers 9 and 11 in the legend).

The Mid-Mountain Mesophyllic Forest Ecosystem zone is mostly represented by willow-poplar forests with light forest mesophyllic shrubs. These forests contain some number of rare endemic species of animals and plants. However, the area crossed by the corridor has been subject to intense deforestation, to the point that nearly all only trees and shrubs in forest fragments are in or adjacent to village areas, plus a few orchards. Much of the area is now barren rocky ground.

The area is generally characterized by open steppe and/or Eurasian steppe belt vegetation. The lower open steppe is, or was, dominated by prickly cushion plants such as *Acantholimon* spp., wormwoods (*Artemisia* spp.), and needle grass (*Stipa* spp.). The higher Eurasian steppe supports needle grass and fescue grass (*Festuca* spp.). The highest zone, which is extensive throughout the Pamir, consists of alpine sedge-meadows (*Kobresia* spp. and *Carex* spp.) with many forb species.

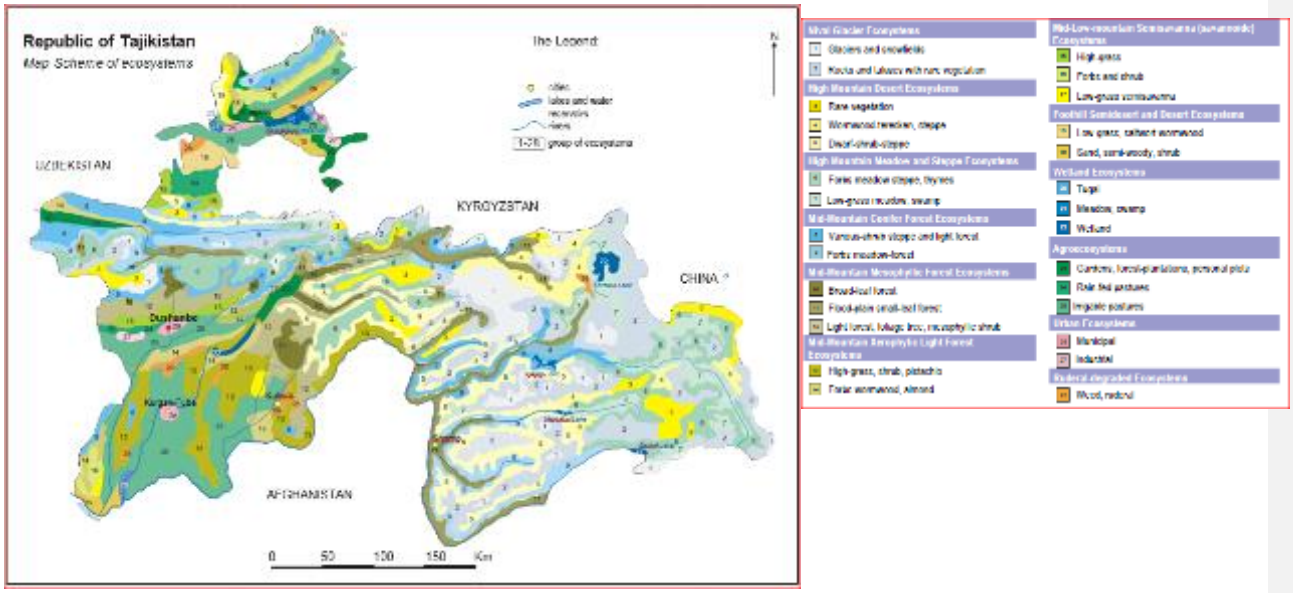

Figure 26. Schematic map of ecosystems in Tajikistan

(*source Fifth National Report on Biodiversity Conservation, 2014)*

Perhaps the most common vegetation features along the corridor are fragments of what is known as "Tugai" (or "Tugay" or "Tugainy") forest, a mix of three or four species of shrubs and trees, as seen on Figure 25~~Figure 26~~. These appear only in small fragments, primarily along the road, and near or in settlements. Few or no trees remain except in along the river valley. Slopes are barren but do support some grass species. Many or most trees show signs of being periodically pruned for firewood. Floral composition of the area is primarily characterized by the species shown in

Table 13~~Table 13~~. Only one species is known to be of conservation concern, the Dwarf everlasting (Helichrysum arenarium), which is a perennial flower. This plant generally grows under dry conditions so would likely not be found near the river. It is not listed in the Tajikistan Red Book. Local people are known to use this plant for medical purposes, specifically for treating diarrhea, All other species known to occur in the region are considered to be of Least Concern by the International Union for the Conservation of Nature (IUCN), and none are listed in the Tajikistan Red

Figure 25. Fragments of tugai forest in the river valley

Book.

Table 13. Floral species in the project area (past and/or present)

#	Species name	Photograph	IUCN Status (if listed)
Medicinal herbs			
1.	Clover *(Trifolium Pratense L.)*		LC
2.	Mulberry *(Morns Alba et morus nigra)*		LC
3.	*Rosa huntica Creshan*		NE
4.	*Peganum harmala L.*		NE
5.	Wormwoods *(Artemisia persica)*		LC
6.	*Ephedra equisentina Bunge*		LC

#	Species name	Photograph	IUCN Status (if listed)
7.	*Ultrica dioica*		LC
8.	*Mastericaria chamemilla*		LC
9.	*Glycyrrhiza glabra*		LC
10.	Everlasting spp. (*Helichrysum arenarium)*		NT
11.	Sea buckthown *(Hippopahe rhamnoides)*		LC
Other species of plants, sedges, grasses, shrubs and trees			
12.	*Salix pycnostachya*		LC

#	Species name	Photograph	IUCN Status (if listed)
13.	*Populus pamirica*		NE
14.	*Elaeagnus orientalis*		NE
15.	Birch (*Betula tianschanica*)		DD
16.	Tuglans regia		LC
17.	*Acantholimon spp*		DD

#	Species name	Photograph	IUCN Status (if listed)
18.	Needle grass (*Stipa spp.).*		NE
19.	Fescue grass (*Festuca spp*.).		LC
21.	*Kobresia spp.*		LC
22.	*Carex spp*.		LC

#	Species name	Photograph	IUCN Status (if listed)
Fruit trees (in Orchards)			
23.	Pear (*Pyrus*)		LC
24.	Plum (*Prunus*)		LC
25.	Cherry plum (*Prunus sogdiana*)		LC
IUCN Red List (https://www.iucnredlist.org/): NT= Near threatened, EN= Endangered, NE= Not evaluated, LC=Least Concern., DD=Data deficient Note: none of these species are listed in the Tajikistan Red Book			

6.1.7. Fauna

Baseline information on fauna was acquired from various sources, including governmental agencies (the Committee for Environmental Protection and others), Pamir Biological Institute, and other referenced documents.

Mammals

Faunal communities of the project area are considered part of the steppe and mountain zoogeographical zone and consist of a range of species associated with steppe ecosystems. Table 14 lists mammal species in the area, as identified by the Pamir Biological Institute, whose scientists have been active in documenting flora and fauna in the region for decades. Snow leopards are found in the higher Pamir Mountains but not at the lower elevations where the project will be located.

There is some hunting by local people, but primarily of animals that live higher in the mountains, away from human development.

Table 14. Mammals in the project area

English name	*Latin name*	*IUCN status*
Wolf	*Canis lupus*	LC
Fox	*Vulpes vulpes*	LC
House Mouse	*Mus musculus -*	LC
Big-eared cony	*Ochotona sp.*	LC
Long-tailed marmot	*Marmota caudata*	LC
Tolai hare	*Lepus tolai*	LC
Least weasel	*Mustela nivalis*	NT
Stone marten (or Altai weasel)	*Mustela altaica*	NT
Eurasian otter (locally known as "Sagi obi")	*Lutra lutra*	NT
Lesser horseshoe bat	*Rhinolophus hipposideros*	LC
Whiskered myotis (bat)	*Myotis mystacinus*	LC
Leatherless nether (Savi's pipistrelle (bat)	*Hypsugo savii*	LC
White-bellied Strelukha	*Otonycteris leucophae*	DD

Eurasian otter

IUCN Status key:
LC: Least concern
DD: Data deficient
NT: Near threatened
Note: none are listed in Red Book

Birds

The area is relatively rich in avifauna, with over 120 species and subspecies recorded. Table 15 identifies those of conservation concern.

Table 15. Bird species of conservation in the project area

English name	*Latin name*	*Status*
Himalayan griffon	*Gyps himalayensis*	RL, IUCN NT
Cinereous vulture	*Aegypius monachus*	RL, IUCN NT
Bearded vulture	*Gypaetus barbatus*	RL, IUCN NT
Osprey	*Pandion haliaetus*	RL
Carrion vulture	*Neophron sp.*	RL
Golden eagle	*Aquila chrysaetos*	RL
Sparrow hawk	*Accipiter nisus*	RL
Barbary falcon	*Falco pelegrinoides*	RL
Ibis-bill	*Ibidorhyncha*	RL
Whistling thrush	*Myophonus*	RL
Little forktail	*Enicurus scouleri*	RL
Plumbeous water redstart	*Phoenicurus fuliginosus*	RL
White-crowned robin	*Cossyphaal bicapilla*	RL
Babbler	*Timaliidae* sp.	RL
Chiffchaff	*Phylloscopus collybitus*	RL

English name	*Latin name*	*Status*
Paddyfield Warbler.	*Acrocephalus agricola*	RL
Common pochard	*Aythya ferina*	IUCN VU
Key: RL: Listed in Tajikistan Red Book IUCN NT: Near-threatened by IUCN IUCN VU: Vulnerable by IUCN		

Fish

The following fish species were reported to be present in the Shokhdara River and its tributaries. The Pamir Biological Institute reported there were no other known species.


False Osman

False Osman (*Schizopygopsis stoliczkai Steindachner)* is a cyprinid fish (carp family) that averages 30-40 centimeters but can reach a maximum length of 80-95 centimeters. The species spawns at an age of 2-3 years. Spawning occurs in tributaries of the Panj, including the Shokhdara, with fish migrating upstream from the Panj in spring and returning to the main river in late spring or summer, with young following in the autumn. The spawning period begins from April and continues throughout June. Spawning occurs once per year and the spawning eggs adhere to the substrate. Individuals can live for 25-35 years, with males living longer than females. The main nutrition in the Panj River is provided by algae and microphytes. There is some local fishing, but fish is not a key part of diets and there is no known commercial fishing. The species has not been evaluated by IUCN (characterized as "data deficient").


Marinka

Marinka (*Schizothorax* sp. *(intermedius*?)) is widespread cyprinid species in the Pamirs and the region. The length can reach 60 centimeters and they can weigh up to about 1.5 kilograms. The color of its body varies depending on environmental conditions. Male Marinkas can spawn at 2-3 years, while females begin ovulation at about 3-4 years. One unusual feature of the Marinka is that the number of males is higher than the number of females. Spawning starts from May and continues into June, with a life history similar to the False Osman—that is, they migrate into tributaries to spawn, with adults returning to the Panj in late spring or early summer and young fish in the autumn. Marinka are found in lower numbers than the False Osman. Like the other species, they are also caught for food, but much less than the False Osman. The fish is not of conservation concern.


Tibetan stone loach

Tibetan stone loach (*Nemacheilus stoliczkai)* can be found in the western and eastern parts of the Pamir at altitudes up to 4,000 meters above sea level. The length is typically about 10-12 centimeters but can reach 16 centimeters. Ovulation and spawning occur when temperatures reach 8-10°C, which occurs from early March into early April. Nutrition consists of algae. The number of Tibetan stone loach is not large and it is not widely used as a source of food. The species has not been evaluated by IUCN. .


Turkestan catfish

The ***Turkestan catfish*** (*Glyptosternum* sp) is found in the Shokhdara River and other tributaries of the Panj and may be present in the Panj itself. It grows to about 18-24 centimeters and is generally not a food source for people. It has not been evaluated by IUCN.

Reptiles

According to the Committee on Environmental Protection, reptiles in the area include Blunt-nosed viper (*Vipera lebetina*—IUCN Least Concern), various asps (*Cerastes* spp.—all species are LC), various racers (*Coluber* spp.—all LC or Data Deficient), and water snakes (*Natrix* spp. -- all reported to be LC). No reptile species are reported to be listed in the Tajikistan Red Book.

Other fauna

There have been few or no studies to identify or characterize amphibians, insects, or macroinvertebrates in the area.

6.1.8. Habitat

There is no undisturbed terrestrial habitat in the project area. While there are few or no introduced species, the remaining habitat is not considered to support viable assemblages of native species although there is some remnant fauna that survive in rocky areas and in remaining forest fragments, and even in orchards. Between villages, in areas that are less disturbed, relatively few trees and other vegetation remain other than remnant shrubs and grass species that grow in rocky terrain and some trees in riparian areas. Even in most such areas, there is evidence of grazing by goats and other livestock that can tolerate steep slopes, and/or of wood harvest from living trees. It is also important to note that the entire project will be within a few 10s of meters of the road. Perhaps the least disturbed areas are the extreme slopes on either side of the valley.

None of the terrestrial or riparian habitat could be considered natural other than possibly the sheer cliffs that would never have supported significant vegetation, and which will not be affected in any event. All other habitat would have to be characterized as modified, in all or nearly all cases heavily modified. The only potentially valuable habitat would be the forest fragments that survive, and even these are heavily exploited for firewood, although not to the degree experienced in the past, when the area was largely deforested; prior to the area being electrified, wood was the primary fuel for

household use and heating and this led to widespread deforestation. Now, trees are trimmed and allowed to grow back, but generally not felled and permanently destroyed.

Aquatic habitat is less disturbed except at bridges and other locations where there has been construction or other disturbance. The reach between the weir and powerhouse has experienced road construction and construction of a bridge in the past, which may have modified aquatic habitat to some extent. To date, however, aquatic habitat and species other than fish have not been well described. Studies are being initiated to characterize the habitat as well as aquatic flora and macroinvertebrates.

Natural and critical habitats

The World Bank places special requirements on projects if they may have impacts on habitat that is considered to be "natural habitat" or "critical habitat". **Ошибка! Источник ссылки не найден.**Table 16 presents the World Bank definitions and the applicability to the areas that may be affected by the Sebzor HPP project.

Table 16. World Bank habitat categories

World Bank Definition	*Applicability*
Critical habitat (ESS6, paragraph 23) is defined as areas with high biodiversity importance or value including:	
a. Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches	The area is not considered important to CR or EN species
b. Habitat of significant importance to endemic or restricted-range species	The area is not considered to be of significant importance to endemic or restricted-range species
c. Habitat supporting globally or nationally significant concentrations of migratory or congregatory species	The habitats do not support important concentrations of migratory or congregatory species
d. Highly threatened or unique ecosystems;	None of the ecosystems are threatened or unique
e. Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).	The area to be affected does not possess the biodiversity values in (a) to (d)
Natural habitats (ESS6, paragraph 21) are areas composed of viable assemblages of plant and/or animal species of largely native origin and/or where human activity has not essentially modified an area's primary ecology function and species composition.	The entire region demonstrates anthropological impact. Deforestation has substantially modified terrestrial habitat and modified natural assemblages and primary functions. Aquatic habitats are less understood but have also been affected by human activities on either side of the river nad the riparian zone (road, bridge, etc.).
Modified habitats (ESS 6, paragraph	Human activity – deforestation, agriculture, etc. – have

World Bank Definition	*Applicability*
19) are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition… The ESS applies to those areas of modified habitat that includes significant biodiversity value.	substantially modified species composition and ecological funcitons of terrestrial and riparian habitats. Aquatic habitats have also been affected by roads, bridges, and other activities, and further investigations are being undertaken to better characterize the biodiversity value of aquatic habitats.

6.2. Protected Areas

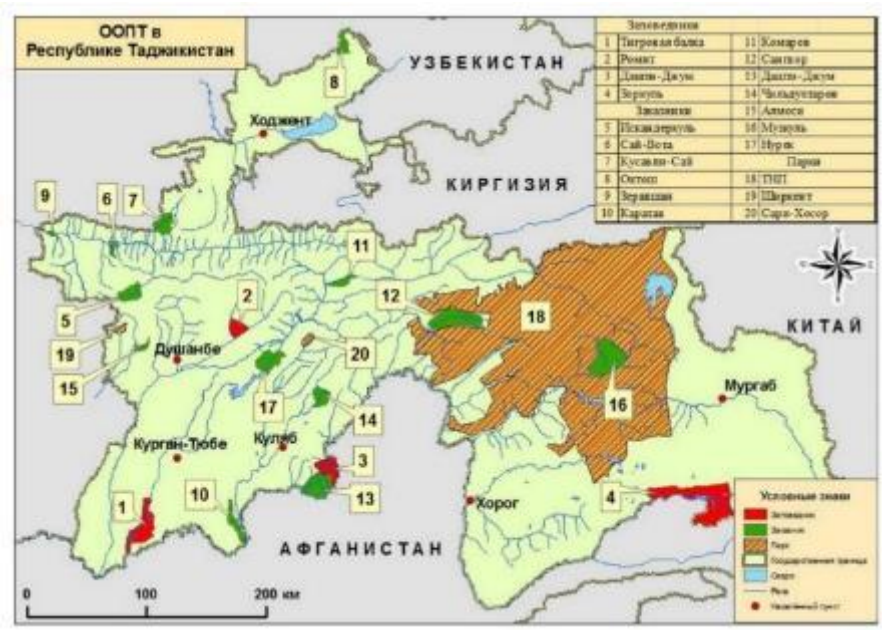

Figure 27. Natural protected areas in Tajikistan

The proposed transmission line corridor does not cross, intersect, or pass near any naturally protected areas. The nearest protected area is Tajik National Park (no. 18 on Figure 27), far from the site. In addition, Drumkul Lake about 40 kilometres upstream of Sebzor has been designated as an Important Bird Area, although it is not formally protected and is considered beyond the area of project's impact.

6.2.1. Soils and Land Use

Soil cover

The project area presents by alpine/sub-alpine landscapes. Hillsides are rocky with only relict soil, but riparian areas, moderate slopes near the river, and along small tributaries may have the following primary types of soils:

- *Alluvial meadow soils* are typical for stream floodplains. The topsoil horizon of such soil is the most developed and these soils are typically used for grazing and/or as arable lands for growing different types of crops (e.g. wheat, potatoes and others). Vegetation cover on these soil cover is presented by meadow grasses, shrubs and so-called Tugai forests, which are predominantly represented by osiers, sand thorn, poplars and other small shrubs, as described above.
- *Mountain and high-mountain, peaty/or meadow-marshy soils.* These types of soil cover are situated in small areas on the mountain slopes, typically near mountain springs. These soils are characterized by the presence of an upper peaty horizon of brown, dark brown color.

Except in the immediate riparian area, soils would typically have poorly developed profiles with a thin topsoil layer. Where the upper profile is developed to 30-50 centimeters, it is susceptible to erosion in this highly deforested area. The Pamir Biological Institute reports that past deforestation was much more intense than at present, since most people now have electricity for heating. However, except along the roads and near villages, there are very few meadows, orchards, or areas with trees. Many trees were observed to be heavily cut back for firewood and other household uses.

Land Use

Some land in and near villages is used for garden plots and grass (for hay), and there are highly fragmented forests in the riparian zone, especially in and near villages—as noted, many of these “forests” are heavily cut back for wood. Agriculture comprises small-scale farming and gardening, hayfields, and orchards. Typical annual crops are potatoes, tomatoes, wheat. Some land is devoted to orchards, mostly pears, apricots, plums and other fruit. Some small areas are covered either with shrubs, pastures, or fragmented forest, all significantly impacted by human activities. This remaining forest, which is only sparsely covered in trees, is exploited for wood and for berries and wild fruit, although this is not an important source of nutrition.

6.2.2. Noise

There are few noise sources in the project area other than vehicles passing, water flowing over rocks, and human activity in villages. As seen in Table 17, noise monitoring conducted in early 2019 was consistent with this, with the maximum of about 70+dB measured near the river at the intake and/or when cars were passing by. There are no industries or other types of industrial activities along the corridor which would produce noise.

Table 17. Noise levels in the project area

Period	*Noise level measured*		
	L_1	L_2	L_{max}
Single measurements at multiple locations	45	52	70

6.3. Social and Economic Baseline Conditions

Socioeconomic baseline data was acquired from government statistics, village records, household surveys conducted among residents of rural villages along the corridor of transmission line, and from data collected by the Aga Khan Agency for Habitat in their hazard mapping of all GBAO settlements. Site specific social information was also collected during the second round of ESIA scoping consultation that took place during February and March 2019.

6.3.1. Demography

Five villages are near the various project sites and thus are subject to potentially significant impacts from construction and operation. The largest of these is Midensharv, which is slightly away from the river and thus will be farther from project activities. Another 25 villages are between Sebzor and Khorog and could be affected by traffic during construction or traffic-related impacts (e.g., dust). Characteristics of the four villages are shown in Table 18.

6.3.2. Disadvantaged / Vulnerable individuals or groups

Several groups are considered vulnerable, including female-headed households, elderly households, households with disabled people, and others that may be identified in the Resettlement Action Plan as being disproportionately affected by the project. As can be seen from the table above, about 11 percent of the total population of these five villages are over 60 years of age, widowed or single-women who head households, or disabled. A much larger percentage of the population could be considered poor.

As described in the Resettlement Policy Framework (RPF), vulnerable people and households will be eligible for special allowances and compensation and Pamir Energy will make special efforts to engage these households in project activities.

6.3.3. Education and income

Data on income are not available for GBAO or smaller units. A very large percent of households would be considered poor, although there is no defined threshold to define poverty levels. Also, it is likely that more highly educated and skilled people – engineers, military, etc. – would probably live in villages nearer to Khorog to take advantages of more employment opportunities in the city.

6.3.4. People affected by land acquisition

For the Sebzor HPP project, 32 hectares of land have been formally allocated to Pamir Energy. About 3 hectares are arable land, 2 hectares are gardens and 2 hectares are meadows used for grazing or hay. The rest of the land has no current use. A total of eleven households, two schools, a bridge, and

four other small buildings (shops, garages, etc.) are within the project footprint and will require relocation and compensation.

Table 18. Social and economic characteristics of potentially affected villages

No.	*Settlements*	*Number of households*	*Population*	*Sex*		*Age*			*Disabled*	*Widowed, women-headed household*
				Male	*Female*	*<12*	*12—60*	*>60*		
1	Dashtak	57	336	167	169	38	286	12	0	0
2	Barjingal	46	300	135	165	65	215	20	15	8
3	Chagev	23	184	84	100	26	154	4	0	2
4	Midensharv	115	533	302	231	114	369	50	10	7
5	Sebzor	≈27	164	82	82	30	110	24	5	9
	Totals	***≈268***	***1517***	***770***	***747***	***273***	***1134***	***110***	***30***	***26***
	Percentages		*100.0%*	*50.8%*	*49.2%*	*18.0%*	*74.8%*	*7.3%*	*2.0%*	*1.7%*

6.3.5. Sebzor village

The village of Sebzor is typical of the five villages and is discussed here. The village is situated on the right and left banks of the Shokhdara river about 20 kilometers west of the city of Khorog, the capital (Khoukumat) of GBAO and 18 kilometers east of Roshtqala, the capita of Roshtqala district. The total area occupied by Sebzor is 39 hectares and is at an altitude that ranges from 2475 to 2600 masl. The village is linked with the city of Khorog and Roshtqala by a gravel automobile road (designated as road AH66) that is in poor condition along some of its route.

The main social infrastructure of the village includes the following:

- A secondary school that was built in 1957 and renovated in 1988.
- A library, located next to the school, whose building is in poor shape and partially ruined
- A bridge 23 meters long and four meters wide that connects the left and right part of the village
- Medical facility with one doctor, located in a resident's private house

As of 2014, there were 28 households in the village and a total population of 236[3]. Among them there were 107 males and 129 females. Approximately 40 residents (16.9%) considered vulnerable, including single mothers (9), people with disability (8), and elderly (24); this contrasts with the data in Table 18, which shows 38 of 164 people (23.2%) could be considered vulnerable.

[3] Population and demographic data discussed in this subsection do not necessarily match the data in Table 18~~Table 16~~. This is because the data discussed here are from Government sources, while data in the table are based on a full house-to-house census by the Aga Khan Agency for Habitat as part of a program of hazard mapping.

Other than household plots and barren land, usable land in the village included arable land (6 hectares), pastures (5 hectares) and orchards (one hectare). Villagers grew livestock: 59 head of cattle, 149 sheep, 140 goats, and 55 poultry. Some villagers grow fruits in orchards, vegetables (mostly potatoes) in their gardens. Some people grow wheat. The primary source of water supply is groundwater (springs) and surface water from small streams.

The main source of income in the village is agriculture (70 percent of people are so employed). The unemployment rate is very high (the exact number is not known but is considered to be well over 50 percent of employable people), and many people (mostly men) temporarily leave the village in seeking for other sources of income (e.g., to urban areas or Russia for employment).

6.4. Cultural heritage and tourism

The Ministry of Culture reported to Pamir Energy there are no places of significant national or international historical or cultural importance located within the Barjingal and Sebzor villages. It was also reported by the agency that there are cultural heritage sites that were considered eligible for inclusion as a UNESCO Cultural Heritage site.

Local people report there are some they value for the cultural and religious traditions of Pamirians. Among these locations would be the “Khojai Nur” site in Badam village, “Khojai Zur” in Andarv village, “Seyid Jalol” in Tavdem village, “Shokh Buron Wali” - Tusyan village, “Pir Fokmukhammed”- Bodomdara village, and “Shokh Abdol Wali” at Nimos village. There are also some ancient petroglyphs found on a few stones near Tusyan and Tavdem villages. In addition, there are some ancient remnants of medieval fortresses found nearby the Barzhang village. The fortress is presumably from the XI-XII century. There is also an ancient historical place called Uzhbok, which is presumed to be Bronze Age.

The area is known to be popular among local and foreign tourists during summer who travel across GBAO on the way to Murghab There is only one road connecting Khorog and Murghab and this automobile road passes through Sebzor and Barginjal villages. Tourists often visit the historical places mentioned above, the remnants of the fortress, the famous places of Lodzhvardara, Lake Drumkul in Sedzh village, Trumtaykul in Javshangoz Village, the natural places in Vazdar village with the mineral spring “Narzan”, and the hot spring “Kug” near the Nimos village. No data are available on the approximate numbers of people who visit or pass through.

7. Environmental and Social Risks and Impacts

This Chapter describes potential environmental and socioeconomic impacts during construction and operation phases of the project. The assessment was conducted using the methodology described in Chapter 5. The assessment of potential impacts was based on the activities described in chapter 3 and the baseline conditions in Chapter 6 and covers project alternatives. When potential impacts could be more than minor, the assessment describes measures that will be taken to avoid or reduce the potential impacts. The measures were identified and selected using the mitigation hierarchy. The Environmental and Social Management Plan and the Monitoring Plan in Chapter 8 then summarize all mitigation requirements and describe how impacts will be monitored.

The chapter is organized as follows:

- Section 7.1: potential impacts on the physical environment, including landscapes and views of residents and visitors (subsection 7.1.1), land use (7.1.2), geology, geohazards, and soil (7.1.3), air quality (7.1.4), noise (7.1.5), and surface water and groundwater (7.1.6); the effects of climate change on the project are described in subsection 7.1.7
- Section 7.2: potential impacts on the biological environment, including flora (7.2.1) and fauna (7.2.2)
- Section 7.3: potential impacts on people and socioeconomic conditions, including health and safety (7.3.1), physical and economic displacement (7.3.2), worker health, safety, and welfare (7.3.3), and economic conditions (7.3.4)
- Section 7.4: potential impacts on cultural heritage
- Section 7.5: comparison of alternatives
- Section 7.6: summary of potential impacts (7.6.1) and preferred alternative (7.6.2).

Each section summarizes activities that have potential to affect sensitive receptors, evaluates sensitivity of potential receptors, evaluates the significance of potential impacts, and identifies actions to avoid or reduce the potentially significant impacts.

7.1. Potential impacts on physical environment

7.1.1. Potential impacts on landscapes and views

This section describes project impacts on landscapes and visual receptors. Several aspects of the project will be visible to residents and visitors to the area, including construction activities, the dam and powerhouse, and the substation near the powerhouse

All project elements would be visible to travelers on the road that runs parallel to the river and to nearby residents. They would be visible from only a short distance, generally less than one kilometer, since none will be more than five meters above the ground surface (the dam will be five meters high, but only three meters above the river bottom and less than two meters above the immediate floodplain.

The road is relatively lightly traveled, with both local and through traffic – less than five percent of residents own vehicles. There are already houses and auxiliary buildings within view, so the view will not change significantly except for a few households.

Activities and potential impacts

Construction and maintenance activities. In general, construction activities (ground clearance, earthworks and excavations, pipe laying, concrete works, traffic, storage and assembly works, roadworks, bridge replacement construction etc.) would be visible to travelers and residents. Construction will be more or less continuous for up to two years, except in winter months, and the construction camp will be active for the entire time.

Dam, powerhouse, and substation. These structures will be permanently visible to travelers on the road and to residents.

Other project elements. The penstock and tailrace will be buried and not visible except at their ends. And of course, the bridge and road will be visible.

Sensitivity of receptors

Visual impact Is generally determined by the way human receptors perceive the landscape changes. The degree of impact is subjective and thus will vary between individuals. However, general statements concerning sensitivity can still be made. The sensitivity of visual receptors and views over project elements will depend on the location and type of visual receptor, as well as the nature of the landscape itself and the expectations of the receptor. Potential visual receptors in the region would include local residents, travelers, visitors, and tourists. Table 19 describes the sensitivity to changes in landscape and views by various receptors.

Table 19. Sensitivity of visual receptors

Receptor	*Sensitivity to Change*	*Sensitive Areas*
Visitors	High	Most sensitive would be tourists who come for natural attractions and who would find large infrastructure to be intrusive. There are few such visitors and exposure would be limited due to short visits.
Residents	Medium	Populated areas: local residents may find the change in views to be intrusive initially, but would become accustomed to the changed views quickly
Travelers	Low	Roads: travelers would be exposed for only very brief periods.

The most important impact could be expected to be on visitors and travelers who may pass through on the way into the high mountains or to Roshtqala. There would be only a small limited number of such people and passing the site would take only a few moments.

People who live near the dam and the powerhouse would experience a permanent change in their customary views, and those who live in the houses nearest the reservoir, dam, and powerhouse would be most affected. They would quickly become accustomed to the view, however, so it would have minimal effect. Table 20 shows the number of residential houses at distances up to 100 meters

from the various project components, which is about the farthest distance it would be intrusively visible from houses in the valley. At about six occupants per household within 100 meters, the line could be intrusively visible to about 360 people. However, residents would become accustomed to the view and the intrusiveness would diminish relatively quickly over time.

Table 20. Houses and buildings near the project sites

Project element	*50m*		*100m*	
	Number of houses	*Number of other buildings*	*Number of houses*	*Number of other buildings*
Weir area: weir, roads, other permanent structures/features	8	3	32	3
Camp, storage, etc.)	2	0	4	1
Penstock	6	1	15	1
Powerhouse area: permanent features	2	2	2	2
Powerhouse area: temporary features	3	2	3	2
Substation at HPP	1	0	2	0
Pamir Energy crushing plant	0	1	0	2
New bridge	2	0	2	0
Totals	***24***	***3***	***60***	***12***

Mitigation measures

There is little that can be done to avoid some intrusion on residents' and visitors' viewsheds, as described above. Overall, it is not expected that the visual impact would significantly detract from the overall attractiveness of any tourist areas, and residents would quickly become accustomed to the change in views resulting from the presence of the reservoir, dam and intake, powerhouse, and substation. Although impacts are not expected to be significant to any receptors, Pamir Energy will plant trees near the intake and around the powerhouse and substation, which will reduce the visual impact over time.

Table 21 summarizes the significance of the potential impacts.

Table 21. Significance of potential impacts on landscapes and views

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Visitors	High	Disruption of views due to construction and permanent presence of project infrastructure	Medium permanent (temporary for individuals)	Minor adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Residents near project elements	Medium	Disruption of current views due to construction and permanent presence of project infrastructure	Low permanent	Negligible adverse
Travelers	Low	Disruption of natural views due to construction and permanent presence of project infrastructure	Very low temporary	Negligible Adverse

7.1.2. Potential impacts on land use

This section describes the potential impacts of the project on existing land uses. As noted there, all land in Tajikistan is owned by the state, with private citizens and other entities granted the rights to use land for specific purposes.

The approximate extent of each land use category that could be affected was estimated using Google Earth, imagers from drone overflights, and site reconnaissance visits. Land use (and habitat) sensitivity criteria are also introduced in this section, together with other characteristics of potential impacts (e.g. magnitude of change, duration, reversibility, etc.).

Activities with potential impacts on land use, and area affected

Table 22 shows the total amount of land that will be needed, permanently or temporarily, for the hydropower plant. As can be seen, only a small amount of land would be needed.

Table 22. Land needed for project

Project component	*Land needed (hectares)*
Permanent use	
Dam, intake, sand trap	1.0
Penstock	0.6
Powerhouse	0.5
Road widening/rehabilitation	0.5
Substation	0.2
Tailrace	1.0
Total permanent use	*3.8*
Temporary use	
Construction camp/laydown area	1.5
Crushing area	0.9
Powerhouse area	0.5
Total temporary use	*2.9*
Total land needed	***6.7***
Land needed for Left Bank alternative would be approximately the same	

Table 23 shows the categories of land use and the amount of land that would be affected temporarily or permanently. Impacts on land use could be permanent or temporary, as follows:

Permanent direct impacts. Such impacts will occur on all land that Pamir Energy will need for project infrastructure: the dam and intake and sand trap (desilting chamber), the penstock corridor, the powerhouse and tailrace, and the substation. If rights to use the land have been granted to any individuals, those rights will have to be terminated and allocated to Pamir Energy, with current rights-holders granted new land or compensation, at their discretion. This will be addressed in the Resettlement Policy Framework and the Resettlement Action Plan.

Temporary direct impacts. Land use will be affected temporarily during the construction phase for the Pamir Energy crusher area and the construction camp, and also for the construction camp (storage and preparation area), plus a small area for storage and preparation near the powerhouse and substation. Pamir Energy has or will lease this land from current rights-holders and will return the land when construction is complete. In addition, the penstock corridor will run parallel to the road and too close to the road to be used for other purposes. Thus, the impact of burying the pipes on this land could be considered to be temporary as well, even though this land is included in the "permanent use" category of the table and no one has been granted the right to use this land.

Table 23. Current uses for land needed for project

Category of land	*Land to be used (ha)*
Household plots/gardens	0.5
River/riparian	1.0
Arable land	2.2
Grassland (hay)	0.0
Grazing land	0.0
Orchards	0.7
Tree/shrubs (private)	0.3
Trees/shrubs (state/village)	0.0
Barren/rocky land	2.0
Schools	0.0
Totals	6.7

To aid in the impact analysis, land use sensitivity criteria were developed based on land use types and relative environmental and social value. Land use sensitivity criteria are shown in Table 24~~Table 24~~ Table 24

Table 24. Land use sensitivity criteria

Sensitivity	*Criteria*
High	- Household plots - Land protected for biodiversity, cultural heritage, or other purpose
Medium	- Arable land used for crops or other valuable plantings

Sensitivity	*Criteria*
	- Orchards
Low	Rocky land and other land not in productive use

Mitigation measures

To prevent unnecessary impacts on land use, Pamir Energy and the contractors will be required to implement a number of mitigation measures, including:

- Limiting the amount of land taken from current users to the absolute minimum needed for the project. If land allocated to Pamir Energy is not actually used, Pamir Energy will take steps to return the land to its original rights-holder and not require any return of previous compensation or other land that was granted for replacement.
- Limiting the construction footprint to the absolute minimum needed. This will include demarcating and marking all construction areas and access roads, and training workers to remain within authorized demarcated areas.
- Keeping all construction vehicles and equipment on prepared roads and construction areas and prohibiting moving onto adjacent lands not under project control.
- Limiting impacts on land away from construction zones by controlling drainage and erosion and by implementing proper spoil and waste management practices
- Providing prompt compensation in case of damages to crops or property, as required by the Resettlement Policy Framework and future Resettlement Action Plan.

Impact summary and significance

Relatively amounts of land will be needed for the project, with the result being that there will be relatively little impact on land use. However, a total of 11 households, two schools, and four other outbuildings (shops, garages, etc.) will require resettlement, relocation, and/or other compensation. Other important impacts would be where current uses are for crops or other plantings on arable land, where orchards are currently located, and where other trees and shrubs are located. Only about 3.0 hectares of arable land will be affected and less than a hectare for orchards and other trees, respectively. Since current users will be compensated with replacement land allocations (as required by the law, the replacement allocations must be of equivalent land) or in case, at the land users' discretion (with a preference for replacement).

As summarized in Table 25, the overall impact on land uses will be minor

Table 25. Summary of significance of potential impacts to land use

Type of land	*Sensitivity*	*Potential Impact*	*Magnitude and duration*	*Impact significance*
Protected areas	High	No such areas to be affected	No change	None
Household plots	High	11 ouseholds to be resettled into new house on new land or provided cash compensation at full replacement value	High permanent	Major adverse
Steep slopes	Medium-	Landslides, mudslides due to	Low permanent	Minor adverse

Type of land	*Sensitivity*	*Potential Impact*	*Magnitude and duration*	*Impact significance*
	high	blasting, seismicity, or other causes		
Arable land, orchards, productive trees	Medium	Land use rights terminated and transferred to Pamir Energy; compensation with replacement land or cash, or trees cut back and compensation paid	Medium permanent	Moderate adverse
Land not in use	Low	Rights transferred to Pamir Energy	Low permanent	Negligible adverse

7.1.3. Potential impacts on geology, soils and geohazards

This section describes potential impacts of the project on geologic conditions and soils, which are described in section 6.1.2. The section also addresses potential geohazards associated with project implementation. The assessment is based on observations made during visits to the corridor, descriptions of geological conditions in the scientific literature, and geoengineer assessments made during and after the feasibility study.

The sensitivity of local soil and geological conditions, which largely determines the magnitude of the potential impact, is presented in Table 26. The primary factors affecting sensitivity include slope, susceptibility of soil to erosion, vegetation condition, presence/potential of landslides, and rock stability.

Table 26. Sensitivity criteria for geology, soils, and geohazards

Sensitivity	*Criteria*
High	- Steep slopes - Large areas already prone to landslide - High seismic zone
Medium	- Moderate slopes - Other landslide-prone areas - Areas where stable bedrock is difficult to reach or anchor into - Areas with topsoil suitable for arable-land farming - Moderate seismic zone
Low	- Minor slopes and flat lands - Areas where complete vegetation clearing is not required, or vegetation could be restored post construction

As can be seen in Table 25, the slope of the land where construction takes place is a key factor in sensitivity, in particular sensitivity to the potential for significant erosion, landslide, and rockfall. Most of the land affected by the project is relatively flat and stable, although there will be significant amounts of topsoil in some locations and those areas will be erosion-prone. This will necessitate careful attention to the implementation of mitigation measures.

Activities with potential impacts on geology, soils and geohazards

Project activities with the greatest potential to affect geology and soils include land-clearing and excavation for the dam, intake sand trap, penstock burial, powerhouse, tailrace, bridge, substation, and bridge.. In addition, any vegetation clearance has the potential to increase the loss of topsoil, and work on or near the riverbanks can increase erosion. Specific activities and potential effects include:

Erosion, topsoil loss, and landslides due to land clearing and vegetation removal at all construction locations. As noted, the risk is much higher on steeper slopes. Exposing the soil to precipitation and run-off makes it subject to erosion, which in turn leads to loss of topsoil and less fertile soils, and erosion can smother areas where the eroded material comes to rest and also affect fish and aquatic habitat. In addition, removal of vegetation and disturbing stable ground can lead to instability in case of ground movement during earthquakes. Loss of fertile topsoil, in turn, may impact agricultural productivity, causing loss in livelihoods. Depending on weather conditions, permanent or temporary measures to ensure proper drainage may need to be taken while construction is underway. If proper care is not taken, some areas could become more susceptible to landslides and mudslides, and valuable topsoil could be lost. In turn, this could affect the success of the program to restore vegetation.

Erosion and topsoil loss due to excavation. To construct the various project infrastructure (specifically, the intake, sand trap, penstock, powerhouse, tailrace, substation, and bridge abutments, it will be necessary to remove topsoil from the entire area and then dig through soil and rock to a depth of 1-2 meters. The substation will be built on top of the current ground surface, but some excavation may still be required. The excavations will generate large amounts topsoil and spoil at each location and some amount at the substation. If not properly stored and protected, soil and spoil can erode and damage other land where it is deposited, and topsoil can be lost. Again, the risk is higher on steep slopes and in areas near the river.

Blasting may be required for deeper excavations in rocky terrain but that is not yet certain. Although blasting is not planned at present, it will be finally decided by the construction contractor based on ground conditions. Blasting activities produce seismic waves that could locally produce rockslides, landslides or mudslides in geologically unstable areas. Blasting in mountainous terrain during the winter and early spring could also set off avalanches in areas of a heavy snowpack.

Machinery operations. Movement of vehicles and equipment can compact soil, leading to losses in fertility and hindering the re-establishment of vegetation; particularly in wet weather conditions, it can also cause rutting, disturb soil, and increase the potential for erosion. The risk is higher in areas that have not previously been disturbed and in wet weather.

Opening borrow pits or other excavations to acquire fill material. Most or all material for construction of the Sebzor HPP and associated infrastructure will come from a small quarry operated by Pamir Energy just downstream of the powerhouse location; surface and shallow gravel/rock sources are exploited, with no blasting needed. Additional material will come from spoil generated at excavation sites. If additional material is needed, the contractor may need to buy rock and spoil or to exploit suitable deposits; the contractor will be required to verify the sites are properly permitted and managed. Without proper management and closure, quarries and borrow pits can cause significant erosion and, in steep terrain, landslides or mudslides.

All the foregoing activities and impacts would take place during construction. Operations and maintenance activities should not affect land not already used and protected, and such minor activity will not cause significant impacts.

Mitigation measures

To ensure that impacts on soil and geological conditions are avoided or minimized, Pamir Energy will require the contractor to undertake the following measures:

- Pamir Energy will complete the geotechnical studies recommended in the feasibility study in order to provide information to allow the design to more accurately account for seismic risk.
- No areas that will be affected have been identified as being high-risk for landslide and avalanche although the entire region is at high risk for seismicity and there are landslide-risk sites nearby. If Pamir Energy or the contractor identify area of particular concern for landslides, rockfall, or avalanche in the future, they will undertake geophysical investigations to determine the risk and to identify measures to reduce the risk to the hydropower plant, road, and local people.
- The contractor will mark the boundaries of construction zones and prohibit workers and equipment from straying beyond the boundaries. Within the boundaries, the contractor will control precipitation run-on and run-off as necessary to prevent erosion from affecting areas outside the demarcated construction zone and access roads. The contractor will ensure that proper drainage is maintained throughout construction and on permanent works so that run-on and run-off cannot destabilize slopes, damage vegetation, or erode topsoil.
- The contractor will carefully remove topsoil from locations where it is more than a few centimeters deep and store it in piles that are protected from erosion. If it will not be used for land restoration when construction is complete, it will be made available for local people to use in garden plots and other areas, with preference for people who received replacement land for land needed for the project.
- If additional soil and spoil is needed beyond that generated by the project, the contractor will take it only from licensed quarries/vendors, and/or ensure that any self-exploitation activities be undertaken with the same mitigations as described above, with full site restoration and reinstatement of vegetation when exploitation has ended.
- The contractor will manage spoil from excavations in a way that prevents damage outside the demarcated boundaries of the construction zone. The contractor will be prohibited from dumping spoil down hillsides, or onto living vegetation in any area, and will be required to place excess spoil in configurations that will be stable over the long term before demobilizing.
- The contractor will prepare permanent parking areas near all project infrastructure locations that Pamir Energy will need to visit regularly during routine operation and maintenance activities. This could include paving or covering areas with gravel, and will include permanent drainage features to control run-off and minimize erosion.
- When construction is complete, the contractor will remove piles and depressions from disturbed areas and will grade those areas to a stable contour, using as much spoil as

possible. The contractor will then spread stored topsoil over the site before planting of native species of grass and/or shrubs, or broadcasting seeds of such species. The contractor will monitor the success of the revegetation program and make repairs as needed to ensure the establishment of self-sustaining maximum ground cover before demobilization.

- The contractor will restore disturbed areas as soon as practicable once major construction activity in that area is complete, even if construction is continuing at other sites, and not wait until construction is complete at all locations before beginning the restoration program.
- Before the contractor is paid the final invoice and allowed to demobilize, the Supervision Consultant and Pamir Energy will inspect all construction sites and areas (including sand and gravel borrow areas and quarries) to verify that all areas disturbed by construction have been restored as required. If the contractor has not and does not take action to correct damages, the Supervision Consultant will have the option to employ a third party to restore damaged areas and reduce contractor payments by the amount paid to the third party.
- If blasting is required, it will be designed and supervised by licensed and authorized professionals. Explosives will be transported, stored, used, and debris managed in full compliance with national law and good international industry practice. Local communities will be consulted prior to blasting and warnings will be given before all blasting events.
- Pamir Energy will manage the quarry/borrow site in accordance with existing authorizations and will leave the site in stable and restored condition when operations are complete.
- If additional rock or earthen material is required from other sources, the contractor and/or Pamir Energy will verify the area is properly permitted and that operations are in compliance with applicable requirements

Impact summary and significance

The significance of potential impacts on soils, geology, and geohazards is summarized in Table 27. Besides the mitigations identified above, potential impacts will be heavily influenced by geologic conditions in the mountainous terrain, with much lower risk of landslides on the gentler terrain in the floodplain where infrastructure will be located but higher risk in or near the river. It is noted that the feasibility study recommended further geological studies at the dam site to facilitate designs that can resist likely seismic activity.

Table 27. Significance of potential impacts to soils and geohazards

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
Ground surface (rock & soil) on steep & moderate slopes affected	High	Significant erosion of topsoil, impaired ability to support vegetation, increased	High permanent	Major adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
by land-clearing		landslide potential, water pollution		
Ground surface (rock & soil) on steep & moderate slopes affected by construction activities	High	Minor erosion, minor increase in landslide risk	Medium temporary	Moderate adverse
Ground surface on riverbanks and riparian areas	High	Moderate to severe erosion of topsoil, water pollution	Medium temporary	Major adverse
Ground surface on slight slopes and flat land away from the river	Low-medium	Slight to moderate erosion of topsoil	Medium temporary	Minor to moderate adverse

7.1.4. Potential impacts on air quality

This section describes the potential impacts the project may have on air quality.

Activities with potential impacts on air quality

There will be no important sources of emissions of air pollutants except possibly generators to supply power for tools (in case the associated 18km transmission line is not completed before construction of the HPP begins). The primary activities that could generate air pollution include:

Movement of vehicles and equipment on the unpaved road and construction zones will create dust in dry weather. Dust can be a nuisance by interfering with driving and breathing and can damage vegetation and property. The amount of dust will depend on vehicle speed (higher speeds and larger size vehicles generate more dust), silt content (smaller particle sizes will increase dust generation compared to sand-sized particles), and the moisture content of the ground surface (wet vs dry). Very small particles can be carried relatively long distances by high winds, but usually dust settles within a few metes or tens of meters of where it is created.

Earthworks (clearing and grubbing) and excavations at construction sites will also create dust depending primarily on silt content and moisture. Again, the distance dust is carried would depend on particle size and wind; most dust would settle within a short distance of the site except under windy conditions.

Open piles of topsoil and spoil, and areas of bare earth at constructions sites can generate dust in windy and dry conditions.

Operation of combustion engines in vehicles, heavy equipment, generators, and other equipment will generate exhaust gases that contain air pollutants, including particulates (soot), sulfur dioxide, nitrogen oxides, and volatile organic compounds. These pollutants can affect visibility, create smog, and damage health. Even during peak levels of construction, the project will be using a relatively small number of vehicles and machines. Unless engines are not maintained properly, emissions can be expected to be low and within Tajikistan standards.

Sulfur hexafluoride (SF6) may leak from gas-insulated equipment, which is typically used as an insulator for electrical switching equipment and in cables, tubular transmission lines, and transformers. If gas-insulated equipment is installed and used at the substation, it could lead SF6 into the air. SF6 is a powerful greenhouse gas that must be managed carefully to avoid leaks and emissions.

Mitigation measures

Pamir Energy will require the contractor to implement the following measures during construction:

- Dampen roads and construction areas during dry conditions, as needed to prevent visible dust
- Dampen or cover soil and spoil stockpiles to eliminate dust generation
- Maintain all vehicles and other engines according to manufacturers' instructions, remove from ser vice any vehicle or other equipment that emits black smoke
- If any vehicle or other combustion engine emit black smoke, take it out of service until properly maintained and there are no longer visible emissions
- Include the cost and practicality of SF6 management in the analysis of options for dielectric equipment selection
- If SF6 is to be used, install and use only equipment with low leakage rate (>99% control), ensure equipment is properly labelled/marked, train staff in proper inspection and maintenance to prevent leakage, and manage decommissioning to minimize SF6 leakage.

Impact summary and significance

Table 28 summarizes the significance of potential impacts. Sensitivity of residents and visitors is classified as "high" since current air quality is generally good. In summary, impacts could be minor or moderate if not mitigated, but are expected to be negligible with proper dust and emissions control and low with even partial controls.

Table 28. Significance of potential impacts to air quality

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude of Impact and Duration*	*Significance*
Residents and visitors	High	Fugitive dust generation during construction and maintenance	Low temporary	Moderate adverse
		Vehicle and equipment emissions during construction and maintenance	Very low temporary	Minor adverse
Vegetation	Medium	Fugitive dust settling on plant and interfering with growth	Low temporary	Minor adverse
Global climate	Medium	SF6 emissions during operation of substation	Very low permanent	Negligible adverse

7.1.5. Potential impacts due to noise

Noise can be defined as unwanted sound. The sound pressure level emitted from any activity that can be heard by a receiver depends on a number of factors. The impact of the noise depends not only on the sound pressure level but on such things as the frequency spectrum, the duration of the noise, the time of day, the activity causing the noise, and the attitude of the receiver. All these aspects must be taken into account in assessing the impact of noise.

Noise levels in the project area are generally low, generally in the range of 30-50 decibels or even lower. Levels are higher near the river, where the water makes noise flowing over rocks, and along the road when vehicles pass. There are no major noise sources in the immediate vicinity other than from normal human activities.

Table 29 provides examples of common noises and the average subjective response. These levels have been used to interpret the noise levels discussed in this assessment and in establishing criteria for the assessment of impact significance.

Table 29. Typical sound pressure levels associated with common noise sources

Sound Pressure Level (dBA)	*Subjective Evaluation*	*Environment*	
		Outdoor	*Indoor*
140	Deafening	Jet aircraft at 25m	
130	Threshold of pain	Jet aircraft during take-off at a distance of 100m	
120	Threshold of feeling	Elevated train	Hard rock band
110		Jet flyover at 300m	Inside propeller plane
100	Very Loud	Power mower, motorcycle at 8m, car horn at 3m, crowd noise at football game	
90		Propeller plane flyover at 300m, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately Loud	Diesel truck (65kph) at 16m	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	Jet aircraft cabin during flight	Close conversation, vacuum cleaner, electric typewriter
60	Moderate	Air-conditioner condenser at 5m, near highway traffic	General office
50	Quiet		Private office
40		Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Bedroom, average residence (without TV and stereo)
20		Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of		

Sound Pressure Level (dBA)	*Subjective Evaluation*	*Environment*	
		Outdoor	*Indoor*
	hearing		

Adapted from Egan 1988 and from Ramsey and Sleeper, 1994.

Various standards exist for noise; this assessment uses those developed by the World Health Organization (WHO), which are shown in Table 30 and are also the same as standards established by Tajikistan.

Table 30. Noise level guidelines

Location	*General effect*	*Noise level, LAeq [dB] Time base [hours]*	
		Daytime (0700-2200)	*Night (2200-0700)*
Residential	Annoyance when outdoors	55	45
Industrial, commercial	Interference with hearing	70	70
Source: WHO 1999 and World Bank Group EHS General Guidelines 2007. Tajikistan limits match WHO: Sanitary Rules of the Republic of Tajikistan CH 2.2.4/2.1.8.562-96.			

The sensitivity of the receptor depends on the type of receptor and proximity to the noise. The persons nearest the construction zone would be those living in residences, the nearest of which is within 50 meters of the construction camp and so would be exposed on a daily basis for the entire duration of construction at nearby sites.

Sources of noise from the project:

The primary sources of noise will include:

- Machinery and equipment used during construction
- Vehicles moving along roads
- Workforce activities (voices, movement, etc.) at construction and maintenance sites during construction and maintenance
- Energized transmission line, especially in wet or humid weather
- Operating electrical equipment at the powerhouse and substation
- Mobile crusher at the quarry site, and blasting if that is necessary
- Workforce activities at the operating substation and occasional maintenance activities on the dam, intake, and powerhouse.

The loudest noise could be expected to come from vehicles, machinery, and equipment and from the construction camp. Table 31 gives typical noise levels a short distance from a typical construction site.

Table 31. Typical noise levels near construction sites

Equipment Description	*Average measured noise level @ 15m (L_{max} dBA*	*Equipment Description*	*Average measured noise level @ 15m (L_{max} dBA*
Auger Drill Rig	84	Excavator	81
Backhoe	78	Front End Loader	79
Chain Saw	84	Generator	81
Compressor (air)	78	Jackhammer	89
Concrete Mixer Truck	79	Man Lift	75
Concrete Pump Truck	81	Pickup Truck	75
Crane	81	Pneumatic Tools	85
Dozer	82	Scraper	84
Dump Truck	76		

Source: US Federal Highway Administration 2017

Distance reduces the sound level that can be heard, with an average of about six decibel (dB) reduction with each doubling of distance. Thus, noise levels from a backhoe (78dB at 15 meters) would be reduced to 72dB at 30 meters, 66db at 60 meters, 60db at 120 meters, and 54dB at 240 meters. Except for the nearest houses, this noise level would generally not exceed the 55dB standard during daytime hours, even if there were no intervening trees or obstructions and no other noises, such as the flowing river.

Mitigation measures

To reduce potential impacts from noise, the following measures will be required:

- The contractor will mobilize to work sites only between the hours of 0700 and 1900.
- The contractor will place a solid barrier at or near the fenceline for the construction camp, between the nearby house and the camp.
- When residences are within 0.5 kilometers of the corridor, the contractor will notify occupants before initiating construction works.
- If blasting is to take place, the contractor will notify nearby residents and post signs at least six hours prior to the time of blasting.
- If residences complain of noise, the contractor or Pamir Energy will monitor noise at the location of concern and implement mitigation measures if noise levels exceed the standards in Table 30or Tajikistan law.

- Ensure that sound mufflers and dampeners on vehicles and equipment are working properly, and remove from service any vehicles and equipment that emit excessive noise until noise levels are reduced.

Impact summary and significance

In general, noise will not be a problem if proper mitigation measures are implemented. Table 32 summarizes the significance of potential impacts.

Table 32. Significance of potential impacts due to noise

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
Both alternatives				
Residents and visitors	High	Construction noise	Medium temporary	Moderate to Major adverse
		Turbine/powerhouse noise during operation	Low permanent (very low away from building)	Negligible to minor adverse
Fauna within 100-200m	Medium to High	Construction noise	Low temporary	Minor adverse

7.1.6. Potential impact on water and hydrology

This section describes direct and indirect impacts of the project on surface water and groundwater resources, including the hydrology of flows in the Shokhdara River. Direct impacts on groundwater are not likely to occur, or to be minimal, due to the small-scale nature of the project at individual locations and because any groundwater at project locations is likely to be alluvial or colluvial in nature and thus part of the surface water system.

Two villages, Sebzor and Chagev, take small amounts of water from the river for irrigation. All other villages and households use water from springs and tributaries for household use and irrigation – tributaries have the same names as the villages and are shown in Figure 28, along with the number of households in each village. None of the tributaries contributes a significant amount of water to the river. Irrigation diversions are made in the summer, when flows are far in excess of what is needed for power generation and environmental flow; for that reason, there will be no effect on irrigation or other uses.

The reservoir will increase the average water level about 1.5-2.5 meters, from an elevation of about 2526 meters above sea level (masl) in winter at present to the crest of the spillway at 2528masl and a level of up to about 2528.5-2829masl during annual summer floods. The crest will be about three meters higher than the riverbed, which would represent the maximum water depth at normal operating level. This compares to the water elevation during a 100-year return interval flood of about 2530masl (with a flow rate of 350m^3/sec) and a 1,000-year return interval flood of about 2531masl (450m^3/sec). Only about 0.5 hectares of arable land will be affected by flooding by the reservoir at normal operating level.

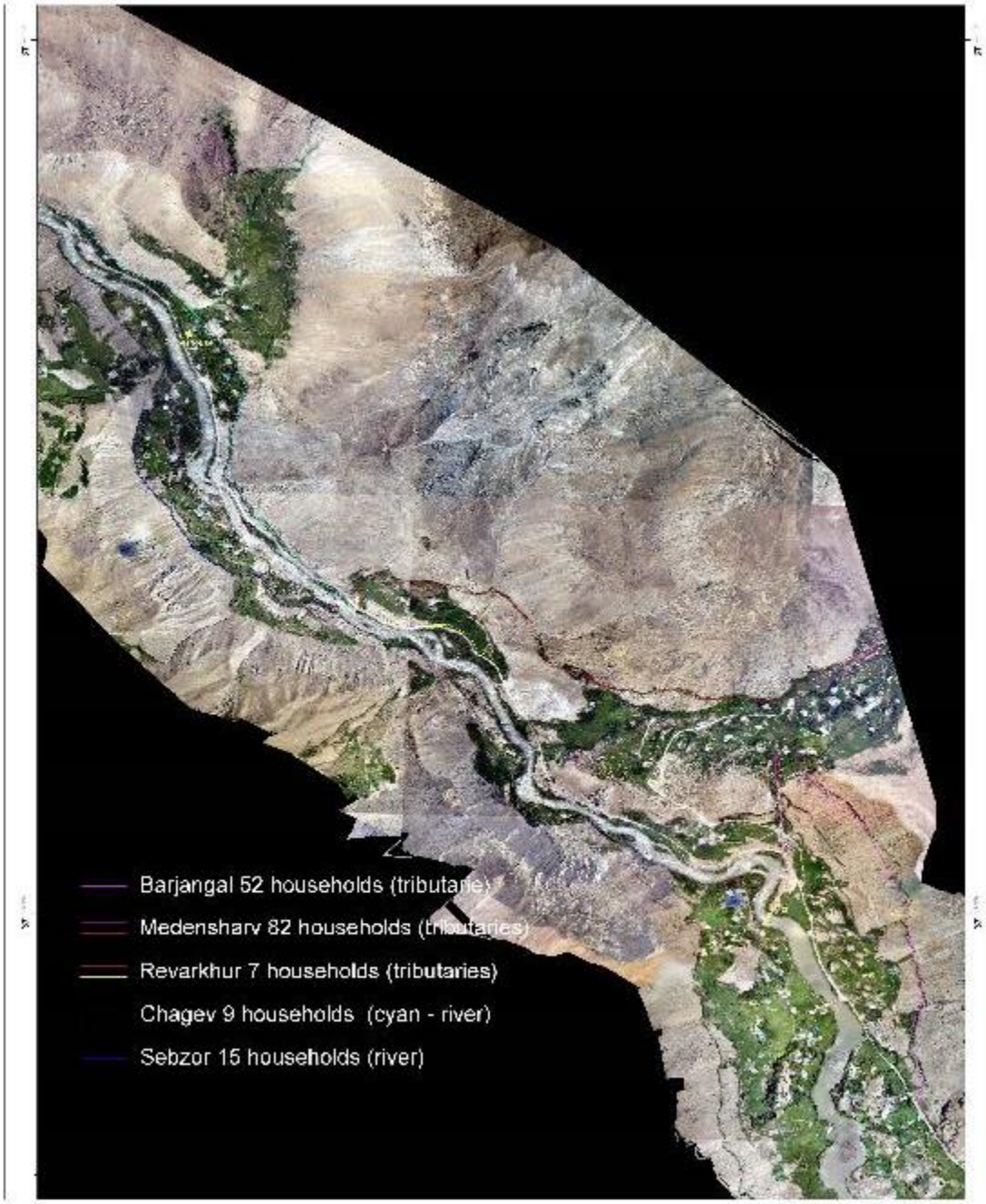

Figure 28. Tributaries and villages within the affected reach

Activities with potential impacts on surface water

Construction activities in and near the river could contaminate the water.

Construction activities in the river (cofferdams, dam, intake, tailrace) could contaminate the water through disturbance of the riverbed and riverbanks, mismanagement of excavated materials, and from spills or leaks from equipment, and could contaminate the riverbed through spills or leaks. Increased solids and turbidity from ground and riverbed disturbance, and from mismanagement of excavated rock and silt, could affect its use by humans or wildlife and would affect aquatic habitat. Spills or leaks of fuel or other materials into the water or into the dry riverbed during construction

could contaminate water and affect its use and also affect aquatic organisms.

Construction activities near the river (sand trap, penstock, tailrace, substation) could contaminate the river through disturbance of the riverbanks and small tributary streams, mismanagement of excavated materials, and from spills or leaks from equipment. The impacts would be the same as for work in the river but could also affect small tributaries with limited potential for recovery.

Spills of fuel, lubricants, paints, or other materials could contaminate surface water and/or groundwater directly or could contaminate soils that are then eroded into surface water.

Concrete works could contaminate water and contribute excess alkalinity, which would make it less useful by people or wildlife and also affect aquatic organisms.

Withdrawal of water for construction purposes (for washing equipment, for use in cement, etc.) could reduce availability of water for other purposes. Consumptive use of water is not considered to be an issue for the project, as the region has adequate water supplies and construction will require only small amounts of water for concrete and other minor uses.

Diversion of water into the penstock during operations will reduce flow in the river for 50 percent of the time of time during an average year. Up to 10.5 cubic meters per second (m^3/sec) will be diverted into the penstock to be carried to the powerhouse for power generation, then returned to the river through the tailrace about 3.0 kilometers downstream of the dam and intake. A minimum of 3.0 m^3/sec will pass over the weir at all times, even when it means less power can be generated.

Installation of a dam and maintenance of a higher water level will result in increased flooding of nearby land in the floodplain during times of high water. The extent of such flooding will depend on the magnitude of flow in the river and will affect recreation and grazing land but should not affect houses.

Ошибка! Источник ссылки не найден.~~Figure 29~~ shows the normal operating water level of the reservoir (2528.5-2529masl) and the small amounts of land that will be inundated. **Ошибка! Источник ссылки не найден.**~~Figure 30~~ shows the maximum level that water will reach from the 100-year return interval flood in the reservoir area. As can be seen, water will not reach any houses. A low dyke about 130 meters long and 1.5 meters high will protect some areas as needed to prevent impacts on houses and grazing land from all but the most extreme floods (the top of the dyke would be at an elevation that would be reached by a flood event that could be expected to return in 1,000 years—see below in next section). The dykes will protect at least one house and a school from flooding, but it was decided they would be relocated as a precaution. In addition, several other houses will be protected from floods that would currently affect them.

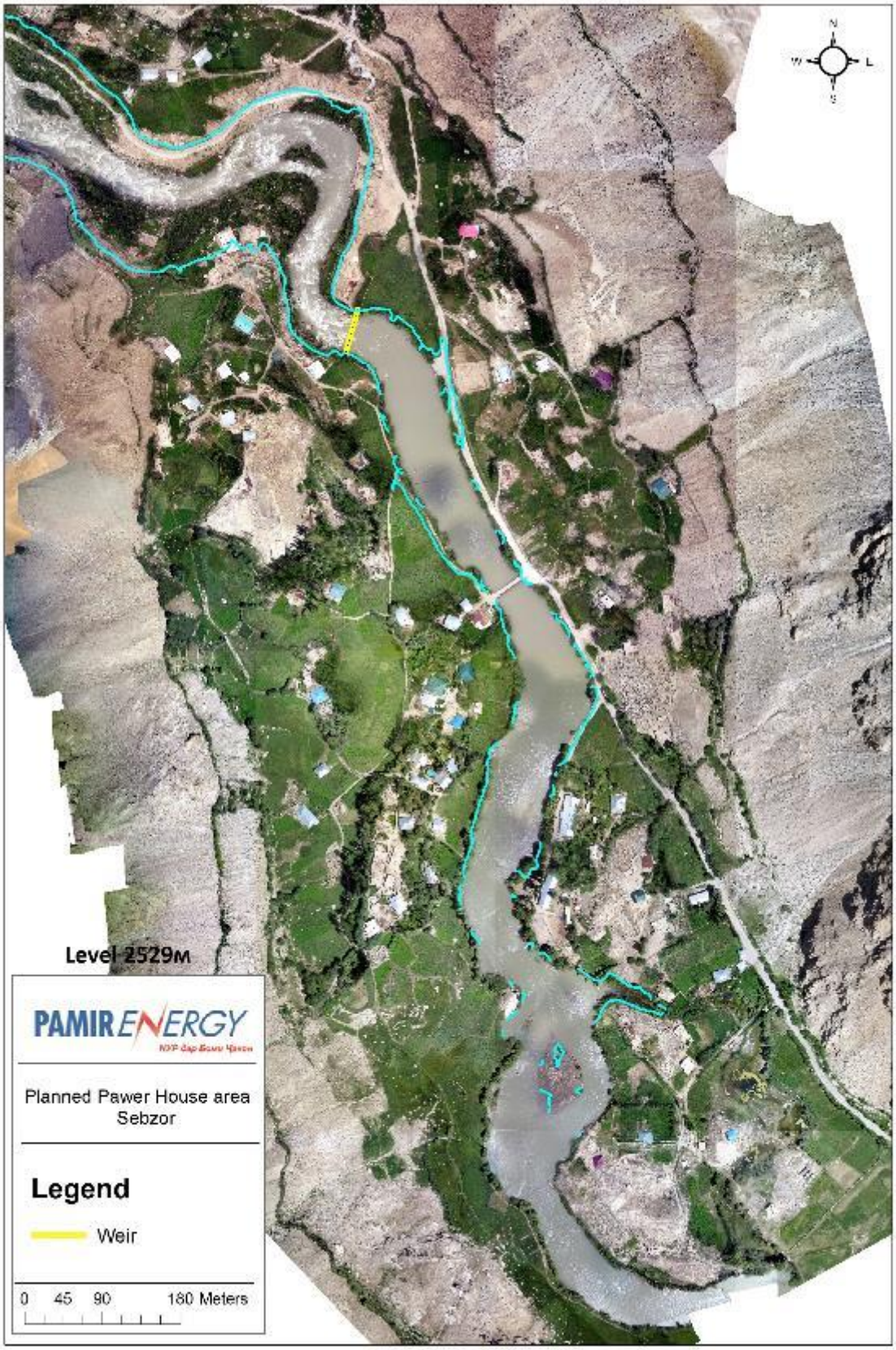

Figure 29. Water level in reservoir at normal operating level (2529masl)

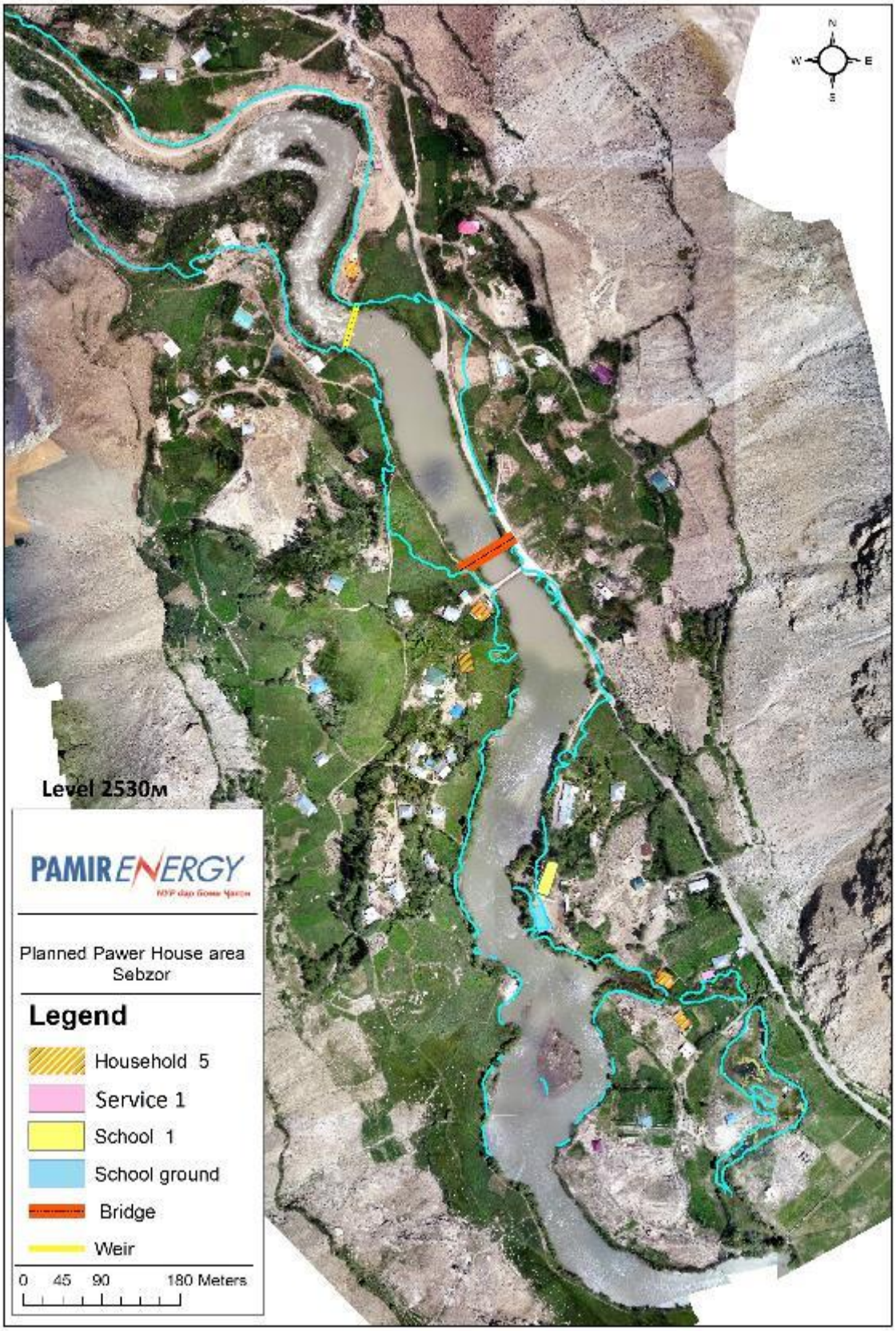

Figure 30. Water levels from 100-year return flood events (2530masl)

The sensitivity of surface and groundwater is shown in Table 33.

Table 33. General sensitivity of the water environment

Sensitivity	*Examples*
High	- River that supports fish with conservation status or provides major fisheries resources - Smaller river with good water quality (no pollution sources) - Surface or groundwater serves as source of household water
Medium	- River that supports common fish or provides resource for small-scale fishing - River with fair water quality (occasional pollution sources) - Surface or groundwater used for industry or agriculture
Low	- Smaller river that does not support fish resources. - Waters with poor water quality (pollution discharge sources). - Intermittent or no use of surface or groundwater by humans

In general, the Shokhdara River is considered to be medium-high sensitivity. It does not support fish species that are major food sources or that are of conservation concern. However, it has good water quality and provides some water for irrigation.

Mitigation measures

The contractor will be required to implement the following measures during construction, and will implement the relevant measures during operation and maintenance:

- Fueling operations and other uses of fuels and hazardous materials will take place at least 50 meters from the river or any other permanent or ephemeral stream. Fueling and vehicle maintenance will take place over drip trays or other impermeable surfaces.
- Small ephemeral or permanent streams will be diverted around construction areas or placed in temporary conduits until construction is complete so they do not become silt-laden before discharging into the Shokhdara River.
- Sanitary facilities (toilets) will be provided or otherwise available at or near all work locations. Workers will be strictly required to use the facilities at all times, with penalties for violations. If vendors provide portable toilets or sewage disposal, the contactor will verify the vendor has proper permits. Toilets will be at least 50 meters from the river.
- Sediment controls will be placed at the downhill/downstream boundary of upland construction zones when there is a risk that sediment-laden run-off could leave the construction or camp site and either damage vegetation or reach the river. Such controls could include sedimentation ponds, silt fences, and/or other measures.
- Runon and runoff will be diverted around or otherwise prevented from coming into contact with concrete, including waste concrete, until concrete is fully cured. Waste concrete will be promptly removed from the construction site and disposed or used where it cannot affect surface or ground water.
- Local surface water may not be used to wash trucks and equipment, including especially equipment, batching, and ready-mix truck washing and cleaning except at distances at

least 50 meters from the river, and with barriers placed as needed to prevent wash-water from reaching the river.

- Washwater from washing trucks, equipment, or concrete will be contained and evaporated, taken for discharge to a sewer, or otherwise managed so it does not contaminate soil or vegetation.
- All vehicles and mobile equipment will have spill cleanup kits, and drivers will be trained in the use of the kits.
- Herbicides will not be used for vegetation control, nor insecticides or other pesticides for vermin control.
- A small dyke will be constructed near the dam to protect low-lying grazing land from being inundated during small floods caused by high flows in the river. They will also protect several houses from floods that would currently affect them.
- An environmental flow of at least 3.0m^3/sec will be allowed to pass the dam and remain in the river between the weir and the tailrace at all times. Flows will be measured in the fish pass and downstream of the weir with devices capable of continuous measurement and electronic recording of results (that is, not only with visual observation or manual recording). If instruments are used to measure water level in the river and calculate flows, water levels and flow rates will be calibrated at least once per year. The monitoring point will be within about 100 meters downstream of the dam and confirmed as being suitable for flow measurement by an independent hydrologist.

  Based on available hydrological data, flows in the river are sufficient to allow full generation capacity to be reached over 55 percent of the time (that is, flows exceed about 13.3m^3/sec about that percentage of the time). During the remaining 45 percent of the time (mostly from November through April), at least some power would be generated, including half or more of capacity for over 99 percent of the time (based on flows calculated to exceed 7.8m^3/sec over 99 percent). Far less than one percent of the time would flows be so low that no electricity would be generated.

Impact summary and significance

The significance of potential impacts to surface and groundwater resources is summarized in0. In summary, impacts will be negligible with proper mitigation.

Table 34. Significance of potential impacts on surface water and groundwater

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
Shokhdara River	Medium-High	Sedimentation during instream or upland works	High temporary	Major adverse
		Contamination from spills or leaks or other sources (washwater, concrete, etc.)	Medium temporary	Moderate to Major adverse
		Contamination from sanitary wastes	Low temporary	Moderate to minor adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
		Reduced flows (impacts discussed for aquatic habitat/ organisms and human use)	Medium permanent	Moderate to major adverse
		Increased flooding near reservoir	Low adverse	Minor to Moderate adverse
Small ephemeral and permanent tributaries to Shokhdara River	High	Sedimentation from erosion due to compaction and soil disturbance	Medium temporary or permanent	Moderate to Major adverse
		Contamination from spills	High temporary	Major adverse
		Contamination from herbicides, pesticides	No change	None
		Contamination from herbicides	No change	None
Groundwater and springs	Medium to High	Reduced recharge due to soil compaction	Very low temporary	Negligible adverse
		Contamination from spills	Very low permanent	Minor adverse
		Reduced availability due to withdrawals	Very low permanent	None

7.1.7. Potential impacts on climate and from climate change

Impacts due to climate change. Glaciers occupy about six percent of Tajikistan's territory and the country is considered the main glacial center of Central Asia[4]. These glaciers retain water and control flows in major rivers, and also have a role in regulating the climate. In the twentieth century, ice volume in glaciers, particularly smaller ones, declined about 2.5 percent. Continuing higher temperatures and accelerated melting, exacerbated by changes in precipitation patterns so that more is falling in late winter and spring, will cause more and more intense flash floods as well as increased avalanches, landslides, and mudslides. In the Panj River basin, which includes the Shokhdara River, modeling suggests that increases in air temperature and the consequent increase in snow/ice melt rates will result in higher annual mean river discharges through about 2060, including 100-year return interval floods, after which flows will decrease as the small glaciers that feed the basin begin to disappear (Kure, *et al.* 2013). More mountainous parts of GBAO and prime agricultural valleys are considered the most vulnerable to climate change (Heltberg and Bonch-Osmolovskiy 2011).

The headwaters of the Shokhdara River and tributaries have several glacial lakes. The Aga Khan Agency for Habitat has modeled a glacial lake outburst flow (GLOF) and determined that flows at the Sebzor HPP approximate the flows that would be expected from the 1000-year return interval flood,

[4] United Nations Development Program, Climate Change Adaptation, Tajikistan. https://www.adaptation-undp.org/explore/central-asia/tajikistan

which would be about 450 m^3/sec. The extent of such flooding is shown in **Ошибка! Источник ссылки не найден.**~~Figure 31~~.

Since the dam will be designed to withstand at least that flow rate, even a GLOF would not affect the project except temporarily. The reservoir will be only three feet deep at the weir and of very limited extent (only 700 meters long and 10-3 meters wide). The downstream water level from even an instantaneous catastrophic failure of the dam would be three meters at the dam, and the spreading water would reduce the leading peak to a meter or less within a few tens or hundreds of meters downstream. This would be expected to cause minimal damage. Further modeling of impacts on the dam, or of dam failure, is not considered necessary.

Changes in climatic conditions would have several implications for the project, however. Primary impacts could be on the project itself, with some increase in effects that would be due to the project (e.g., floods) on people as well.

- The dam will need to withstand more intense floods. This is being accommodated in the design, which was informed by modeling results showing various return interval floods. The final design is being based on the ability to withstand a flood of at least 450 m^3/sec, which is estimated to have a return interval of at least 1000 years, far beyond the expected life of the project.
- As noted in the previous section, the dam will impound a small reservoir, and these together will have a small effect on floods in the immediate vicinity. This would not be an issue for major floods, which would involve much larger flows than the dam could affect. A low dyke will be constructed in low areas to prevent such floods from affecting houses even temporarily.
- The dam's expected life of up to about 50 years is too short for future decreases in flow caused by glacial melting to have an effect on power generation.

Carbon emissions resulting from the project, including the construction phase, will be insignificant and could have no role in future climate change.

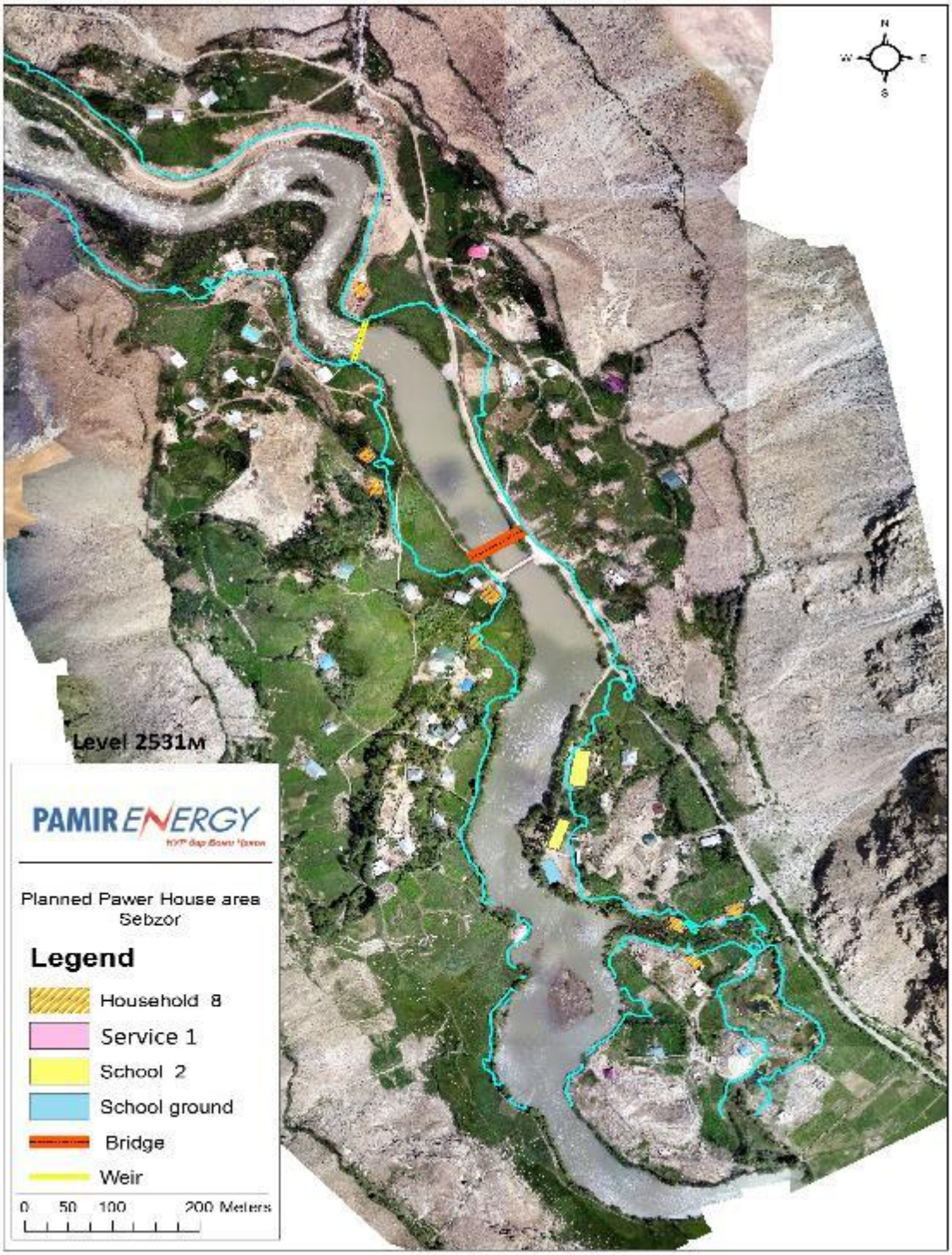

Figure 31. Flooding from 1,000-year return flood event, or from GLOF event (2531 masl)

7.2. Potential impacts on biological environment

This section describes the potential impact of construction and operation of the transmission line and substation on biodiversity, including flora, fauna, and habitats.

7.2.1. Potential impacts on flora and habitats

Activities with potential impacts on flora and habitats

The primary project activities with the greatest potential to impact habitats, flora, and fauna include establishment of construction areas project infrastructure sites, construction activities, and reduction in flows of the river during operation.

Clearing and Construction. Clearing of the land at areas to be used for construction and infrastructure will involve removal of most or all vegetation to the ground and will transform floral composition (depending on the characteristics of existing vegetation, which is sparse in many places), topographic features, and the land itself. Habitat alteration could include destruction or fragmentation of forest habitat, loss of wildlife feeding/hunting and breeding areas, and introduction of nonnative invasive plant species. In addition, animals and plants could be injured or crushed, and individual animals could be disturbed by noise and visual disturbance due to the presence of machinery, construction workers, transmission towers, and associated equipment. Some impacts would be long-term or permanent (for example, tree removal, use of land for project infrastructure, reduction in flows, etc.) and some would be temporary (for example, vegetation removal/crushing in construction preparation areas, human activities during construction and maintenance).

As described in Chapter 6, the area to be affected is very small and has limited biodiversity value. As was shown in Table 22, only small areas currently support any sort of habitat, including river and riparian areas (1 hectare), some arable lands (3 hectares), orchards (1 hectares), and barren land (2 hectares. All told, over 2,500 trees and other terrestrial plants will need to be cut, including both riparian trees as well as fruit and other productive trees. Owners will be compensated at replacement value, and also will be provided with replacement seedlings.

As noted in Chapter 6, however, there is limited or no information on aquatic habitat and flora. However, the area that will be affected by construction of the weir and penstock, and the subsequent reduction in flows, will occur in a river reach that is only three kilometers long and that is similar to upstream and downstream reaches. A program to characterize aquatic habitat has been initiated, and additional mitigation measures will be implemented if aquatic habitats are determined to be distinctive or to have significant biodiversity value.

Invasive species

Invasive species tend to occupy disturbed places after vegetation clearing, most significantly when it is cleared to the ground. It is likely that areas to be affected, which are already disturbed, support invasive species but this has not been confirmed. In the areas near the transmission line and substation at least two invasive species are known.

In order to decrease risk of spread of invasive plants, land that is disturbed only temporarily will be seeded or planted with native plants when construction is complete. In addition, they will be inspected by a qualified specialist and if invasive species are found, they will be removed manually

and the area re-seeded with native species.

Natural and critical habitats

As noted in Chapter 6, the World Bank places special requirements on projects if they may have impacts on habitat that is considered to be "natural habitat" or "critical habitat". As described there, none of the terrestrial or riparian habitat could be considered valuable habitat for flora or fauna, as it is already significantly modified and not supporting its original assemblages of plant and animal species. Therefore, impacts on habitat will not be significant. As noted, it is considered unlikely that aquatic habitat would be considered "critical" or "natural" since the road, bridge, and constant human activities will have led to significant changes in species and assemblages. However, the aquatic habitat is little understood at present and require further study. Studies are being initiated, with further action to be taken if it is determined aquatic habitats have significant biodiversity value.

Potential impacts on plant species of conservation concern

The likelihood of encountering any plant species of conservation concern is considered to be low. Dwarf everlasting, the only known plant species of conservation concern, prefers dryer soil than would occur near the river, where all construction activities will take place, and so is unlikely to be present.

Significance of Potential Impacts on Flora and Habitats

Two main criteria were used in considering the potential impact on flora and habitat: the area of impact and the sensitivity of impacted area, including the likely presence of species and populations of conservation concern. Sensitivity for flora and habitats is shown in Table 35.

Table 35. Flora and habitat sensitivity criteria

Sensitivity	*Criteria*
Flora	
High	– Protected area – Largely intact (nonfragmented) forests – Small areas surrounding trees or shrubs of conservation concern in forests or non-forested land in agricultural or other disturbed areas
Medium	– Fragmented and modified forests with at least partly intact ecosystems, mostly intact shrublands – Orchards
Low	– Used and unused agricultural land, grazing land/grasslands – Mostly rocky or barren land, overgrazed grasslands – Areas of urban intrusion or uncontrolled development in rural areas
Habitats	
High	– Critical habitat – Natural habitat not significantly fragmented
Medium	– Significantly fragmented natural habitat – Modified habitats supporting populations/species of conservation concern
Low	– Severely degraded modified forest habitats – Agricultural land and other nonforested land of secondary vegetation (except isolated plant specimens of conservation concern

It is possible that specimens or small populations of Dwarf everlasting (*Helichrysum arenarium)*, which is listed as Near-Threatened by IUCN, occur on some areas that will be affected. This is considered unlikely since most areas are heavily modified, and the species prefers dryer ground that will typically be affected by the project. The expected impact from spreading of invasive species is considered to be low, since there will be no import of seeds or seedlings and proper mitigation will reduce the risk even further.

Table 36. Potential impacts on flora and habitats

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Flora				
Common tree & shrub species	Medium	Trees and other plants will be cut and cleared	Low permanent	Moderate adverse
Dwarf everlasting (*Helichrysum arenarium*)	High	Destruction of near-threatened flower species	Low permanent	Minor adverse
Orchards	High	Trees will be cut	Medium permanent	Major adverse
Terrestrial habitat				
Critical habitat	High	Reduction in populations of one or more flora/fauna species of conservation concern, adverse impacts on habitat	No change	None
Natural habitat	Medium-High	Loss of or other impact on natural habitat	No change	None
Modified habitat	Medium-Low	Reduction in biodiversity value	Low permanent	Minor adverse
Aquatic habitat				
Critical habitat	High	Reduction in populations of one or more flora/fauna species of conservation concern, adverse impacts on habitat	No change	None
Natural habitat	Medium-High	Loss of or other impact on natural habitat	Medium or no change	Moderate to none
Modified	Medium-Low	Reduction in biodiversity value	Low permanent	Minor adverse

Mitigation measures for flora and habitats

Even though the project will not have significant impacts on plant species or populations of conservation concern, on protected areas, or on forest habitats other than very locally, the significant deforestation and general habitat degradation that has been experienced makes any remaining trees and habitat even more valuable. Therefore, measures to avoid or minimize impacts will be required. These include:

- Prior to construction, a team of qualified biologists will survey the areas to be affected in order to identify and mark locations where construction and vegetation cutting could affect valuable habitats or specimens of Dwarf everlasting (*Helichrysum arenarium*), the only plant species of conservation concern known to occur in the area. The contractor will be required to avoid such areas whenever possible unless there are no feasible alternatives, and the Supervision Consultant agrees there are no feasible alternative location(s). If specimens or populations of Everlasting spp. (*Helichrysum arenarium)* are found, Pamir Energy will plant at least 10 specimens in an appropriate location for every specimen that has to be destroyed by the project (seeds are reported to be commercially available, and transplanting may be an option) and will protect the plants to maturity.
- The contractor will demarcate the boundaries of areas where construction activities will take place and will limit disturbance to within the boundaries. In addition, the contractor will train workers not to stray onto property, including any forests, that is outside marked areas and will prohibit workers from collecting or damaging plants or the ground surface.
- If there are isolated specimens of protected tree species that have to be cut, the contractor or Pamir Energy will plant at least five trees of the same species outside the affected area. If other trees have to be cut, they will plant at least five trees of the same species outside the affected area; for privately owned trees, Pamir Energy will provide owners with at least five trees of the same species in addition to cash compensation for lost productivity. The success of such plantings will be monitored until specimen are well-established, with replanting as needed to replace unsuccessful specimens.
- The contractor will control precipitation run-on and run-on as necessary to prevent erosion from affecting areas outside the demarcated construction zones or access roads. The contractor will ensure that proper drainage is maintained throughout construction so that it does not destabilize slopes or topsoil and affect vegetation and habitat.
- The contractor will be required to manage spoil from excavations in a way that prevents damage outside the marked construction area boundaries. The contractor will be prohibited from dumping spoil down hillsides, or onto living vegetation in any area, and will be required to return excess spoil to the site once construction is complete. The contractor will remove piles and depressions and will grade the area to its approximate original contour, then spread topsoil over the site before planting or broadcasting seeds of native species of grass and/or shrubs. Finally, the contractor will monitor the success of the re-vegetation program and to make repairs as needed to ensure the establishment of self-sustaining maximum ground cover before demobilization.
- The contractor will be required to restore all areas disturbed by construction as soon as practicable once construction in that area is complete, and not to wait until construction is complete across the entire site. Pamir Energy will monitor site restoration at least once per quarter during construction and require remedial action as needed.
- The contractor will plant fast-growing trees or shrubs of native species between project infrastructure and the road or houses.
- Before the contractor is paid the final invoice and allowed to demobilize, Pamir Energy will inspect all construction sites and areas to verify that project footprints, temporary

roads, assembly and support areas, temporary roads, and all other areas disturbed by construction have been restored as required and the vegetation cover is established and self-sustaining. Pamir Energy will require remedial action as required, and if the contractor does not take action and correct damages, Pamir Energy will employ a third party to restore damaged areas and reduce contractor payments by the amount paid to the third party.

- Prior to construction, Pamir Energy will appoint a qualified consultant to characterize aquatic habitat, flora, and fauna (fish, macroinvertebrates) in the reservoir area, between the weir and powerhouse, and downstream of the powerhouse. Surveys will include:
  - Characterization and mapping of habitat and identification of differences in habitat in the areas to be surveyed.
  - Verification of the four fish species known to inhabit the river, and identification of additional species, if any.
  - Identification and characterization of macroinvertebrates and other aquatic species, including aquatic plants.

  If these studies determine there are species of conservation concern, or that aquatic habitat in river reaches to be affected could be considered "natural habitat" as defined by the World Bank, Pamir Energy will develop and implement additional mitigation measures to avoid or reduce impacts and/or to offset the loss of habitat.

7.2.2. Potential impacts on fauna

Construction projects have the potential to cause direct and indirect impacts on fauna as a result of short-term construction and maintenance activities and the long-term presence of project infrastructure. Construction and maintenance works will involve cutting and clearing vegetation, excavating soils, moving vehicles and equipment over roads, terrain, and even streams, and general human activities. These in turn can lead to:

Injury or death of animals. Construction activities can crush, suffocate, remove from their habitats, destroy nests, and otherwise affect animals. These usually result in the immediate or eventual death of affected animals. Such impacts can be significant if they involve large numbers of organisms, occur on a regular basis, or affect animal populations/species that are particularly sensitive, unable to reasonably compensate for losses, or already low in numbers.

Destruction or damage to habitat, including nesting areas, breeding areas, or important proportions of their habitat can lead to the death of affected animals, or to the movement of animals to other areas, where they may not survive.

Migration from home territories, either permanently or temporarily, can be caused by noise, dust, traffic and vehicles/machinery operating onsite, and project workers. Construction will disturb relatively small areas, so animals would need to migrate only short distances and for limited times; however, in their new territories, they would be more vulnerable to predation and would have to compete with existing populations. After completion of work, when all sources of disturbance are removed, most surviving animals can return to traditional habitats except in the specific locations where infrastructure is now located.

Habitat fragmentation, which is related to vegetation clearance. This has a long-term impact by isolating populations and limiting movements of individual organisms. This is not an issue here, since habitat is already significantly fragmented.

Impacts during construction

Direct impacts. Few or no large mammals, reptiles, and amphibians are likely to occur in the area that will be affected by construction due to the presence of the road and ongoing human activity. Any that do remain, such as Stone marten and Least weasel (both categorized as Near Threatened by the International Union for the Conservation of Nature), will be able to avoid direct impacts since they can readily move away from construction zones to adjacent areas although, as noted, even those that move may not survive. However, smaller animals such as shrews and moles, although they could move if given time, may not be able to relocate in time to avoid construction activities. In order to minimize the impacts on such mammals, all areas that could be affected, and any nearby land that could support fauna, will be surveyed by a qualified biologist to identify whether there any previously unknown fauna species of conservation concern that could be affected. This would include Eurasian otter (*Lutra lutra*), which is considered Near Threatened by IUCN and which could occur in the river.

Impacts caused by habitat loss. The main impact of the project on animals is likely to be habitat loss due to land-clearing and vegetation cutting. It is not clear that any valuable habitat would be affected; if so, it would be a tiny fraction of similar and higher-value habitat in the region.

The forest fragments that will be affected provide habitat for birds, but local ornithological diversity in most of these mostly fragmented forest areas is lower than in less affected forests and not of exceptional importance in terms of the number of bird species or the density of birds in various species.

A possible exception could be species of owls or bats that nest and live in trees or structures. Owls and bats prefer mature trees with hollows, which they use for nesting and roosting. Construction will need to cut such trees in small areas.

Several measures will be taken to avoid or minimize even minor impacts. As noted above, a biologist will conduct a survey prior to construction, and one result will be identification of any mature trees that are used by bats or owls for roosting or nesting. If they are, cutting of those trees will be avoided, or at least postponed until young birds/bats have successfully left their nests in late spring or summer, and/or bats have left their roosts at the end of winter hibernation. Construction would not take place until hibernating bats had left and young birds and bats had left their nests. In addition, if trees that support bat hibernation, roosting, or nesting do have to be cut, bat boxes will be placed nearby to provide alternative living sites, with two or more boxes placed for every tree cut. ***Noise impacts***. Noise from construction activities will disturb animals for tens of hundreds of meters from the source of the noise. It will disrupt animals as they perform their daily activities and could affect their ability to find food. This cannot be avoided. However, it is not anticipated the areas of concern support important number or species, and the preconstruction surveys will identify any issues of concern. In addition, it is important to note that many or most animal species are nocturnal; since all construction will be during daylight hours, noise will have little impact on these species.

Other impacts. The presence of humans is inherently disruptive to animal behavior and can result in major impacts on individuals and local populations. If workers go off construction sites, and if they are allowed to hunt or collect animal specimens, there could be significant local impacts. This will be prevented by requiring the contractor to adopt and enforce a strict code of conduct that prohibits hunting, going beyond construction sites, and disturbing animals for any reason.

Impacts during operation

The primary impact that could occur during operation would be due to the interruption of migration paths for fish in the river and loss of habitat due to lower flow in the three-kilometer river reach in which flows will be reduced. Several factors should prevent any impacts:

- A fish pass will be designed to accommodate upstream and downstream migration of fish. The design will be based on the two migratory species in the river. An independent expert will review and verify the adequacy of the design.

- Migration occurs in May-June and in August-September, which are months in which average flows are well over 20 m^3/sec (from mid-May until mid-October), so half or more of the normal flow will remain in the river, which should not affect fish.

In addition, aquatic habitat could be smothered by sediment during sluicing operations if the operations are not managed properly. The primary risk would be in the three-kilometer river reach in which flows will be reduced. Fish could also be drawn into the intake, and if they entered the penstock could not survive passage through the turbines.

Mitigation Measures

Although impacts are not expected to be significant, Pamir Energy will implement a number of mitigation measures to verify the conclusions of the ESIA and to overcome any residual or unexpected impacts.

- As noted previously, Pamir Energy will ensure that biodiversity experts conduct preconstruction surveys to inventory the presence of flora and fauna species on and near areas that will be affected and advise the contractor of areas that must or should be avoided permanently or temporarily. Surveys will include:
  - Identifying and mapping the current presence or signs of past presence of species of conservation concern, in particular reptiles and amphibians, about which less is known than other families.
  - Identifying, marking, and mapping mature trees with cavities that support or have supported bat hibernation or roosting, and/or nesting by owls or bats.
  - Identifying and mapping past and present nests of raptors.
  - Characterizing aquatic habitat and aquatic species and assemblages, including fish, amphibians, macroinvertebrates, aquatic plants, etc.

  If these studies determine there are species of conservation concern, Pamir Energy will develop and implement additional mitigation measures to avoid or reduce impacts.

- If cutting and/or construction within 100 meters of mature trees with cavities used by owls or bats cannot be avoided, cutting and/or construction within 100 meters will be

delayed until after bats have emerged from hibernation, young owlets and bats have permanently left the nests, and roosts are not being actively used.

- If mature trees with hollows that support or have supported hibernating or nesting bats must be cut, the contractor will place “bat boxes”, approved by a qualified expert, in a place approved by the expert. Pamir Energy will replace bat boxes as needed for the first five years of operation. At least two bat boxes will be placed for each bat-supporting tree that is cut.
- The contractor will clearly mark construction zones and train workers to remain within demarcated areas. Within such zones, specific areas will be designated for washing, eating, smoking, toilets, and other personal activities, and such activities will be confined to those areas. The contractor must establish and enforce rules to prohibit workers from hunting, exploiting, feeding, or disturbing animals and birds, and must train workers in those rules and enforce penalties for violations, including dismissal.
- The contractor must place ramps of some sort (e.g., logs or boards placed in the excavation so they reach the top) in excavations that remain open at night to allow small animals to escape if they fall into the excavation.
- The contractor will adopt rules against disturbing or destroying plants and wildlife, and provide induction training for workers these rules. The contractor will enforce these rules with appropriate penalties, up to and including dismissal.
- Pamir Energy will require that a fish pass be included in the weir design, suitable for passage of the False Osman and the Marinka, and that the design is approved by an independent expert.
- The intake structure will include a screen to prevent the entry of fish into the penstock. The size of the screen has not yet been determined, but is tentatively planned to be the range of 40 – 60mm.
- Pamir Energy will release a minimum of 3m^3/sec at all times, including 1.25 m^3/sec through the fish pass, even when the plant is not operating at full capacity due to lack of water. This will be monitored continuously in the fish pass and in the downstream river within about 100 meters of the weir. Rating curves to relate water elevation to river flow will be calibrated at least once per year.
- Pamir Energy will design rules to govern the release of sediment from the sand trap. These will require releases of sediment only during periods of high flow when sediment will be washed downstream and not settle in the river reach with reduced flows, and monitoring to verify that sediment is not accumulating in the reduced-flow river reach.
- Pamir Energy will appoint a qualified consultant to monitor fish and aquatic habitat in the river during migration seasons for at least two years after commissioning. The monitoring program will include surveys in the river and the fish pass to verify that fish can migrate upstream and downstream, and reports will include appropriate recommendations for refinements to the program, including extending the program for additional seasons if results are not definitive. The results of this study will determine whether a more detailed management plan is needed for ensuring adequate environmental flows for some months or the entire year.

Impact summary and significance

Overall, the impacts on fauna that are described above are expected to be minor, and mitigation will reduce them even more. Significance of impacts on fauna are shown in Table 37.

Table 37. Summary of potential impacts on fauna

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Terrestrial fauna	Medium-low	Animal death due to crushing or direct impact	Low permanent	Minor adverse
		Abandonment of home territories due to construction disturbance	Low temporary	Minor adverse
		Nest abandonment/disruption of breeding animals due to construction disturbance	Low temporary	Minor adverse
		Worker interference with animals or nests	Very low temporary	Negligible adverse
Owls and bats	Medium	Loss of hibernating and nesting places in mature trees (or buildings, for bats)	Low permanent	Minor adverse
Fish	Medium	Interruption of migration (thus preventing upstream spawning)	Low permanent	Minor adverse
		Lost breeding habitat due to reduction in flow	Low permanent	Minor adverse
		Death of fish due by being drawn into the penstock and carried to turbines	Low permanent	Minor adverse
		Smothered habitat due to sedimentation during construction or sluicing	Low temporary	Minor adverse

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7.3. Potential Impacts on Socioeconomic Conditions

This section identifies and assesses the potential impacts the project will have on socioeconomic conditions – that is, on people and the economy. As is also true for environment impacts, socioeconomic impacts can occur during construction and/or operation, and can be both - positive and negative. These impacts will vary by location, size, duration, distance to communities, land ownership and other factors. This section is organized as follows:

- Section 7.3.1 examines potential impacts on community health and safety
- Section 7.3.2 summarizes potential impacts of physical and economic displacement.
- Section 7.3.3 examines potential impacts on worker health, safety, and welfare
- Section 7.3.4 examines potential impacts on economic conditions in the region
- Section 7.3.5 examines potential impacts on cultural heritage.

7.3.1. Potential impacts on community health and safety

In general, the potential for impacts of construction and operation on communities and community members is related to the distance that people live from the transmission line. Table 38 shows the number of houses and other buildings within certain distances of the various project elements (distances are from the approximate nearest boundary of the land that would be affected).

Table 38. Houses and buildings near project activities and infrastructure

Project element	*50m*		*100m*	
	Number of houses	*Number of other buildings*	*Number of houses*	*Number of other buildings*
Weir area: weir, intake, desander, access road	8	3	32	3
Camp, storage area.	2	0	4	1
Penstock	6	1	15	1
Powerhouse area: permanent features	2	2	2	2
Powerhouse area: temporary features	3	2	3	2
Substation at HPP	1	0	2	0
Pamir Energy crushing plant	0	1	0	2
New bridge	2	0	2	0
	24	***3***	***60***	***12***

Activities with potential impacts on community health and safety, and mitigation measures

A number of actions and activities by Pamir Energy, the contractors, and workers could affect community health and safety. Activities that could cause impacts, and measures that will be taken to avoid or reduce impacts are listed below:

Activities that result from labor Influx

Poor behavior by workers from outside the region can lead to disruption of local community cohesion, especially smaller communities. This can occur through unaccustomed or violent behavior, including gender-based violence, and/or an increase in communicable diseases. This will be controlled by requiring workers to abide by a Worker Code of Conduct that will require certain behaviors and forbid others; the contractor will be required to enforce the Code, with penalties leading up to dismissal. In addition, Pamir Energy, the Supervision Consultant, and the contractor will consult with local authorities and community leaders, which will ensure they (that is, project managers) are aware of incidents and can take appropriate action if the issue arises. Finally, Pamir Energy (through the Supervision Consultant) and the contractor will establish communications with the nearest law enforcement authorities so they are aware of the influx of workers, including where they will be working and where they will reside, and can take appropriate precautions. As noted, it is likely that over 50 percent of workers will be from local communities, possibly much more than that. The risk of gender-based violence (GBV) under this project is assessed to be low given the relatively small size of workers' teams and lack of precedents that indicate such risks in Tajikistan. Nevertheless, a number of mitigation measures will be taken to prevent risks due to GBV or sexual

harassment, such as sensitization for project employees and communities and the adoption and monitoring of Codes of Conduct for all project workers.

Increased demand on community services, such as medical and law enforcement, due to use of the services by project workers from outside the region could leave fewer services for community members. The relatively low number of workers and the requirement for the contractor to consult and coordinate with community leaders and law enforcement will ensure that added demand for community services will not cause significant reductions in services available to the community. Most community services would be provided in Khorog, which would be better able to accommodate slightly increased demand.

Increase in HIV/AIDS and/or other communicable diseases could occur due to the increase of male construction workers into rural communities and an increase in prostitutes or other sex workers who came to serve them. The relatively low numbers of nonlocal workers (likely to be no more than 100-150) who are employed would reside in accommodations at the camp or rented quarters in Khorog. If ongoing engagement with community leaders or others suggests there may be problems of this sort, Pamir Energy and the contractor will enhance training on the Code of Conduct, monitor worker behaviour more closely, and dismiss offending workers.

Other activities

Inappropriate actions and responses by security personnel could injure or harm community members. The contractor will probably appoint a subcontractor to provide security. Tajikistan law prohibits security personnel from having firearms, but they can have a variety of other nonlethal devices. Pamir Energy will require the contractor to hire only licensed security providers, and to verify the subcontractor and security personnel have not been involved in past abuses. The contractor will also have to ensure security personnel are trained in the appropriate use of force.

Project traffic could interfere with normal public traffic and could cause an increase in accidents involving pedestrians and vehicles on the road between Khorog and Sebzor. In addition, road construction will significantly affect travelers over the three kilometers of road that will be reconstructed and expanded. The contractor will be required to develop and implement a Traffic Management Plan that provides for driver training, vehicle safety, coordination with local traffic authorities, and traffic control at road construction.

Accidents and emergencies caused by the project could affect communities. The most likely impacts during construction would be from fires and traffic accidents since there will be only limited use of hazardous or flammable chemicals. Workers will be trained in fire prevention, and implementation of a Traffic Management Plan will reduce the potential for accidents. During operation, the most likely emergency would be dambreak, which is discussed above.

Nuisances such as noise and dust during construction could disturb nearby residents and other community members. Pamir Energy will require the contractor to have at least one water bowser for use in damping the road, and possibly construction sites, in dry weather when project activities are causing visible dust. Pamir Energy will require the contractor to maintain vehicles and equipment to minimize noise, and to consider the timing of construction activities so they can avoid periods when specific areas would be most sensitive. In addition, the contractor will be required to control dust from unpaved roads and construction sites during dry periods.

Uncontrolled or poorly controlled access to work sites could expose members of the public to extreme hazards, including areas near excavations, around heavy equipment and vehicles, under lifting operations or overhead work, and other such situations. To control access, all construction areas will be marked with barriers or safety tape with limited access points. Excavations will have physical barriers or intact safety tape placed on all sides of the excavation at any time there is no active work in the excavation. Lifting operations will have one or more flagmen and riggers on duty who can warn people away.

Nuisance noise during operation could be experienced near the powerhouse, where turbines and generators will produce noise, and near the substation, where corona noise could be generated by electrical equipment. During operation, such noise would be a low buzzing, crackling, or hissing sound that could be audible within a few tens of meters of the source. These sounds are produced as a result of corona discharge from air contact with conductors, from damaged or dirty insulators, or due to wind blowing through conductors and tower lattice. The noise is usually louder during wet and foggy weather, when the relative humidity of ambient air is over 80 percent, and in windy conditions. The noise level also increases with voltage. According to various literature sources, during relatively dry and calm conditions noise level is usually in the range of 40-50dBA and could increase to about 50-60dBA in wet and windy weather. Noise would decrease rapidly away from the corridor, becoming inaudible in no more than 20-30 meters; therefore, it should not be heard at the nearest occupied house. Overall, corona noise could be a minor nuisance, but only for a few people for short periods of time.

Open channels at the weir could present fall and drowning hazards to trespassers, and could be attractive to children. There will be a fence and warning signs to prevent access to project elements, and all open channels (intake, desilting chamber) will have a sturdy barrier to prevent falls. They will also have life-saving rings or other means to rescue anyone who falls into the water. The powerhouse and substation areas will have signs that warn of danger and prohibit climbing, with signs in local languages and with graphic danger symbols demonstrating dangers of falls and electrocution.

Coming into contact with energized equipment or conductors could electrocute children or others who trespass at the tower and substation. This could happen if people, especially children, trespass at the powerhouse or substation areas. Pamir Energy will ensure these areas have signs that warn of danger and prohibit climbing, with signs in local languages and with graphic danger symbols demonstrating dangers of falls and electrocution. The signs will have a 24-hour telephone number to which emergency calls can be made. Pamir Energy will provide information on all risks to trespassers and others to local schools to help prevent falls, drowning, electrocution and other such accidents.

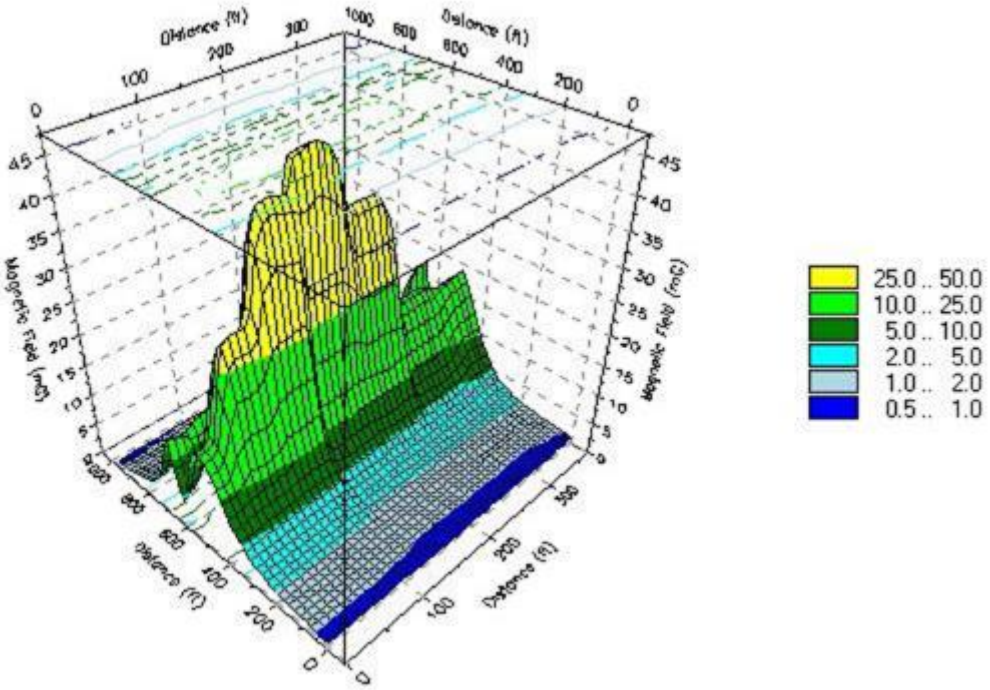
Electromagnetic fields. Due to the complexity of this issue and the high level of interest in potential impacts that has been shown at other projects, this topic is discussed in some detail in the following subsection.

Potential impacts of electric and magnetic fields (EMF)

An electromagnetic field (EMF) is emitted by any electrical device, including electrical equipment in the powerhouse and substation. The electric field (EF) is produced by the difference of potential between two points (that is, the voltage) and is measured in kV per meter. The magnetic field (MF) is produced by electric current and is measured in microteslas (µT) or nanoteslas (nT)—one tesla (T) is

equal to 10,000 Gauss. Unlike electric fields, magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease inversely to the square of the distance, therefore reduction in voltage takes place quickly over very short distances, even for high-voltage lines, as is illustrated in Table~~Figure~~ 39.

Table 39. Decrease in Electromagnetic Field Strength with Distance from 500kV Circuit (Horizontal Axis is in Feet (0.331m), Vertical Axis is mG (see scale))



Over the last 30 years, extensive research has been conducted in the European Union, the United States, and around the world to examine whether exposure to EMF has adverse health or environmental effects. In general, exposure to EMF is affected by the types of electrical sources, the distance from these sources, and the amount of time spent near these sources. Scientific research has focused on magnetic fields, since objects such as trees and walls act as physical barriers that easily block and shield electric fields.

Since the intensity of magnetic fields diminishes quickly with distance from the source, few homes are close enough to transmission lines for the lines to have an impact on the magnetic field level within the home. Rather, the major sources of residential magnetic field levels are electrical appliances within the home. To provide some context, in many homes the background alternating current magnetic field levels average about 0.1 to 10 µT, and are the result of electricity passing through wiring within the home and appliances, and through power lines outside the home. The average daily exposure is the composite of instantaneous, higher exposures (such as driving under a power line) and long-term, low exposures (such as wiring within a home).

Most countries do not have limits on exposure to occupational or public exposure to EMF. Many countries, including the United Kingdom, however, adopt the positions of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which has several times reviewed the epidemiological and experimental evidence and concluded that there was insufficient evidence to warrant the development of standards limiting long-term exposure to EMF. Rather, the guidelines

put forth in its 1998 and 2010 documents set limits at much higher field levels to protect against direct short-term health effects (for example, stimulation of nerves and muscles, a shock-like effect) that are known to occur at very high exposure levels. The ICNIRP in 1998 recommended a residential exposure limit of 833 mG (or 83.3 µT) and an occupational exposure limit of 4,200 mG (ICNIRP, 1998). Also, the International Committee on Electromagnetic Safety (ICES) recommends that exposures of the general public be limited to 9,040 mG (ICES, 2002). Both standards are designed to provide a very large margin of safety.

The exposures of workers and persons living in close proximity to the substation (and the associated transmission lines) will be well below these guidelines. In general, EMF levels outside and at distance from the substation corridor will be extremely low, much lower than research has shown to present a hazard to human health.

To avoid any potential for impacts to occur, any person who lives within 150 meters of the substation (or transmission line) line may request that electromagnetic fields be measured in their house. If monitoring shows that EMF levels exceed 0.5kV/m or 10uT, Pamir Energy will shield or otherwise reduce levels to below that standard or will relocate the people in accordance with the Resettlement Policy Framework. In addition, consultations with communities following disclosure of this ESIA and other documentation will specifically include presentations by Pamir Energy on EMF levels, potential risks, and mitigations. If community concern is high, Pamir Energy will hold special consultation sessions specifically to discuss EMF issues.

The Stakeholder Engagement Plan will include requirements for including EMF discussions in consultations with leaders and community members if there is interest in such discussions. In addition, if there is interest, Pamir Energy will also develop and post a page on its website that discusses levels and risks that result from high-voltage transmission lines (and from other sources such as cellular telephones).

Impact summary and significance

Potential impacts on community health and safety are briefly noted in the paragraphs above. With proper implementation of mitigation measures, there should be limited. Table 40 summarizes the potential significant of impacts on community health and safety. With proper implementation of mitigation measures, potential impacts should be no more than minor and negligible in most cases.

Table 40. Significance of potential impacts on community health and safety

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
Community	Medium	Worker influx	Low temporary	Minor adverse
		Pressure on services (medical, etc.)	Very low temporary	Negligible adverse
Community members (individuals)	High	Disease	Very low temporary	Minor adverse
		Violent behavior (including GBV)	Low temporary	Moderate adverse
		Nuisance and safety: noise, dust, etc.	Low temporary	Moderate adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
		Accidents, emergencies	Low temporary	Moderate adverse
		EMF	Very low permanent	Minor adverse

7.3.2. Potential Impacts due to physical or economic displacement

If people live on land that is needed by Pamir Energy, they will be required to move—this is called "physical displacement" or "resettlement". In addition, the economic losses (that is, the loss of income or the value of property) that people may suffer due to the project is called "economic displacement", and can result from such things as loss of land used for crops, pastures, or other purposes; from damages to property or animals; or from other project-related causes. As noted in Chapter 2, Tajik law and World Bank standards each include requirements for dealing with physical and economic displacement. It is also noteworthy that all land in Tajikistan is owned by the State, with rights allocated to individuals and organizations for specific uses.

Activities that could cause physical or economic displacement

Physical or economic displacement can result from:

- *Termination of rights to use land because it is needed for the project* can cause physical displacement if the land is needed at the intake or desander, penstock, powerhouse, or substation if households currently live. This can cause economic displacement if land is currently used for agriculture, grazing, orchards, or other economic purposes and can no longer be used.
- *Damage to crops, animals, or other property* could cause economic displacement when vehicles and equipment cross croplands or collide with animals or other property.
- *Cutting trees or other vegetation* could cause economic displacement by reducing wood supplies, produce from orchards, or other valuable products.

Mitigation measures

To avoid or minimize potential economic and physical displacement, Pamir Energy will:

- Acquire rights to use the absolute least amount of land necessary for the project. If land whose rights are terminated is not actually used, Pamir Energy will work with authorities to return rights to the land to the previous rights-holder, even if replacement land has been provided.
- Require the contractor to mark the boundaries of lands that Pamir Energy has been allocated, and any others construction zones, and require workers to remain within those boundaries and disturb no other land that other people use.
- Require the contractor to restore land that is not acquired for permanent use to its former use as soon as possible after construction is complete. This would be on land the contractor or Pamir Energy leased for construction storage and staging. Restoration would be agreed with the owner and could include de-compacting agricultural land

where vehicles and equipment have driven, parked, or worked; and/or re-vegetation with native or grass species. If grazing lands or other lands are revegetated with native species, the contractor will monitor during the following growing season to verify that grasses or other vegetation are successfully established.

- Require the contractor to undertake, wherever possible, as much of the required land-clearing, road construction, construction of towers, and conductoring that will take place on land used for gardens or agriculture between the autumn harvest and spring planting in order to minimize disruption of agriculture (and required compensation for damages).
- Appoint a qualified consultant to prepare a Resettlement Action Plan (RAP) for review and approval by the World Bank and the Government of Tajikistan. The Plan will identify the legal status of land that will be needed, owners and persons to be resettled and compensated, the methods by which compensation amounts will be determined, the rates of compensation for various losses and land uses, and the amounts. and to work alongside the "District Bureaus of Technical Inventory" (or MBC) as it implements the legal requirements for allocating land rights and requiring compensation. the contractor selects final locations of towers, construction sites, and substation, when the contractor selects final locations of towers, construction sites, and substation. It is noted that some information may be withheld from disclosure to protect privacy.
- Require the contractor to consult with village and Jamoat authorities concerning how wood from trees cut from non-allocated land can be donated to local people, with preference to those who lose land and those who currently exploit timber resources in the forest for personal use. Otherwise, wood is to be donated for community distribution and use.
- Not authorize the contractor to begin construction until all compensation for physical and economic displacement has been paid (except compensation for damages that may occur later, during construction).
- Identifying and making special provisions for affected people who are considered vulnerable or disadvantaged, and thus more likely to be adversely affected and/or less able to participate in the consultation process. These could include elderly households, women-headed households, households in extreme poverty, or others identified during preparation of the RAP. The RAP will provide for special provisions for vulnerable people such as higher rates of compensation, special funds, and/or other assistance and support as needed to ensure their living conditions and livelihoods are improved, or at least restored.

Impact summary and significance

Table 38 showed the number of households within 50 and 100 meters of the edge of land that will be affected. A total of eleven households are expected to be relocated. The number of people who may suffer economic losses due to loss of agricultural or other land or of buildings will be determined during preparation of the RAP; preliminary numbers of buildings and other infrastructure are shown in Table 41. Only a limited number are expected to suffer such losses, however, as the amount of land needed is relatively small, and they will be fully compensated.

Table 41. Buildings and infrastructure to be relocated/replaced

No.	*Item*	*Number*
1	Trees & plants (by piece)	2569
2	Residential houses	11
3	Schools	2
4	Bridges	1
5	School Grounds	1
6	Small buildings (shops, garages, vulcanizations)	4

The effect of the loss of wood resources due to tree cutting in the vegetation control zone will not be significant. The number of trees that will need to be cut, up to about 2,500, comprises only a small fraction, of similar trees in the immediate vicinity.

Table 42~~Table 41~~ shows the significance of potential impacts. With mitigation as described in the Resettlement Policy Framework, impacts can be reduced from potentially significant to minor. It will be possible to achieve the goal of having no displaced people worse off than they were before the project.

Table 42~~41~~. Potential Significance of Physical and Economic Displacement

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude of Impact and Duration*	*Significance*
Residents who live on land needed for project	High	Physical displacement	High permanent	Major adverse
Land users (with rights to land and/or use)	Medium-high	Permanent loss of land	Medium permanent	Moderate adverse
		Temporary loss of land (construction)	Low temporary	Minor adverse
Land users (without rights to land and/or use)	Medium	Permanent loss of use of land	Medium permanent	Moderate adverse
		Temporary loss of use	Low permanent	Minor adverse
Private wood harvesters (for firewood, etc.)	Medium	Loss of wood resource	Low permanent	Minor adverse
		Wood donation for community use	Low temporary	Minor positive

7.3.3. Potential impacts on worker health, safety and welfare

Protection of workers is increasingly recognized as being extremely important, as witnessed by the World Bank's adoption in 2018 of Environmental and Social Standard 2, "Labor and Working Conditions" and the enhancement of Tajikistan safety standards in the 2016 Labor Code.

Actions that could cause potential impacts and mitigation measures

- *Poor labor management practices* by the contractor and/or subcontractors could lead to situations where workers are exploited or taken advantage of. This could happen if the contractor did not have written labor management procedures or did not to enter into written contracts that inform workers of compensation, work hours and leave, and other information required by Tajikistan law. This can lead to problems between workers and

employers, which in turn can put work and schedules at risk, not to mention the effects on the workers. Pamir Energy has developed a Labor Management Procedure (LMP), which sets out the general principles that will govern the management of project workers by the contractor and subcontractors as well as the Supervision Consultant. The procedure is based on Tajikistan legislation and World Bank's ESS2 and includes a requirement for written employment contracts. It also requires contractors to include equivalent provisions in subcontracts and to enforce compliance. Pamir Energy and the Supervision Consultant will also monitor working hours to ensure that daily and weekly hours do not exceed legal limits and do not place fatigued workers in high-risk situations near the end of their workdays and workweeks. The need to limit working hours, especially when completing high-risk tasks, will also be emphasized in induction training and toolbox talks.

- *Unsafe working conditions* could place workers at risk of injury or death. Such conditions could be caused by vehicles and equipment that do not meet safety standards (seat belts, horns, lights, tires, etc.), unprotected access to dangerous locations (unmarked excavations), poor practices and equipment for lifting operations (during tower construction, conductoring, and maintenance), poor electrical safety (untrained workers, inadequate tools, etc.), inadequate safeguards on tools and equipment (unprotected saws, etc.), and other poor practices. In addition, contractors could fail to provide, free of charge to the workers, adequate personal protective equipment, including head, hand, hearing, eye, and foot protection, and could provide insufficient training to workers in the risks of their jobs and how to perform their work safety. To ensure workers are provided with a safe working environment, the contractor will be required to develop and implement, and to train all workers in the requirements of, an Occupational Health and Safety Plan that includes requirements that meet Tajikistan law, ESS2, the World Bank Group EHS Guidelines, and good international industry practice; the Plan will need to be submitted with bidders' proposals and will be considered in the selection of construction contractors. The final Plan will have to be approved by the Supervision Consultant before the contractor is allowed to mobilize and begin any works or investigations. In addition, contractors will have to require subcontractors to comply with this Plan or to develop equivalent Plans. Finally, contractors will report key safety statistics to the Supervision Consultant on a monthly basis,
- *Not giving workers to opportunity to express concerns* can lead to worker dissatisfaction and affect productivity. Equally importantly. it can lead to missed opportunities to identify unsafe conditions that workers are in the best position to recognize. When workers are allowed to freely express opinions and to make their grievances known to management, with the knowledge that management will take action as needed, it can lead to more efficient and safer working conditions and also increase worker satisfaction. Pamir Energy will require the contractor to develop and implement a mechanism by which workers can submit, including anonymously, their opinions and grievances, and to take action in response to all such submissions. The contractor will also make the mechanism available to subcontract employees, and ensure their grievance are addressed. Further, the contractor will be required to include in their monthly reports to the Supervision Consultant a summary of grievances, and how they were resolved.

- *Substandard accommodations* can lead to illness or disease among workers, which in turn can result in increased turnover as well as reduced productivity. At present, it is not known if the contractors will provide accommodations for workers, but if they do, they will be required to comply with good international industry practice for accommodations, as recorded in the IFC/EBRD Guidance Note on "Workers' Accommodation: Processes and Standards".
- *Inadequate water and/or sanitation* can affect workers' health, contaminate soil and surface water, and lead to worker illness or disease. Contractors will be required to provide workers with potable water, at no cost to the workers. Contractors will also have to provide sanitary facilities, including portable toilets in remote areas, and to enforce the Code of Conduct's prohibition on using the bush.

Special attention will be given to the issues related to gender equality. Taking into account the nature of the project, the number of women workers who will be employed for construction and operation of the hydropower plant is likely to be relatively low. There are many reasons for this, including the historic absence of women from employment in general and hard labor in particular. It is not expected that many women would be employed on construction crews, although some could be involved in engineering designs and in technical teams. In addition, women would be likely to fill support roles at offices and camps. During selection of the contractors, Pamir Energy will consider their labor management policies, including gender nondiscrimination policies, and will require contractors to establish and achieve realistic goals for hiring women in different positions.

Impact summary and significance

Table 43~~Table 42~~ summarizes the significance of potential impacts on worker health, safety, and welfare.

Table 43~~42~~. Potential significance of impacts on worker health, safety and welfare

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude of Impact and Duration*	*Significance*
Workers (contractors and Supervision Consultant)	High	Poor labor management practices	Medium temporary	Moderate to major adverse
		Unsafe working conditions	High temporary or permanent	Major adverse
		Inability to express concerns	Medium temporary	Moderate adverse
		Substandard accommodations	Medium temporary	Moderate adverse
		Unsanitary conditions	Medium temporary	Moderate adverse

7.3.4. Potential impacts on economic conditions

Potential impacts on local incomes

The loss of income due to land acquisition and the loss of use of agricultural land and woodlands lands is addressed in section 7.3.2. Other than those impacts, the project can affect local income in two ways: by employing local people and by purchasing materials and supplies from local suppliers. More direct impacts can be felt by the improvement to the regional and national electrical supply,

which in turn can help development of industrial, manufacturing, and other economic potential.

Construction of the project will require up to 250-300 workers, with the actual number of workers to be determined by the contractors. At present, it is not known if the contractors will be local, from elsewhere in Tajikistan, or from another country. The electromechanical contractor is likely to probably be international firm, while the civil works contractor may be local or Tajik.

It is expected that most or all unskilled laborers will come from local communities, as will support staff working in camps, auxiliary infrastructure and other support facilities. This will definitely have a positive effect on perception of the project, which is generally supported by the people and their leaders, since unemployment and lack of the work opportunities is perhaps the most significant challenge facing the communities.

Insufficient employment opportunities for local workers can lead to community dissatisfaction and not provide expected economic boosts to the community. Pamir Energy will require the contractors to open all employment opportunities to local workers and to ensure at least half of the total workforce comes from local communities (that is, communities between Khorog and Sebzor and for 20 kilometers to the east); only if the contractor can demonstrate there is insufficient interest or skills will this goal be lowered.

The overall impact of increased income is expected to be significant at the local level during the construction period, given the extreme unemployment and high poverty levels in the area. This will last only two or three years. Similarly, the local sourcing of materials and supplies will not be more than very minor given the scale of the project and thus the relatively limited materials and supplies that will be required, although it would be important for individual vendors.

On the other hand, the project has the potential to cause at least some temporary loss of income due to reallocation of land used for crops or fruit. This is particularly important considering that a significant proportion of the populations in the affected municipalities is considered to be vulnerable (elderly, poor, and displaced people). Most of the population engage in subsistence and market agriculture with at least some income is often generated from agriculture and animal husbandry. It was not possible to quantify information regarding the importance of wood products in incomes of local communities, but it is considered to be very low. Tree cutting and collection of wood for personal use is more widespread, but impacts will be minor, probably negligible except possibly in isolated cases.

Table 18 showed the number of households and people in the villages closest to the project and Table 38 showed the number of houses and people who live in close proximity to the project and thus are more likely to lose land or other assets. It is likely that very few of these people and households would be significantly affected by loss of land or assets, although some will be, as described above. As noted above, the RAP will provide the details of the land that Pamir Energy will need to use for the project and the compensation that those with rights to the land will be provided. This will include replacement or market value compensation for all assets. If people have to move from their current homes, Pamir Energy will provide further compensation and assistance. Overall, the project will improve, or at least restore any reduction in living standards or income.

Potential impacts on power supply and key economic sectors

A reliable power transmission system is essential to continued economic development in the country

and the regions the transmission line will cross. As mentioned previously, the project will significantly increase the power supply in GBAO and also provide power that can be exported to Afghanistan in the future. This in turn will contribute to long term economic development. It could also help maintain strong intergovernmental relations with neighboring Afghanistan.

Agriculture sector: The area of affected agricultural land will be very small, especially in comparison to other agricultural land in the municipalities. As noted, only about 2.2 hectares of arable land will be affected. Thus, the impact on agricultural production due to construction activities and placement of towers and substation on the land is expected to be small. Following construction, all agricultural land can return to its original use except orchards with trees higher than 4 meters and areas occupied by towers; this would affect only a few hectares, again too small to result in any significant impact on agriculture. Small amount of agricultural land that could be affected

Tourism sector: The tourism sector is not known to be important in the immediate vicinity of the project but tourists do pass by the project sites on the main road and could be temporarily affected. has an important economic role in some areas along the transmission line corridor.

Potential Impacts on vulnerable people and groups

Section 6.3.2 provided baseline information regarding vulnerable groups in the region. Project implementation will require land acquisition for project sites as well as some vegetation clearance and establishment of roads, which will cause impacts on those who own or use land and its assets and products. Thus, some impacts could be felt by vulnerable groups as well. The gender composition of the population in impact zone is provided in section 6.3.

Even minor impacts can have added significance to vulnerable people, especially the poor. For that reason, Pamir Energy will provide additional compensation for permanent loss of land, buildings, or other assets when the land or assets are used by vulnerable people such as the elderly, women-headed households, those with disabilities, and the extremely poor, Pamir Energy will provide special assistance as needed to ensure these people will not suffer any reduction in their standard of living or income.

Potential impacts on Infrastructure

Infrastructure. The only infrastructure that would be at risk would be the road, and it is in poor repair. Pamir Energy will reconstruct and expand about three kilometers of the road at the project site, which will be a significant improvement, and will also construct a new bridge across the river.

Potential impacts on traffic

Activities that could affect infrastructure include:

- *Project traffic and road construction* could also interfere with traffic on the public road, especially while the road is under construction and while the penstock is being installed, and also where there are turnoffs to the powerhouse, camp, and weir.
- *Heavy machinery* could damage the road to Khorog roads and interfere with public traffic.

To avoid adverse impacts on infrastructure, Pamir Energy will require the contractor to:

- Consulting with traffic authorities concerning proper controls when the road is being reconstructed and when the penstock is being buried beside the road, and where vehicles will be leaving and entering the road at turnoffs. Controls could include flagpersons, one-way traffic, diversions, signs and lights, and other measures.
- Develop and implement a Traffic Management Plan that includes operating and safety requirements for drivers, vehicles, and other project activities with the potential to affect traffic.
- Provide flag persons or other signals when heavy equipment and vehicles could disrupt normal traffic.
- For traffic between Khorog and Sebzor, consider having heavy vehicles travel in convoys at scheduled times of the day.
- Ensure only vehicles suitable and licensed for use on public roads are used on public roads.
- Repair any damage to the public road to the satisfaction of local traffic authorities and repair damaged secondary and rural unpaved roads immediately to ensure no disruption of community activities

Impacts on traffic should be temporary and relatively minor if mitigation measures are implemented carefully.

Impact summary and significance

Table 44~~Table 43~~ summarizes the potential significance of impacts on economic conditions.

Table 44~~43~~. Potential significance of impacts on economic conditions

Affected factor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
Local incomes	Medium	Increased employment and income	Low temporary	Minor positive
		Increased income by local suppliers	Low temporary	Minor positive
		Decreased income for market farmers	Low permanent	Minor adverse
Key economic sectors	Low-high	More reliable power supply	High permanent	Major positive
		Reduced agricultural output	Low temporary	Negligible adverse
		Reduced tourism	Low temporary	Negligible adverse
Infrastructure	Medium	Temporarily damaged public road	Low temporary	Negligible adverse
		Improved public road	Low permanent	Minor adverse
		Interference with traffic	Medium temporary	Moderate adverse

7.3.5. Potential impacts on cultural heritage

This section identifies and assesses potential impacts of the project on cultural heritage. None of the areas noted by local people as being valued for their cultural or religious values are located in the immediate vicinity of the project and so would not be affected. As noted in Chapter 6, there are no areas recognized by cultural authorities or known to be protected by national law in the vicinity of the project. Thus, there will be no effects on known cultural heritage, although excavations could uncover prehistoric or artifact artifacts.

Activities with potential impacts on cultural heritage

The following activities could affect cultural heritage sites:

- *Excavation at the weir area, powerhouse, and substation* could destroy or damage artifacts or archaeological sites if the cultural resource is not detected.
- *Land clearing* at project sites could damage or destroy surface artifacts and signs of underground archaeological remains.

Mitigation Measures

To avoid or reduce the potential for impacts, Pamir Energy will:

- Require the contractor to consult with community leaders to verify the presence of any sites of local interest within areas to be affected, and to work to minimize impacts.
- Require the contractor to develop and implement a chance find procedure that will require work to stop upon discovery of artifacts or other items of cultural interest until clearance is given to resume work by representatives of the Ministry of Culture. Supervisors and workers will receive training in actions to take if such a discovery is made.
- Require the contractor to include in the contractor's Worker Code of Conduct, and to enforce, prohibitions against disturbing or destroying any materials, areas, or items that could have cultural heritage or natural value.
- Require the contractor's Traffic Management Plan to include cultural heritage sites as sensitive areas for purposes of establishing requirements to avoid or minimize impacts.

Impact summary and significance

Table 45~~Table 44~~ shows the sensitivity criteria used to assess potential impacts on cultural heritage sites. As noted above, the distance of the line from any natural or cultural monuments will prevent direct impacts from construction or operation, except the very low risk of impacts from traffic or worker activities. The required mitigation measures will result in the risk of significant impacts being very low. Potential significance of impacts is shown in Table 46~~Table 45~~

Table 45~~44~~. Sensitivity criteria for cultural heritage

Sensitivity	*Criteria*
High	- Physical damage to cultural heritage sites of national or international importance - Significant long-term alteration of near-field visual landscape at sites of national or international importance - Significant damage or destruction of undiscovered archaeological site or surface sign of unknown archaeological site - Intentional removal of artifacts of cultural significance from their surroundings

Sensitivity	*Criteria*
	- Permanent disruption of access to cultural heritage sites
Medium	- Physical damage to cultural heritage sites of local or regional importance - Limited damage to undiscovered archaeological site or artifacts - Longer-term disruption of access to cultural heritage sites - Damage to individual artifacts on the surface
Low	- Minor disruption or damage to undiscovered archaeological site or artifacts - Short-term alteration of near-field visual landscapes or permanent alteration of distant landscapes - Short-term disruption at cultural heritage sites due to noise, increased traffic, or other nearby construction activity - Temporary disruption of access to cultural heritage sites

Table 46~~45~~. Significance of potential impacts on cultural heritage

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & Duration of Impact*	*Significance*
Valued cultural artifacts/areas	High	Noise, worker interference, direct impacts	Low permanent or temporary	Minor adverse
Undiscovered cultural heritage	High	Damage or destruction of archaeological site	Low permanent	Minor adverse
		Destruction of surficial artifact or sign of archaeological remains	Low permanent	Minor adverse

7.4. Comparison of Alternatives

The left- and right-bank alternatives are similar in most respects except that the left-bank alternative would be susceptible to three areas identified as having high risk of landslides or rockfall and would pass through populated parts of villages. The other viable alternative considered alternative penstock routes, alongside the road versus in a tunnel for part of its length. The former would have a more significant impact on vehicle traffic while the latter would generate much larger amounts of spoil that would have to be managed and also would present higher risks to workers.

7.5. Cumulative impacts

The combined and incremental effects of multiple projects and ongoing human activity can pose a greater threat to environmental and social resources than one project alone. However, there are no known developments planned for the Shokhdara River valley other than the Sebzor HPP and the 18-kilometer transmission line that will evacuate power to Khorog. The only known developments in the Shokhdara River valley are the Sebzor HPP and the associated transmission line that will evacuate power to Khorog. The transmission line will begin at the Sebzor powerhouse, so there will be almost no spatial overlap between the projects. Potential cumulative impacts could include:

- There could be additional adverse impacts on the river from construction of the 18km transmission line, but these would be very minor, transient, and very localized, and downstream of the HPP.
- Traffic on the road between Khorog and the hydropower project would be increased by both projects, thus affecting the people along the road, and for a longer time. The intent is to complete the transmission line in advance of the hydropower project, or possibly simultaneously, and there will likely be some overlap. Both projects will require the contractor to develop and implement a traffic management plan that should avoid most adverse impacts. These temporary adverse impacts will be somewhat balanced by the longer-term positive impacts of the improved roadway between the weir and powerhouse.
- Both projects will employ some number of local people, thus providing a temporary boost to local household incomes and local economies. The projects will train workers, thus instilling some skills that may enhance employability in the future.
- The increased power supply and electrification of the region could enhance future development of the area, including in Afghanistan. The degree of such development cannot be predicted at present.

In summary, it is considered unlikely there would be any significant cumulative impacts from the Sebzor HPP and the transmission line.

7.6. Summary of Potential Impacts and Preferred Alternative

7.6.1. Preferred alternative

The evaluation of alternatives was conducted as described in Chapter 5 and 7, and the preferred alternative was selected following these evaluations and visits to the area to evaluate land ownership and use, flora and fauna, cultural heritage, and other characteristics of the area. The No-Action Alternative is not described further since there would be no direct impacts on people or the environment, but rather adverse impacts to the country and region from insufficient electricity generation and a less reliable energy supply.

As noted previously, the right-bank alternative was designed so as to minimize social impacts, including land take and relocation. The key advantages of this alternative are that there would be less disturbance of local populations than under the left-bank alternative, the construction logistics would be much more manageable, and the existing road (improved) could be used instead of a new service road having to be constructed. Implementation of required mitigation measures and good international industry practice should prevent any significant impacts other than the physical displacement of 11 households, and these will be properly mitigated by implementation

7.6.2. Summary of potential impacts and significance

Ошибка! Источник ссылки не найден.~~Table 46~~ summarizes the potential impacts of the preferred alternative on all the environmental and socioeconomic resources described previously.

Many or most potential impacts of construction and operation of the hydropower project and substation are considered to be generally minor or insignificant and would not typically require

specific measures to avoid or mitigate the impact other than the implementation of routine good international industry practices. However, there are several moderate to major adverse impacts associated with this project that will require pecific measures to avoid or mitigate impacts. These are primarily associated with potential impacts due to physical and economic displacement as well as impacts due to construction disturbance of communities and impacts on biodiversity (fish and aquatic habitat during both construction and operation). The key potential impacts and the measures that will be implemented to avoid or reduce the impacts include the following:

- For all the action Alternatives, construction and the presence of new infrastructure will create a minor impact on aesthetics and views for residents and passersby. This cannot be completely avoided, and the only mitigation will be to plant trees between project structures and the road and between the structures and houses.
- For all Alternatives, flow in the river would be reduced during 6-8 months of the year. Measures to reduce impacts will include inclusion of a fish pass into the weir design, required releases of an environmental flow of at least $3m^3$/sec at all time, surveys to better characterize fish populations and the aquatic environment and the identification of further mitigations if needed, and future surveys to verify the effectiveness of all mitigation measures, in particular verification that the fish pass is allowing fish to migrate and that flow rates are sufficient to allow fish passage.
- For all Alternatives, cutting trees and other vegetation on project sites will reduce biodiversity marginally and also slightly reduce the wood supply for local populations. To ensure no species of conservation concern will be affected, a qualified biologist will survey the potentially affected areas to identify plant communities and species and to determine if specimens or populations of Dwarf everlasting could be affected. If this species could be affected, Pamir Energy (or the contractor) will plant at least 10 specimens for every one that has to be removed and ensure they survive to and through maturity.
- For all Alternatives, the presence of the weir and desilting chamber could attract trespassers who could fall into the water from the weir or in the desilting chamber. The area will be fenced, and the open-channel chamber will have a sturdy barrier on all sides to prevent the risk of falling. There will also be warning signs.
- For all Alternatives, construction workers would be exposed to significant health and safety risks, with operations workers also exposed to lesser but still significant risks. Employers will be required to provide equipment and materials that are sufficient to provide a safe working environment, and to provide, at no cost to workers, personal protective equipment. In addition, workers will be trained in the risks of their jobs and how to protect themselves from injury or death. Requirements will be recorded in a Occupational Health and Safety Plan that will be submitted with bidders' proposals so that Pamir Energy will be able to evaluate the bidders' commitment to safety. The Plan will be finalized before construction begins and updated as needed throughout construction. In addition, Pamir Energy is required to update its own safety procedures to meet the requirements of World Bank Environmental and Social Standard 2 and to review its Human Resources Manual to verify it meets the requirements of the same Standard.

- For the right-bank alternative, eleven households will need to be relocated and some additional number will lose some land they currently have the rights to use. For the left-bank alternative something over 10 households wouldl need to be relocated and a larger number would lose the rights to use their land. Overall, the RAP will require that no people who are affected by the project be worse off financially/economically due to construction and operation of the project. If relocation or compensation is necessary, it will be complete before construction begins.
- For all alternatives, construction or future maintenance activities could damage crops or herds and have a minor to moderate impact on subsistence farmers and herders. This will be avoided or reduced by adherence to best management practices and required mitigation measures for vehicle movements and tower construction sites, and further mitigated by prompt compensation in accordance with the future RAP.

As noted above, most adverse impacts that are minor or negligible will be reduced or avoided altogether by the use of good international industry practices and required mitigation measures. More serious potential impacts will be avoided or reduced to acceptable levels by implementation of the mitigation measures. Avoidance strategies, mitigation measures, and best management practices are presented as part of the Management and Monitoring Plans in Chapter 8.

Table 47~~Table 46~~ summariz~~s~~e~~pe~~s the potential impacts on environmental receptors, people, and communities and their significance.

Table 47~~46~~. Significance of potential impacts

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Landscape and views				
Visitors	High	Disruption of views due to construction and permanent presence of project infrastructure	Medium permanent (temporary for individuals)	Minor adverse
Residents near project elements	Medium	Disruption of current views due to construction and permanent presence of project infrastructure	Low permanent	Negligible adverse
Travelers	Low	Disruption of natural views due to construction and permanent presence of project infrastructure	Very low temporary	Negligible Adverse
Land use (left-bank alternative would affect more households, right-bank would affect more arable land)				
Protected areas	High	No such areas to be affected	No change	None
Household plots	High	Household required to be resettled into new house on new land or provided cash compensation to allow replacement	High permanent	Major adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Steep slopes	Medium-high	Landslides, mudslides due to blasting, seismicity, or other causes	Low permanent	Minor adverse
Arable land, orchards, productive trees	Medium	Land use rights terminated and transferred to Pamir Energy; compensation with replacement land or cash, or trees cut back and compensation paid	Medium permanent	Moderate adverse
Land not in use	Low	Rights transferred to Pamir Energy	Low permanent	Negligible adverse
Soils and geohazards				
Ground surface (rock & soil) on steep & moderate slopes affected by land-clearing	High	Significant erosion of topsoil, impaired ability to support vegetation, increased landslide potential, water pollution	High permanent	Major adverse
Ground surface (rock & soil) on steep & moderate slopes affected by construction activities	High	Minor erosion, minor increase in landslide risk	Medium temporary	Moderate adverse
Ground surface on riverbanks & riparian areas	High	Moderate to severe erosion of topsoil, water pollution	Medium temporary	Major adverse
Ground surface on slight slopes and flat land away from the river	Low-medium	Slight to moderate erosion of topsoil	Medium temporary	Minor to moderate adverse
Air quality and climate				
Ambient air	High	Fugitive dust generation during construction and maintenance	Low temporary	Minor adverse
		Vehicle and equipment emissions during construction and maintenance	Low temporary	Minor adverse
Vegetation	Medium	Fugitive dust settling on plant and interfering with growth	Low temporary	Minor adverse
Global climate	Medium	SF6 emissions during operation of substation	Very low permanent	Negligible adverse
Noise (left-tank alternative would affect more residents)				
Residents	High	Construction noise	Medium temporary	Moderate to Major adverse
		Turbine/powerhouse noise during operation	Low permanent (very low away from building)	Negligible to minor adverse
Fauna within 100-200m	Medium to High	Construction noise	Low temporary	Minor adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Water quality and quantity				
Shokhdara River	Medium-High	Sedimentation during instream or upland works	High temporary	Major adverse
		Sedimentation from sluicing	Medium temporary	Moderate adverse
		Contamination from spills or leaks or other sources (washwater, concrete, etc.)	Medium temporary	Moderate to Major adverse
		Contamination from sanitary wastes	Low temporary	Moderate to minor adverse
		Reduced flows (impacts discussed for aquatic habitat/ organisms and human use)	Medium permanent	Moderate to major adverse
		Increased flooding near reservoir	Low adverse	Minor to Moderate adverse
Small ephemeral and permanent tributaries to Shokhdara River	High	Sedimentation from erosion due to compaction and soil disturbance	Medium temporary or permanent	Moderate to Major adverse
		Contamination from spills	High temporary	Major adverse
		Contamination from herbicides, pesticides	No impact	None
		Contamination from herbicides	No impact	None
Groundwater and springs	Medium to High	Reduced recharge due to soil compaction	Very low temporary	Negligible adverse
		Contamination from spills	Very low permanent	Minor adverse
		Reduced availability due to withdrawals	Very low permanent	None
Climate				
GHGs	Medium	Addition of GHGs to atmosphere (SF6, CO_2)	Low permanent	Minor to negligible adverse
Flora (right-bank alternative would require more trees to be cut)				
Common tree & shrub species	Medium	Trees and other plants will be cut and cleared	Low permanent	Moderate adverse
Dwarf everlasting (*Helichrysum arenarium*)	High	Destruction of near-threatened flower species	Low permanent	Minor adverse
Orchards	High	Trees will be cut	Medium permanent	Major adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Habitat				
Critical habitat	High	Reduction in populations of one or more flora/fauna species of conservation concern, adverse impacts on habitat	No impact	None
Natural habitat	Medium-High	Loss of or other impact on natural habitat	No impact (to be confirmed)	None
Modified habitat	Medium-Low	Reduction in biodiversity value	Low permanent	Minor adverse
Fauna				
Terrestrial fauna	Medium-low	Animal death due to crushing or direct impact	Low permanent	Minor adverse
		Abandonment of home territories due to construction disturbance	Low temporary	Minor adverse
		Nest abandonment/disruption of breeding animals due to construction disturbance	Low temporary	Minor adverse
		Worker interference with animals or nests	Very low temporary	Negligible adverse
Owls and bats	Medium	Loss of hibernating and nesting places in mature trees (or buildings, for bats)	Low permanent	Minor adverse
Fish	Medium	Interruption of migration (thus preventing upstream spawning)	Low permanent	Minor adverse
		Lost breeding habitat due to reduction in flow	Low permanent	Minor adverse
		Smothered habitat due to sedimentation during construction or sluicing	Low temporary	Minor adverse
Community health and safety (more disruption for left-bank alternative)				
Community	Medium	Worker influx	Low temporary	Minor adverse
		Pressure on services (medical, etc.)	Very low temporary	Negligible adverse
Community members (individuals)	High	Disease	Very low temporary	Minor adverse
		Violent behavior (including GBV)	Low temporary	Moderate adverse
		Nuisance and safety: noise, dust, etc.	Low temporary	Moderate adverse
		Accidents, emergencies	Low temporary	Moderate adverse
		EMF	Very low permanent	Minor adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
Physical and economic displacement (significantly more displacement for left-bank alternative)				
Residents who live on land needed for project	High	Physical displacement	High permanent	Major adverse
Land users (with rights to land and/or use)	Medium-high	Permanent loss of land	Medium permanent	Moderate adverse
		Temporary loss of land (construction)	Low temporary	Minor adverse
Land users (without rights to land and/or use)	Medium	Permanent loss of use of land	Medium permanent	Moderate adverse
		Temporary loss of use	Low permanent	Minor adverse
Private wood harvesters (for firewood, etc.)	Medium	Loss of wood resource	Low permanent	Minor adverse
		Wood donation for community use	Low temporary	Minor positive
Worker health, safety, and welfare				
Workers (contractors and Supervision Consultant)	High	Poor labor management practices	Medium temporary	Moderate to major adverse
		Unsafe working conditions	High temporary or permanent	Major adverse
		Inability to express concerns	Medium temporary	Moderate adverse
		Substandard accommodations	Medium temporary	Moderate adverse
		Unsanitary conditions	Medium temporary	Moderate adverse
Economic conditions				
Local incomes	Medium	Increased employment and income	Low temporary	Minor positive
		Increased income by local suppliers	Low temporary	Minor positive
		Decreased income for market farmers	Low permanent	Minor adverse
Key economic sectors	Low-high	More reliable power supply	High permanent	Major positive
		Reduced agricultural output	Low temporary	Negligible adverse
		Reduced tourism	Low temporary	Negligible adverse
Infrastructure	Medium	Temporarily damaged public road	Low temporary	Negligible adverse

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Magnitude & duration of impact*	*Significance*
		Improved public road	Low permanent	Minor positive
		Interference with traffic	Medium temporary	Moderate adverse
Cultural heritage				
Valued cultural artifacts/areas	High	Noise, worker interference, direct impacts	Low permanent or temporary	Minor adverse
Undiscovered cultural heritage	High	Damage or destruction of archaeological site	Low permanent	Minor adverse
		Destruction of surficial artifact or sign of archaeological remains	Low permanent	Minor adverse

8. Environmental and Social Management and Monitoring Plan

The environmental and social impacts that could result from construction, operation, and maintenance of the Sebzor hydropower plant and substation are described in Chapter 7 and summarized in Table 47~~Table 46~~. As described in that Chapter, some activities during the construction, operation, and maintenance of the transmission line and substation could have a moderate or even major adverse impact on specific environment and social resources. That makes it imperative for precautions to be taken to ensure that significant adverse effects are avoided, reduced, or otherwise mitigated. This will take a concerted effort by the Pamir Energy, the Supervision Consultant, and the contractors selected for design and construction to ensure that proper design and operating procedures are implemented throughout the procurement, project preparation, construction, and operation phases of the project, and that the mitigation measures proposed in this Chapter are incorporated into requirements for bidding, design, construction, operation, and maintenance of the line and substation.

Table 48~~Table 47~~ describes and outlines the Environmental and Social Management Plan for the project. It builds upon the mitigation measures described in Chapter 7 and identifies the measures that must be implemented to avoid, reduce, or otherwise mitigate potential moderate and major adverse impacts identified in the ESIA. It also identifies best management practices (BMPs) and other mitigation measures that will minimize, reduce, or eliminate many of the impacts of minor or even negligible significance which could escalate to become more important if they are not handled properly. It is expected that mitigation measures will be sufficient to reduce all risks to acceptable levels. In many cases, the ESMP requires development of detailed plans to manage specific risks and hazards and includes an overview of the relevant requirements of those plans. Primary responsibility for implementing mitigation measures during construction will rest with the contractors, although Pamir Energy will have responsibility for some of the actions. All works by the contractors, including implementation of mitigation measures, will be overseen and supervised by the Supervision Consultant (also known as the Consulting Engineer, Owner's Engineer, or other names), with ultimate oversight and responsibility resting with Pamir Energy.

It is important to note that Pamir Energy, in part through its contractors, will also be responsible for complying with relevant requirements of Tajikistan law, the World Bank Environmental and Social Framework, the World Bank Group's General Environmental, Health, and Safety (EHS) Guidelines, which may be have much more detailed requirements than the Plan presented here.

The ESMP table is organized as follows:

- Section 1.0 includes measures for the procurement phase (that is, the process by which Pamir Energy will select the contractors)
- Section 2.0 includes measures to be implemented during the project preparation stage, between the time the contractors are appointed, and main construction begins. This will include employing workers and specialists, developing detailed management plans, conducting surveys, marking construction areas, and then establishing initial access roads, construction storage and preparation areas, and camps.
- Section 3.0 includes measures during construction, which for the hydropower plant will include land clearing; installation and removal of cofferdams to allow work in the river;

excavation of foundations for the weir, intake, and desilting chamber; concrete works, installation of gates and instruments. For the substation, work will include land clearing, excavation, concrete works, and installation of breakers, transformers, and a control room.

- Section 4.0 includes measures to be implemented during demobilization by the contractor.
- Section 5.0 includes measures to be implemented by Pamir Energy during operation and maintenance of the hydropower station and substation.
- Section 6.0 includes measures that must be implemented during all phases of activities that could have an impact on environmental or social resources.

Following this table of mitigation measures, Table 49~~Table 48~~ provides the Environmental and Social Monitoring Plan. This Plan is necessary to ensure there is close scrutiny over actual environmental and socioeconomic performance so that prompt action can be taken if mitigation measures are not being implemented or if the measures are not adequately mitigating actual impacts. Since the Supervision Consultant will oversee all actions by the contractors, most of their monitoring responsibilities are not shown in the Table. The objectives of the monitoring program are to:

- Meet legal, World Bank, Pamir Energy, and community obligations
- Identify project impacts during preconstruction, construction, demobilization, and operation
- Verify that mitigation measures are being implemented as required
- Evaluate the effectiveness of mitigation measures and identify any shortcomings
- Allow refinement and enhancement of mitigation measures if needed to further reduce impacts
- Allow development of mitigation measures to deal with unforeseen issues or changes in operations
- Allow Pamir Energy, Tajikistan authorities, and the World Bank to verify that their respective requirements are being met.

Pamir Energy will oversee the Supervision Consultant, which will in turn oversee the design and construction contractors to ensure these companies, their subcontractors, and all workers are fully implementing the proper mitigation measures during the preconstruction, construction, and demobilization phases. These measures include training for workers so they are familiar with their own responsibilities as well as their employer's. The first level of monitoring during construction will be conducted by the contractor in routine management of ongoing activities. This will be supplemented by nearly continuous monitoring by the Supervision Consultant and somewhat less frequent monitoring by Pamir Energy, and by the World Bank. In addition, there will be at least one third-party audit during construction and another before the contractor has completed demobilization. During operations, there will be many fewer activities that could result in significant impacts, so monitoring will be less intense, with general performance monitoring conducted by Pamir Energy or various government agencies, with periodic reviews by the World Bank, and more specialized monitoring conducted by aquatic biodiversity specialists and RAP consultants.

Table 4847. Environmental and Social Management Plan for the Sebzor Hydropower Plant and Substation

No.	*Activities*	*Potential Adverse Impact*	*Mitigation Measures/ Best Management Practice*	*Target outcome of mitigation*	*Responsible body*
1.0 Procurement Phase					
1.1	Preparation of bidding documents for design of HPP, substation, road rehabilitation, and bridge	Failure to optimize design to avoid impacts on people and environment Unacceptable impacts	As required by World Bank Standard Procurement Documents, include relevant documentation (ESMP, RPF, SEP, ESCP) in procurement documents. Include the following in work requirements: – HPP, penstock, powerhouse/substation, bridge, and road designs to avoid household plots with occupied houses or buildings or on arable land wherever possible – HPP design to include fish pass designed to allow passage by Marinka and False Osman and sufficient depth at outlet of fish pass to allow largest fish to pass in both directions even during low flow periods. Design to be verified by independent expert. – Include screen to exclude fish from penstock and to return fish to the river – Include barriers where needed to prevent access to sites and to prevent accidents – If substation insulation is to include SF6, select low-leakage equipment (>99% control) – Specific safety measures necessary to ensure safe construction	– Designer understands need to minimize impacts – Minimal physical displacement and minimal economic displacement – Fish pass appropriate designed	Pamir Energy World Bank (approval)
1.2	Preparation of bidding/ procurement documents for all construction of all project components	– Failure of bidders to recognize E&S requirements, to plan for E&S management, and to incorporate E&S requirements in cost proposals and planning – Unacceptable impacts	As required by World Bank Standard Procurement Documents, include relevant documentation (ESMP, RPF, SEP, ESCP, design requirements, etc.) in procurement documents, for construction contracts and require proposals to include the following plans as part of Management Strategies and Implementation Plan (MSIP): – Occupational health and safety plan for mobilization stage – HR manual or labor management plan – Worker Code of Conduct and worker Grievance Redress Mechanism, to include provisions	– Bidders understand E&S requirements and prepare responsive proposals – Higher E&S capacity by bidders – Realistic proposals	Pamir Energy World Bank (approval)

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			specified in SPDs and others noted in the ESIA Define key personnel to include, for the project (that is, not corporate-level): – E&S manager – Safety manager – Community liaison/social specialist – HR manager		
1.3	Review and evaluation of proposals	– Failure to consider bidders' E&S qualifications and experience in scoring proposals – Unacceptable impacts	– Inclusion of E&S specialist(s) in proposal review team, with sufficient time provided for evaluation – Awareness by entire evaluation team of key E&S requirements – Scoring includes corporate E&S experience and qualifications, E&S staff experience and qualifications and evaluation of management plans in MSIP – Recognition of unqualified bidders	– Bidders' E&S qualifications and experience receive full consideration in evaluations – Bidders disqualified for poor safety record, inadequate E&S qualifications and experience, or inadequate MSIP (that is, inadequate understanding of requirements)	Pamir Energy
1.4	Selection of contractors	– Selection of contractor unqualified and/or unprepared to implement ESMP full C-ESMP – Unacceptable impacts	– MSIP plans sufficient to avoid or control impacts – Key staff qualified and available – Award only to contractors with E&S qualifications and experience that meet specific criteria	– Award to contractor able to implement this ESMP – Contractor ultimately implements ESMP satisfactorily – Fewer delays in project preparation and construction	Pamir Energy World Bank (approval)
2.0 Project preparation					
2.1	Implementation of Stakeholder Engagement Plan (SEP)	– Uninformed local people and other stakeholders – Unrealistic expectations by local people and others – Long-term distrust of contractors and Pamir Energy – Protests or other disruptions – Vandalism	– Outreach to identified stakeholders – Realistic information on employment opportunities – Meetings with community leaders and citizens as appropriate – Implementation of Grievance Redress Mechanism – Train project personnel (Pamir Energy, contractors, etc.) in relevant requirements of SEP, including receiving and reporting grievances	– Well-informed supportive community – Realistic expectations – Trust of contractor and Pamir Energy to resolve issues – Timely resolution of grievances – Pamir Energy awareness of concerns and issues	Pamir Energy manages overall program and deals with high-level grievances Contractor implements on

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
					day-to-day basis during construction
2.2	Management of E&S issues	– Failure to hire qualified specialists with sufficient time to manage issues – Noncompliance with applicable requirements – Excessive E&S impacts due to mismanagement or failure to manage E&S issues	– Assign key E&S personnel defined in requirement 1.2 and provide sufficient time to perform duties – Employ and train sufficient safety officers: at least one per work crew and overall ratio of at least 1 per 50 workers – Implement MSIP and other mitigations necessary to avoid or reduce impacts to acceptable levels – Train managers and supervisors/foremen in key requirements for E&S mitigation (i.e.., this ESMP and monitoring plan), including Code of Conduct – Develop checklists for use by E&S staff to record findings – Develop templates for monthly E&S reports to Supervisions Consultant – Develop templates for investigating and addressing root cause of serious incidents /injuries/accidents – Develop registers for recording grievances from external stakeholders and from workers	Qualified staff in sufficient numbers to implement/oversee C-ESMP	Contractor
2.3	Complete Contractors' Construction ESMP (C-ESMP) by preparing/ updating: – Materials and Waste Management Plan – Land Management and Erosion Control Plan – Community Health and Safety Plan – Labor Management Plan/Procedure – Refuelling and Spill Prevention Plan – Worker Occupational	– Contractor begins works without programs to avoid or minimize impacts on human and environmental resources: – Unsafe vehicles, accidents – Damage to protected flora – Subcontractor E&S performance not managed – Noise disturbances to communities – Community disruption, violence, crime, disease due to worker influx – Unsafe and/or unsanitary accommodations	– Plans prepared by qualified E&S specialists and project managers – Supervision Consultant to review and approve all C-ESMP plans and procedures, including updated C-MSIP plans that had been submitted in contractor's proposal – All plans reviewed and ultimately approved by qualified experts – Awareness-raising sessions on GBV conducted for all workers – Code of Conduct adopted, acknowledged and signed by all workers on site (Contractor, Sub-Contractors, Supervision Consultant, as applicable)	– No activities undertaken without underlying procedure or plan to protect workers, community, and environmental resources – Comprehensive contractor program for avoiding and minimizing impacts – Subcontractor compliance with plans – All activities in accordance with C-ESMP – No unacceptable or unpredictable impacts	– Contractor (prepare) – Supervision Consultant (approve) – Pamir Energy to review

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
	Health and Safety Plan for construction phase – HR Manual (finalize MSIP draft) – Worker Code of Conduct (finalize MSIP draft) – Community Health and Safety Plan Develop detailed method statements/procedures on: – Traffic management – Emergency response – Flora, fauna, and habitat preconstruction survey – Working in and near water – Explosives and blasting (if explosives are to be used) – Worker accommodation and work camp management				
2.4	Conduct geotechnical study to identify seismic risks	Dam failure due to earth movement	Implement geological study to identify seismic hazard to allow design to withstand specific level of ground movement/acceleration	Stable dam	Design contractor
2.5	Prepare and implement terrestrial and aquatic biodiversity survey plans	Unplanned and/or unnecessary impacts on biodiversity	Appoint qualified consultants to prepare and implement survey plans, with initial surveys completed before construction begins. Terrestrial plan to require, for all areas to be disturbed: – Qualified experts to prepare and implement, during spring and/or summer – Identification of Dwarf everlasting plants and any other plant specimens and populations of conservation concern that may be at potential risk, and planting 10 dwarf everlasting for every one affected	– Minimal impacts on biodiversity, no impact on species of conservation concern – Program to monitor success of aquatic mitigations	Pamir Energy

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			– Identification of trees that will need to be cut down or cut back and suitable location for replacement trees – Identification of trees and affected buildings with bat roosts, hibernation sites, breeding pairs – Identification of trees with owl or raptor nests – Presence of birds or other fauna of conservation concern and assessment of likelihood of adverse impacts – Plan for planting 5+ trees for every one cut, for placing bat boxes for every bat location affected – Requirement to delay or change activities so there will be no impact on fauna or flora species of conservation concern – Detailed recommendations for these and other appropriate mitigations as needed – Timeframe for implementation of mitigations Aquatic plan to require: – Qualified expert to prepare and implement detailed plan to characterize aquatic habitats and identify species of fish, amphibians, macroinvertebrates, and other aquatic fauna and flora that could be affected – Prior to and during construction, surveys of river from upstream of weir to downstream of powerhouse/tailrace area during at least two spring & fall migration seasons and during spawning to better characterize aquatic biodiversity, to cover river from weir to powerhouse – If aquatic habitat determined to be “natural habitat”, detailed recommendations for achieving no net loss of habitat. If species of conservation concern identified, detailed recommendations for avoiding or minimizing impact – Detailed recommendations for operation practices to minimize short- and long-term impacts,		

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			including further management of environmental flows if needed – Timeframe for implementation of mitigations – TOR for further surveys to verify successful operation of fish passage and spawning during operation, or recommendations to overcome issues with passage or spawning		
2.6	Develop and implement Resettlement Action Plan (RAP) based on Resettlement Policy Framework (RPF)	– All Project Affected Persons (PAPs) not identified – All physical and economic displacement not compensated or replaced – Inadequate compensation – Violations of Tajikistan law and/or World Bank ESS5 for land take and compensation – Hardships for PAPs prior to compensation – Degradation of PAP livelihoods or living standards – Loss of community support	– Appoint qualified consultant to develop RAP – Identify and characterize PAPs and impacts, identify vulnerable people, land uses and legal status, assets, valuations, etc. – Consult with PAPs – Consult with authorities on valuation and compensation – Acquire rights to land for weir structures, penstock, and substation, provide compensation or like-for-like replacement for physical and/or economic displacement prior to displacement occurring	– Physical and economic displacement compensated at replacement cost or more, or like-for-like compensation – RAP implementation meets requirements of ESS5 – Affected people are fully compensated for losses at replacement value or land-for-land – Compensation paid to all PAPs prior to issuing authorization to proceed to contractor – Participation by authorities and PAPs in process – Community support	Pamir Energy World Bank (RAP approval) Government of Tajikistan (RAP approval)
2.7	Recruit and employ workers and subcontractors	– Unqualified workers and/or subcontractors – Poor labor practices (substandard pay, uninformed workers, unsafe conditions, etc.) – Excessive staff turnover	– Implement Contractors' Labor Management Plan (LMP)-see 2.3 above – Preference for local hiring, with PAPs given preference (50% local unless Pamir Energy approves less, with justification) – No employees under age 18 – Written contracts with workers, per LMP and Tajik law – Other provisions per Labor Code of Tajikistan – Subcontracts include and require compliance with contractor's LMP and law – Subcontracts include and require compliance with	– Maximum hiring of PAPs and other locals: establish goal of at least 50% of workforce from local population – Workers employed in compliance with law (nondiscrimination, equal opportunity, income, etc.) – Low staff turnover	Contractor

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			C-ESMP – Workers receive full induction training		
2.8	Establishment of construction camps/laydown areas, storage areas, footpaths, quarries/borrow areas, etc. and other land contractor may need for temporary use/possession	– Contractor trespasses on land – Placement of construction zones in inappropriate locations (excess tree-cutting, too close to residents, etc.) – Impacts outside boundary of designated area – Unrecorded damage to biodiversity – Excess damage to topsoil/subsoil, vegetation cover, erosion, spills and soil/water contamination, impacts on communities	– Existing quarry to be operated in compliance with existing or new authorizations and permits – If new quarry or borrow pits/areas are to be developed, prepare impact assessment to identify impacts and identify mitigations; comply with ESS1 and Tajikistan law for impact assessment – No ground disturbance until C-ESMP approved – Implement C-ESMP requirements for noise, fuel and hazardous materials, noise, worker safety, and community safety, etc., including worker training on topics relevant to their jobs, including Code of Conduct – Reach written agreements with land users prior to undertaking activities on their lands – Implement recommendations from biodiversity and cultural heritage surveys – Train/warn workers to remain within boundaries and penalize for violations – Maximize use of existing paths and disturbed areas – Consult with roads authority concerning Traffic Management Plan and damages to public roads – Prevent/minimize movement of vehicles and equipment off roads, especially in wet conditions – Plant 5+ trees for every one cut, place bat boxes for bat roosts disturbed, avoid disturbance of breeding/nesting fauna – Minimize cutting of mature trees and trees of conservation concern: maintain log of all trees cut – Maintain photographic and written log of plants of conservation concern that are cut Implement Land Management and Erosion Plan, including at a minimum: – To extent possible, avoid landslide-prone areas and areas with severe erosion potential – Establish and mark boundaries of construction	– Compliance with approved C-ESMP – No unexpected or unacceptable impacts – All work within marked boundaries – Minimal disruption to breeding fauna – Minimal disruption to bats and owls – Minimal disruption to fauna and flora of conservation concern – Minimal disruption to traffic – Wood and flammable debris material removed before it becomes a fire hazard –	Pamir energy (quarry) Contractor (all others)

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			zone – Keep all activities inside boundaries – Strip and store topsoil within project boundaries, protect from erosion – Store excavated subsoil and spoil separately, protect from erosion, reuse as much as possible – Install drainage control as needed to control erosion that would affect off-site – Place gabions, walls, silt fences or other measures as necessary to prevent erosion from leaving construction areas		
2.9	Establishment of accommodations, kitchens, sanitary facilities	– Worker illness or death – Worker dissatisfaction and lower productivity – Contamination of land and water	– If accommodations are to be provided, comply with ESS2/IFC/EBRD guidance "Workers' Accommodation: Processes and Standards" – Develop and use operating and maintenance checklists for operation of canteens/kitchens – Appoint persons to be responsible for cleanliness of accommodations, kitchens, canteens, break areas, etc. – Provide toilets at or near all work locations, establish and enforce rules prohibiting workers from using the bush	– Sanitary and compliant facilities and amenities – Healthy workers – Toilets in place where needed	Contractor
2.10	Assessment of impacts from bridge construction	– Unexpected and uncontrolled impacts	– Conduct environmental impact assessment of new bridge construction to meet ESS1 and Tajikistan law	– Impacts identified and avoided or controlled	Pamir Energy
3.0 Construction phase					
3.1	All activities, beginning with fieldwork during preparation phase	– Worker injury or death – Damage to vegetation, land, property outside construction zone	Implement Occupational Health and Safety Plan (see 2.3), including: – Medical clearance for workers to perform their tasks – Assessment of risks and identification of mitigation measures for all tasks, with PPE as last resort – Design tasks for maximum safe operations – Workers provided with proper equipment and tools, and PPE, to accomplish tasks safely – Only trained workers allowed to complete tasks	– Tasks completed with no worker injuries or deaths – Tasks completed with no damage to vegetation, land or property outside construction zone	Contractor

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			– Safety Officers oversee all works (minimum 1 per crew and 1:50 workers overall) – Sufficient First Aiders to provide first-level medical care as needed – Fully supplied first aid kits in all vehicles and equipment and at all workplaces – Communications established with nearest medical facilities and personnel regarding works to be completed, arrange for support as appropriate – Record safety statistics (work hours, near misses, minor & incidents and accidents, fatalities) – Worker transport (passenger vehicles only, no riding on heavy equipment, wear safety belts, etc.) – Work within boundaries, penalize supervisors and workers for violations – Install physical barriers at deep excavations and near water to prevent accidents – No solo workers near water (use “buddy system”) – Provide lifesaving equipment near water Implement Traffic Management Plan (see 2.3), to include: – Consultation with local traffic authorities on timing, repairs, etc. – Drivers/operators licensed for vehicles and equipment – Driver trained as needed and tested – Vehicles properly licensed/registered – Vehicles/equipment checked for safety daily by drivers/operators (horns, tires, fire extinguisher, headlights and taillights, safety belts, intact glass, etc.) – Speed limits established and enforced – Require special precautions for sensitive areas (hospitals, schools, etc.) – Keys never left in vehicle/equipment when driver/operator not present – Trained flaggers and/or signs/signals placed on		

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			public roads to control traffic at locations where roadside work not visible for 0.5km – Public notice/consultations prior to roadwork in construction zones Mark boundaries of all construction zones before activities		
3.2	Implement all other relevant C-ESMP plans as part of all activities (see 2.3)	Excessive impacts on people and environmental resources	Management of activities as planned to avoid or minimize potential impacts on people and environment	– Implementation of mitigation measures – Adaptive management for unexpected impacts – Compliance with law and ESSs	Contractor
3.3	Manage contractors	Inadequate or incomplete implementation of E&S requirements	– Include evaluation of E&S performance in decisions on payment of invoices for work completion= – Pay 100% of milestone completion invoices when E&S requirements have been implemented as required, reduce payment if requirements are not implemented and pay only when 100% complete	– Full implementation of E&S requirements – No unacceptable E&S impacts	Pamir Energy
3.4	Manage subcontractors	– Subcontractors not aware of E&S requirements – Poor labor practices and poorly trained workers – Failure to implement C-ESMP – Poor E&S performance, including safety, leading to environmental impacts, impacts on local communities, and worker injury or death	– Include relevant portions of C-ESMP in procurement documents and subcontracts – Require compliance with contractor's LMP safety, and other requirements, or equivalent requirements approved by contractor – Supervision of C-ESMP implementation by contractor and Pamir Energy (or Supervision Consultant) – Structure milestone payments to include C-ESMP implementation and withhold payments for failure to comply – Contractor to reduce subcontractor payment if E&S requirements are not implemented, and to pay only when 100% complete	– Subcontractor implementation of C-ESMP – No unacceptable E&S impacts	Contractor
3.5	Land clearing at tower locations, construction zones (tree & vegetation cutting, land clearing,	– Worker injury or death – Excess damage to surrounding areas, including biodiversity and private land and property	– Implement chance find procedure if artifacts or heritage discovered – Train workers and implement Occupational Health and Safety Plan, including requirements for	– Minimum biodiversity damage due to land clearing – No damage outside boundaries	Contractor

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
	excavations, earthworks in some places, equipment/building placement, etc.)	– Excessive erosion – Landslides	working with machinery and tools, working on steep slopes, animal/plant hazards, working in hot or cold environments, etc. – Agree with communities how debris/wood will be managed, with preference for donation to PAPs – To extent possible, micro-locate construction boundaries to minimize cutting/clearing of plants Implement Land Management and Erosion Control Plan including at a minimum: – Mark and stay within boundaries of construction zones and paths – Train/warn workers to remain within boundaries, penalize supervisors and workers for violations – Strip and store topsoil and subsoil/spoil in separate piles within construction boundaries, protect from erosion – Store subsoil/spoil in controlled areas, prevent erosion, maximize reuse – Install drainage control as needed to control erosion that would affect off-site areas – Restore disturbed areas per Plan Implement recommendations from biodiversity surveys, including – If surveys detect hibernating bats or nesting owls, bats, or raptors in mature trees, delay construction/clearing activities within 150m until after bats have left roost and/or young bats, raptors, and/or species of conservation concern have left nests – If surveys identify breeding or nesting fauna of conservation concern in or within 50m of construction zone, postpone disturbance within 100m until young have left the nests – Maintain photographic and written log of plants of conservation concern that are cut – Place 2+ bat boxes for every mature tree with evidence of bat hibernation/roosting/ nesting,	– Limited damage to ground surface and root zone – Survey completed, trees and shrubs marked – Bat box placement and tree/shrub plantings completed as required	

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			within 50m of tree that was cut – Plant 5+ trees of same species for every tree that is cut		

3.6	Work in the river	– Excessive damage to river morphology and aquatic habitat	– Implement relevant parts of Occupational Health and Safety Plan to minimize risk of working in and near water
			  – Train workers on buddy system and lifesaving practices/equipment
			  – Provide lifesaving equipment/measures
			– No refueling operations within 25m of river
			– Minimize work in moving water, use upstream barriers for work outside cofferdams wherever feasible
			– Cement transfers that are not within cofferdam only over impermeable surfaces
			– Toilets at least 25m from water, enforce use of toilets
			– Immediate cleanup of excess/waste concrete
			– Remove as much excess/waste concrete and other materials as possible before breaching cofferdams
				Minimal impacts on river and aquatic habitats	Contractor

3.7	Penstock excavations and road reconstruction	– Worker injury or death
		– Excessive soil and spoil removed
			– Train workers and supervisors in Occupational Health and Safety Plan (as above), in particular:
			  - Working in/near excavations/ confined spaces
			  - Workers trained in use of all tools and equipment
			  – Use of harnesses on steep slopes
			  – Barriers between work zone and road
			– Implement relevant provisions of Land Management and Erosion Control Plan, including:
			  – Disturb as small an area as possible
			  – Remove and store topsoil and spoil separately on prepared areas, protect from erosion
			  – Mark and work within boundaries
			  – Replace topsoil, ensure area is stable when complete
				– Works completed safely
				– No damage outside boundaries
				– Safe and efficient operations
				– Minimal interruptions and disturbance of traffic
					Contractor

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body

			– Establish/restore vegetative cover
			– Provide physical barriers around excavations if no active ongoing work
			– Implement relevant portions of Traffic Management Plan
			  – Consult with authorities concerning community safety measures, need for one-way traffic, diversions, etc.
			  – Flaggers and warning signs/lights on either end of all construction zones and on curves with limited sight-lines		

3.8	Excavations and cuts on steep and moderate slopes	– Worker injury or death
		– Loss or damage to equipment
		– Excessive land affected
		– Landslides
		– Erosion
			– Train workers and supervisors on Occupational Health and Safety Plan (see above):
			  – Harnesses, handrails as needed:
			  – Working in steep terrain
			  – Working around heavy equipment
			– Implement Land Management and Erosion Plan:
			  – Mark construction zone boundaries
			  – Strip and store topsoil (if any) and spoil on site, allowing none to escape downhill
			  – Grade surfaces, install gabions, walls, silt fences, etc., as necessary to prevent landslides, slope failure, mass erosion and stabilize slopes
			  – Clear site of all debris and waste when works are complete
			  – Restore land (stable contour, replace topsoil if possible, restore/establish vegetative cover with native species
				– Works completed safely
				– No works or damage outside construction zone boundaries
				– No landslides and no severe erosion
				– Land restored and stabilized after works completed
					Contractor

No.	*Activities*	*Potential Adverse Impact*	*Mitigation Measures/ Best Management Practice*	*Target outcome of mitigation*	*Responsible body*
3.9	Blasting (if required)	– Worker injury or death – Off-site damage from fly rock or vibration – Theft of explosives	Implementation of Explosives and Blasting Management Plan (if blasting is required): – Licensed subcontractor with proper permits from authorities – Transport and storage per Tajik law, storage at distance from other works – Licensed blaster – Notice to communities (signboards, posters, sirens, alarms, etc.) – Pre- and post-blast surveys of buildings within 500m – Compensation per RAP	– Explosives transported and used safely – Minimal off-site damage – Off-site damaged identified and compensated per RAP, as necessary	Contractor
3.10	Restoration of disturbed land	– Post-construction erosion, landslides – Failure to restore/establish vegetative cover – Reduced production from cropland and grasslands	– Restore all disturbed areas per Land Management and Erosion Control Plan (see items above): – Remove all waste and debris – Establish stable contours – Spread spoil and topsoil (except on rocky barren terrain) in stable configuration – Remove excess spoil/soil for use elsewhere. Donate excess fertile topsoil to PAPs – Plant native species of grasses and shrubs. – On land used by contractor for construction zones: restore land as above unless landowner requests modification (for example, no planting on cropland, etc.) – Plant trees to shield project infrastructure from road and houses where possible – Verify riverbanks and road verges are stable	Land returned to productive use	Contractor

3.11	Protection of camps, storage areas, equipment, property, substation, etc. (security)	– Abuse of local population or workers, including injury or death
		– Loss of community support, possibly active opposition
		– Liability for contractor and Pamir Energy
			– Prepare and implement Security Plan:
			  – No armed security
			  – Contractor/Subcontractor and guards checked for licenses, past abuses
			  – Guards trained in appropriate use of force
			  – Consultations with local law enforcement authorities
				No vandalism, theft, or incidents involving security	Contractor
					
					Pamir Energy to approve

3.12	Protect workers employed	Child labor, forced labor, and/or	If Pamir Energy or contractor has significant control or	No child labor or forced labor or	Contractor

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
	by primary suppliers	serious safety issues at primary suppliers	influence over primary suppliers (specifically, turbine and transformer manufacturers, transport contractors, steel provided for bridge, etc.), contractor to monitor supplier and require improvement in labor safety practices or remedies in case of child or forced labor, or change suppliers	serious safety issues at primary suppliers	(supported by Pamir Energy)
3.13	Payment of invoices for completion of milestones	Failure to implement E-CSMP in completion of construction milestones: erosion damage, works/damage outside construction zone boundaries, poor soil/spoil management, poor safety practices, risks to community, etc.	– Consider relevant E&S management requirements to be an integral part of each construction milestone – Penalize initial failures to implement mitigations by withholding partial payment until mitigations are properly implemented – If contractor fails to correct, appoint third party to implement corrective measures, reduce contractor invoices by that amount and more – Penalize repeated failures to implement mitigations by considering milestones incomplete and reducing payments permanently	– Proper implementation of C-ESMP – Minimal impacts on biodiversity, people, and property	Pamir Energy for contractor invoices Contractor for subcontractor invoices
4.0 Demobilization					
4.1	Completion of work	– Non-operational components – Unsafe and unstable conditions	– Inspect all disturbed areas to verify C-ESMP has been fully implemented – Verify installation of security fencing and hazard/warning signs – Verify tree and other plantings are stable and self-sustaining	– Construction complete with C-ESMP fully implemented	Pamir Energy
4.2	Closure of construction areas, camps, accommodations, etc.	– Contaminated soil , waters remain after contactor departs – Liability for Pamir Energy	Implementation of Land Management and Erosion Control Plan prior to departure (site restoration, revegetation, etc.): – Removal of all equipment, storage units/tanks, debris, wastes, etc. – Removal of contaminated soil – Establish stable contours to eliminate standing water and match surrounding terrain as much as possible – Spread spoil and replace topsoil – Plant native species or take final action as	– Areas used for construction operations restored to pre-construction uses or as agreed with land users – No residual liability or damages	Contractor

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			requested by private landowners. – Monitor plantings until established and self-sustaining		
4.3	Payment of final invoice	Demobilization incomplete, with residual damage, unrestored land, improper drainage, etc.	– Withhold payment until Pamir Energy confirms demobilization is complete from E&S perspective – Appoint third party to complete restoration activities if contractor fails, at contractor's expense	– No continuing or residual damages or contamination – Land restored to former use as required	Pamir Energy
5.0 Operation and maintenance					
5.1	Preparation/updating and implementation of operating plans (prior to commissioning): – SEP – Occupational Health and Safety Plan – Labor Management Plan – Flow management plan To be included in overall operating manual, not kept as separate	– Noncompliance with employment and safety laws – Failure to implement mitigations required for E&S protection – Uninformed community – Unacceptable risks to workers, biodiversity, community	– Pamir Energy Safety Manual updated per World Bank Group EHS General Guidelines – LMP updated to reflect World Bank ESS2 requirements – Update SEP to include plans for continued consultation, including commissioning open house – Update OHS plan to include requirements or routine HPP and substation operation and maintenance – Develop flow management plan to ensure 3.0m^3/sec flows over the weir and remains in the river, including 1.25m^3/sec through fish pass	– Legal compliance – Informed and supportive community – Safe working conditions and workers – Continuous flow sufficient to support biodiversity	Pamir Energy
5.2	Commissioning testing (periodic diversions)	– Unexpected changes in water levels downstream – Risk to downstream people in river	– Require warning system in case water diversions are to end, thus raising downstream water levels quickly – Inform local communities of expected testing and changes	Safe testing	Pamir Energy
5.3	Energizing substation	– Electrocution of workers or others – Damage to towers, conductors, substation	– Consult with communities before energizing – Workers trained per Occupational Health and Safety Plan: electrical safety, working at heights, lifting – Follow Pamir Energy technical protocols/ procedures for energizing lines/components – Keep bystanders/observers away from corridor and substation during procedure – Inspect entire corridor in case of malfunction	Works completed safely	Contractor and Pamir Energy

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
5.4	Routine maintenance and security patrols	– Worker injury or death – Damage to ground surface and cover vegetation, soil erosion – Traffic accident – Damage to private property (trees, crops, etc.)	– Workers trained in requirements of Pamir Energy Safety Manual specific to their jobs – Workers trained in requirement of Traffic Management Plan – Compensation per RAP	– Works completed safely – Damages compensated promptly per RAP	Pamir Energy
5.5	Implementation of monitoring plans (see E&S Monitoring Plan)	– Unexpected conditions not recognized – Unexpected or unacceptable impacts	– Biodiversity consultant appointed to completes aquatic surveys – RAP consultant appointed to verify compliance of RAP implementation with ESS5 and law	– Changes in conditions recognized and addressed – Compliance	Pamir Energy
6.0 All phases					

6.1	Oversight of E&S performance of design and construction	– Lack of timely knowledge about contractors' E&S performance
		– Unnecessary E&S impacts
		– Minor issues become major problems
			– Appoint qualified professionals to oversee E&S performance on the project
			– Supervision Consultant to communicate with to Pamir Energy on weekly basis, writeup reports on monthly basis
			– Monthly progress meetings involving contractor, Pamir Energy, and (if appropriate) supervision Consultant
			– Pamir Energy corporate staff to visit site unannounced at least monthly
			– Project management to provide data for website updates
			– Pamir Energy HSE Department (corporate) to:
			  – Schedule and participate in consultation meetings and informal interviews
			  – Periodically consult with municipal and village authorities
			  – Review grievance logs periodically
			  – Maintain communications with important NGOs
			  – Maintain communications with Committee for Environmental Protection
				– Pamir Energy project HSE staff and corporate HSE Department knowledgeable and up to date on E&S performance
				– Pamir Energy management well-informed of issues before they become problems
					Pamir Energy (and Supervision Consultant as appropriate)

6.2	Operating passenger and heavy vehicles	– Traffic accidents – Injury or death to drivers or passengers	Implement Traffic Management Plan – Trained and licensed drivers – Speed limits	– Vehicles and equipment operated by authorized personnel	Owner/ Operator of vehicle:

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
		– Damage to pedestrians, other drivers and passengers, property – Liability to contractor and project	– Daily safety checklist – Passengers only in seats designed for persons (safety belts, etc.), no standing or riding in back of trucks or on equipment – No giving rides to public – No vehicle/equipment movements off construction zones and roads unless authorized by site supervisor	– No traffic accidents – No injuries to drivers or passengers, no damage to property	Contractor, Supervision Consultant, Pamir Energy
6.3	Completion of all construction works	Damage to vegetation, land surface, property outside construction zone boundaries	– Implement relevant elements of Land Management and Erosion Control Plan – Implement relevant elements of Occupational Health and Safety Plan – Control dust from soil/spoil piles, construction sites by covering or vegetating, from roads by dampening – Control noise by maintaining equipment and vehicles, training workers	– All work within construction zone boundaries – Minimal damages, compensation per RAP – Work completed safety	Contractor Pamir Energy (OHS)
6.4	Stakeholder engagement	– Uninformed stakeholders – Distrust of Pamir Energy – Increased vandalism	– Implement Stakeholder Engagement Plan – Notify local authorities of ongoing maintenance and repair operations – Implement Grievance Redress Mechanism: receive and respond to comments and complaints	– Informed stakeholders – Public support	Pamir Energy (manage throughout, implement during operation) Contractor (day-to-day) during construction
6.5	Hazardous and nonhazardous waste and materials management	– Spills and contamination of soil and surface water – Extra cost due to wastage	Implement Materials and Wastes Management Plan, including – Minimize use of hazardous materials, using nonhazardous substitutes wherever possible – Store hazardous materials (including fuels) in secure area over impermeable surface – Material Data Safety Sheets to be kept at all locations where hazardous materials (including fuels, paints, lubricants) are stored or used	– Minimal spills and contamination, rapid and proper cleanup as needed – Proper and safe waste management, including third-party management	Contractor

No.	Activities	Potential Adverse Impact	Mitigation Measures/ Best Management Practice	Target outcome of mitigation	Responsible body
			– Allow only authorized and trained personnel to work with hazardous materials – Segregate used materials/wastes in categories to maximize ability to restore, reuse, recycle and minimize disposal – Dispose wastes in licensed disposal area or hire licensed hauler to take wastes to a licensed area (verified by contractor) – For hazardous wastes taken away by hauler, verify hauler's license and verify that final disposal/recycling location is properly permitted		
6.6	Vehicle and equipment fueling and maintenance	– Spills and contaminated soil or water – Fire	– Vehicle and equipment fueling and maintenance only over impermeable surfaces. Use drip trays when not over paved surface. – Fire extinguishers with proper chemicals in all vehicles/equipment and at all fueling locations – Spill cleanup kits at all locations where fuel and hazardous chemicals are stored and in all vehicles and mobile equipment – Vehicles maintained per manufacturers' recommendations: mufflers, safety equipment, engine and fuel burning (no black smoke), etc.	– No contamination from incidents involving fueling – Vehicles maintained as required	Contractor
6.7	Working within 10m of river	– Spills of fuel or other materials into water – Damage to streams and water bodies – Erosion into streams and water bodies	– Implement procedure for working in or near surface water – Barriers between work zones and water if within 5m of water – No fueling within 25m of river – Vehicle/equipment crossings of drainageways or small streams only at designated locations – Apply gravel or otherwise prepare surface at places of frequent crossings to minimize damage to streambed – Minimize crossings during wet weather – Repair rutting and other damage to stream banks and streambeds immediately when works are completed in that area (grade, revegetate)	– No water contamination – Minimal damage to streams and drainageways	Contractor

No.	*Activities*	*Potential Adverse Impact*	*Mitigation Measures/ Best Management Practice*	*Target outcome of mitigation*	*Responsible body*
6.8	Responses to emergencies	– Worker injury or death – Community member injury or death – Excess damage to property or people	Implement Emergency Preparedness and Response Plan, which is to include: – Appointment of emergency response team – Train workers in their responsibilities in case of emergencies and in responding – Identify possible emergencies and possible consequences (fire, accidents, injuries or deaths, earthquake or weather event, civil unrest, spills) – Develop and use checklists to verify readiness for emergencies – Place and maintain emergency response equipment (fire extinguishers, first aid kits, radios/communication devices, etc.) – Conduct investigations/reviews to identify causes and avoidance measures following emergencies, including accidents	– Emergencies avoided – Emergency equipment in place and ready if needed – Quick and effective responses to emergencies	Contractor and Pamir Energy
6.9	Protection of cultural heritage	Damage or destruction of artifacts or archaeological remains	Implement chance find procedure, to include – Stop work upon discovery – Notify Ministry – Consult with Ministry on steps to commence work – Protect site while awaiting work re-start – Begin work when authorized by Ministry – Train workers and supervisors in procedure	– Qualified personnel make judgments about possible finds – Cultural heritage protected	Contractor

Table 4948. Environmental and Social Monitoring Plan for the Sebzor hydropower plant

Activity	*What*	*Where*	*How*	*When*	*Why*	*Who*
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
All construction works	Technical progress and implementation of mitigation measures, compliance with	Selected past and all current work areas	– Observations during normal activities – Inspections – Monthly reports and incident reports	Continuous or as necessary	Verify implementation of mitigation measures	Pamir Energy (or Supervision Consultant)

Activity	What	Where	How	When	Why	Who
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
	Tajikistan E&S law, World Bank ESF, and C-ESMP		E&S monitoring audit	First year of construction, one further time during last year	– Verify implementation of C-ESMP – Identify needed modifications ot C-ESMP	Third-party consultant appointed by Pamir Energy
	Working conditions, biodiversity management, and erosion control	All active work areas	Observations	During daily rounds (continuous)	Verify implementation of OHS Plan	Contractor safety manager
			Inspections	At least weekly		
		Active and recent tree cutting areas, active sites on steep slopes, active construction sites	Observations	During daily rounds	Verify relevant aspects of C-ESMP are being implemented	Contractor E&S manager and/or specialist(s)
			Inspections	At least weekly		
		New construction sites	Inspections	Before construction begins	Verify supervisors are aware of requirements, construction boundaries are marked, etc.	
		Upstream and downstream of construction activities	Instrumented measurements of suspended solids, pH, etc.	Monthly during construction	–	
	Working conditions (equipment, tools, etc.) and workers (PPE)	All active work areas	Observations	During daily rounds (continuous)	– Verify safety of working conditions and workers – Provide guidance to supervisors and workers	Safety Officers
			Inspections	At least weekly		Contractor safety manager
	Worker and supervisor safety training	All active work areas	Records checks & interviews	Daily or as needed before beginning new work	Ensure workers are trained to work safely	Supervisor (foreman)
				Spot checks (at least once every site monthly)		Contractor safety manager
Progress reports/meeting	Technical progress and status of C-ESMP	Recently and currently active sites	– Interviews with contractor E&S & technical staff – Review monthly contractor	Monthly	Verify technical progress and E&S protection	Mandatory attendees: – Contractor E&S personnel

Activity	What	Where	How	When	Why	Who
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
	implementation: – Safety – Biodiversity survey and restoration activities – Erosion control & site stabilization – Site restoration – Grieveance management		and Supervision Consultant E&S reports – Review worker & stakeholder grievance registers – Site visits			– Supervision Consultant (if any) – Pamir Energy project E&S specialists and HSE Department representative
Drivers and vehicle safety	Driver qualifications	Office	– Verify valid driver's license and operator's permit as required – Check with traffic police if needed – Skills test as needed	– Before allowed to vehicles/equipment – Annually	Trained drivers	Contractor PM & safety manager
	Mobile plant/ vehicle safety (horns, backup alarms, lights, tires, safety belts, fire extinguisher, cleanup kit, first aid kit, etc.)	All mobile plant in use	Inspect and complete checklist	Daily before first use	Minimize traffic accidents, protect workers and other drivers/pedestrians	Driver/operator
			Review checklists and vehicles	Spot checks: at least monthly for each vehicle		Contractor safety manager
Marking boundaries of work areas	Boundary is clearly marked	All active work areas	Observations and photographs	– The day before work is to begin – At least once during each stage of construction works	- Limit areas of impacts - Verify no off-site damage	Contractor supervisors & E&S personnel
Water quality	Erosion/ sedimentation	In river upstream and downstream of works	Visual observation or turbidity (discoloration/clarity)	Continuous during dally rounds	Determine if construction is affecting water quality, verify implementation of	Supervision Consultant and Contractor E&S

Activity	What	Where	How	When	Why	Who
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
	Suspended solids, pH, temperature		Electronic	Monthly during construction	Land Management and Erosion Control Plan	manager and/or specialist(s)
Air quality	– Visible dust and/or dust coating leaves on vegetation	Road, construction areas	Observations	Continuous during daily rounds	Determine need for damping roads to suppress dust	All contractor managers, supervisors, E&S personnel,
	Black smoke from vehicles, equipment, other engines	All engines			Determine need to remove engine from service until repaired	
Biodiversity preconstruction surveys (	Terrestrial and aquatic biodiversity	All areas to be affected by construction	– Visit to ongoing survey – Debriefs by survey team	- Visits and spot checks two times during each survey	Verify surveys are following TOR	Pamir Energy HSE Department
	– Mature trees (and buildings) with hibernating/ nesting bats & birds logged, photographed, & marked – Trees to be cut marked – Fauna present and/or at risk identified, including birds of conservation concern (if any)	Selected areas being surveyed, while surveys are ongoing	– Visits to ongoing surveys – Spot checks of specimens marked after surveys – Debriefs by survey team(s)	- Visits and spot checks: at least one site daily during surveys - Debriefs: daily verbal or email/written	Verify surveys are identifying species of concern, mature trees, natural habitat	Contractor E&S manager & specialists

Activity	What	Where	How	When	Why	Who
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
Land clearing activities (roads, towers, substation, & construction areas)	Compliance with Land Management and Erosion Control Plan, including: – Boundary marking before construction begins – Working within boundaries – Topsoil storage and spoil storage – Drainage control to prevent erosion	All areas being cleared	– Visits/inspections – Reports from supervisors to E&S manager	– Before clearing – Daily during clearing – After clearing and before construction	– Limit extent of clearing – Verify topsoil salvaged – Verify drainage controlled and erosion avoided –	– Contractor E&S personnel – Contractor PM (spot checks)
		All areas under construction	Inspections	At least weekly	Verify implementation of LC&EC Plan	Contractor E&S personnel
	Condition of land/vegetation at boundary		Observations and photography	Before clearing begins	Allow verification of working within boundaries	Contractor E&S personnel
	Site restoration	Construction sites	Inspections	When and immediately after construction ends at that site	To verify restoration	Contractor E&S personnel
Excavations and cuts	Areas of excavations marked, edges of excavations marked (tape, rock barriers, etc.)	Foundation locations, cuts on steep slopes	Before ground broken	Before excavations	Limit area of disturbance	Contractor E&S personnel
	Works are within boundaries	Tower locations, substation location	Observation, photographs	Daily during works	Limit area of disturbance	Contractor E&S personnel & supervisors
	Soil salvaged and	All excavations	Observations and	At least once during works	Topsoil conserved and	Contractor E&S

Activity	What	Where	How	When	Why	Who
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
	stored separately from subsoil/spoil		photographs	at each site	protected from erosion	personnel
	Workers received relevant training	Work sites and records	Interviews, records review	Prior to work at excavation sites	Verify workers can work safely	Contractor safety manager
	Barriers (tape, rocks, etc.) placed to prevent falls	Perimeter of excavations >1m deep	Observation	When excavation is complete	Protect workers and others against falls	Supervisor
				Spot checks (including when no active work is ongoing, such as weekend)		Contractor E&S personnel
	Open excavations marked when no ongoing work and end of workday		Observation	End of workday	Protect community members from falls	Supervisor & Contractor E&S manager
Vegetation cutting	Implementation of Flora and Fauna Survey Plan – Trees to be cut marked – If flora species of concern identified: logged, photographed, & marked – Mature trees with bats/birds logged, photographed, & marked – Fauna signs and presence documented, risks identified	Areas where trees and shrubs are to be cut	Observation	Immediately prior to cutting/clearing and during ongoing cutting/clearing	Verify species and specimens of concern are identified	Contractor E&S manager

Activity	What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Who (Is responsible for monitoring?)
Tree and shrub plantings	5+ trees and shrubs of same species planted per tree cut/removed	In location suitable for growth selected by qualified biologist	Observation and photography	During spring following cutting	Verify plantings	Botanist appointed by contractor
	Survival of 5+ plantings per tree/shrub cut			Prior to demobilization	Verify success to allow final payment	
				Annually for 5 years after planting	Verify success or identify need for replanting	Botanist appointed by Pamir Energy
Bat box placement	2+ bat boxes placed per bat-supporting tree cut or building removed	In location selected by qualified expert	Observation	Within one month of tree cutting	Verify placement	Contractor- or Pamir Energy-appointed biodiversity expert
				One year after original placement	Verify in place	
Land restoration	Implementation of Land Management and Erosion Control Plan – Stable contours after construction – Placement of topsoil (if any) on bare ground – Planting native species (seeds or plants)	All areas where land was disturbed that will support vegetation	Observation and photography	Within one month of end of activities at that site	Identify need for repairs or verify restoration	Contractor E&S personnel
	Establishment of self-sustaining vegetation cover	All restored areas except slopes not capable of supporting vegetation cover	Observation & photography	Each month (spring, summer, fall) until vegetation cover determined to be self-sustaining and one year after that	Verify vegetation is established & determine if further action or repairs needed	Botanist appointed by contractor (and Pamir Energy after construction ends)
Noise	Noise levels	Workplaces	Noise meters	Monthly at typical work sites	Verify noise is within	Contractor E&S

Activity	*What*	*Where*	*How*	*When*	*Why*	*Who*
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
generation		Off-site locations		Within 24 hours of request or noise complaint by worker or external party	standard or identify need for mitigation	personnel
		At nearest residence when works are within 250mkm		Weekly, while work is ongoing within 250m of houses		
Blasting	Slope slippage (landslide potential)	Within 200m of blasts	Observation	Same work shift as blast	Determine risk of landslide and need for corrective action	Personnel assigned by blast master
	Pre-blast condition	Buildings within 0.5m of blast	Inspection and photography	Prior to blast	Establish pre-blast condition	Personnel assigned by blast master & Contractor PM
	Post-blast condition: cracks, settling, flyrock damage, etc.			Within 24 hours after blast	Identify blast damage	
	Blasting contractor compliance with legal requirements for transport, storage, use	Magazine and blasting sites	Inspection	Monthly	Verify compliance, ensure safety	Contractor E&S manager
Ensuring adequate hygiene	Sanitation, water, etc.	Kitchens, break areas, toilets, accommodations	Inspections			
	Toilets & potable water	Work locations	Observations	Daily during rounds	– Verify workers have potable water – Verify toilet facilities are available	Safety Officers and/or E&S specialists, supervisors, managers
			Inspections	At least weekly		Contractor E&S specialist and/ or safety officer
Worker grievance	Worker grievance register	Work sites and Contractor records	Review of register	Weekly	Verify grievances are being recorded and resolved	Contractor HR manager and PM

Activity	What	Where	How	When	Why	Who
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
resolution	Grievance handling and resolution	office	Interviews with managers responsible for resolution and with complaining workers	Before monthly progress meeting	Verify grievances are being addressed properly	Contractor HR manager, supervisors
External stakeholder grievance resolution	Stakeholder grievance register	Contractor records office	Review of register	Weekly	Verify grievances are being recorded and resolved	Contractor HR manager and PM
	Grievance handling and resolution	Community	Interviews of selected stakeholders who submitted grievances and with persons responsible for addressing	Before monthly progress meetings	Verify grievances are being addressed properly	Contractor E&S manager, social specialist/CLP
	Pre-blasting consultation (if blasting is needed)	Community	Consultation with leaders and with residents within 500m of blasts	Prior to blasts	Warn communities of upcoming blasts	Contractor E&S manager/foremen
Stakeholder engagement	Worker behavior in communities	Community	– Reviews of grievance log – Interviews with community leaders	Quarterly	Determine need for training/dismissals/ etc.	Contractor HR manager, PM, social specialist/CLO
	Community satisfaction with project	Community	– Reviews of grievance log – Interviews with community leaders and local residents	Quarterly	Identify community issues	Social specialist, CLO
Resettlement and compensation	Compliance with RAP	As specified in RAP				
Erosion control, land stability	Effectiveness of erosion control and land restoration	Tower locations and substation	Observations during routine maintenance patrols	Semi-annually during operation	Identify need for further land stabilization and erosion control	Pamir Energy
River flows	Flow over fish pass	At fish pass	Instruments supplemented by staff gauge reading	Instruments continuously, gauge reading daily	Verify fish pass has sufficient (but not too much) water	Pamir Energy HSE specialist
	Flow in river	Upstream and downstream of weir (within 100m of weir)	Instruments supplemented by staff gauge reading		Verify environmental flow is being released	Pamir Energy HSE specialist

Activity	*What*	*Where*	*How*	*When*	*Why*	*Who*
	(Is the parameter to be monitored?)	*(Is the parameter to be monitored?)*	*(Is the parameter to be monitored?)*	*(Define the frequency / or continuous?)*	*(Is the parameter being monitored?)*	*(Is responsible for monitoring?)*
Aquatic biodiversity	Fish migration	At weir/fish pass	Observe fish blocked by dam and passage over fish pass	After commissioning: Spring and fall migration seasons (2 years, plus more if needed)	Verify migration is not impeded	Consultant
	Fish spawning (if preconstruction surveys verify spawning)	Upstream and downstream of weir (same locations as monitoring before construction)	Observe spawning fish and	After commissioning: Spring spawning (2 years, plus more if needed)	Verify environmental flow is sufficient for spawning	Consultant (year 1; may train Pamir Energy staff for year 2+)

9. Stakeholder Engagement and Public Consultations

9.1. Purpose of stakeholder engagement within ESIA

Stakeholder engagement is an integral part of project development and implementation, and should begin as early in project development as possible and continue through the project's full life cycle. The purpose of stakeholder consultation during the international ESIA process is to ensure that the views, interests and concerns of project stakeholders are taken into account in the following decisions:

- Decisions taken during the planning, design and implementation of the project;
- ESIA decisions regarding planning of the ESIA scope, assessment of the potential impacts and identification of appropriate management measures;
- Decisions by the state environmental agency (CEP) to approve successive ESIA stages leading to completion and approval of the local OVOS; and
- Decisions by development financiers on the funding of the project and corresponding loan conditions.

9.2. Stakeholder engagement and consultation process for Sebzor HPP

An overview of the ESIA stakeholder consultation process for the Sebzor HPP project is presented in Table 50~~Table 49~~.

Table 50~~49~~. Overview of the stakeholder engagement process during the Sebzor HPP ESIA

Steps	*Objectives*	*Stakeholders involved*	*Activities*	*Main documents to be produced*
SCOPING Corresponds with the scoping phase of the ESIA	- Identify regulatory authorities and other stakeholders who should be involved in the ESIA process. - Notify stakeholders of the ESIA process and give them the necessary procedural and substantive information to facilitate their input to the process. - Engage stakeholders – listen to them and record issues raised (concerns, comments and questions).	All	Stakeholder identification and analysis (desktop social scan)	List of potential stakeholders
			Planning stakeholder consultation and disclosure	SEP
			Notification of stakeholders of ESIA process and the proposed project	Background information document for stakeholders
			Engagement of stakeholders	- Records of meetings. - Updated stakeholder database and issues record.

Steps	*Objectives*	*Stakeholders involved*	*Activities*	*Main documents to be produced*
DISCLOSURE AND CONSULTATIONS ESIA and RPF stakeholders	Disclose ESIA and RPF	Local communities, and regulatory authorities, NGOs and other stake-holders as required	Meetings with stakeholders, as per the procedure described in SEP	- Records of meetings. - Specific information-sharing documents.
FEEDBACK RESPONSE on the results of the ESIA	- Provide relevant stakeholders with an update on progress with project planning, expected impacts and proposed mitigation. - Acknowledge issues raised by stakeholders and tell them how the project proponent (Pamir Energy) proposes to address these. - Engage stakeholders – listen to them and record additional issues raised.	All stakeholders that have shown an interest in the project	Notification of stakeholders	- Issue specific feedback documentation as necessary - Non-technical summary of the ESIA.
			Engagement of stakeholders	- Records of meetings. - Updated issues record.
			- Pamir Energy advertises public hearing "Asia Plus" and "Badakhshan" newspapers - Delivering public meeting information through Pamir Energy electrical inspectors	- Advertisements - Notices for distribution by electricity inspectors
			Public hearing within 30 days of public notice	A record of the hearing(s) and meetings

9.2.1. Previous Stakeholder Engagement and Consultations (2015-2018)

Pamir Energy began planning for the Sebzor HPP and substation before 2015 and commissioned SWECO International to complete a Feasibility Study. During the Feasibility Study, SWECO and Pamir Energy conducted stakeholder engagement and scoping consultations. A stakeholder engagement plan (SEP) was prepared ad part of Feasibility Study 2016. From 2017, Pamir Energy has conducted informal engagements with local authorities and with local communities to collect information about the project and in some cases to learn about people's concerns. Pamir Energy met with leaders and community members in Roshtqala, Barjingal, and Sebzor.

Pamir Energy provided project information and asked for opinions about the project, and highlighted anticipated social, economic and environmental issues in the district and communities. All stakeholders expressed support for the proposed project, emphasizing the potential social and economic benefits. Interviewed persons were perhaps most concerned about employment

opportunities, since unemployment is a major concern in the entire region and especially in these rural communities. They all expressed their wish that local people have the chance to be employed during construction. In late 2016, SWECO produced a SEP that was adopted and implemented by Pamir Energy as the project moved forward.

From May to October 2016, Pamir Energy held a number of meetings with a total of 135 stakeholders in four communities located in Roshtqala district and within the area that could be affected by the project. The communities included Barjingal, Dashtak, Mirsaid and Mirshakar. Pamir Energy disclosed project information, including the duration of proposed project activities and the potential impacts that could result from project construction and operation. The local communities were also provided with information on possible relocation of about 11 households that are located within the project area. Once again, local residents unanimously confirmed their support of the project, and the heads of households closest to the project agreed they would be willing to be relocated if that is necessary. A working group (committee) was established among local residents, who have provided support to the communication and remained in frequent communication with Pamir Energy regarding the relocation and compensation aspects.

Later, upon the completion of the second scoping consultations, Pamir Energy produced a Resettlement Action Plan (RAP), which was then further disclosed and consulted with stakeholders and affected people.

9.2.2. Scoping consultations for international ESIA

In 2019, prior to and during preparation of the draft ESIA and SEP, Pamir Energy conducted interviews with community members in Khorog and in three villages. Pamir Energy then organized more community meetings in May 2019 in the project affected area. The main topic of the community meetings has been to share information, communicate with the local population, and identify their needs and interests.

All community members who have expressed opinions to date have had positive opinions about the proposed Sebzor HPP and transmission line construction projects. All respondents support the projects due to its high social and economic value to local communities. Everyone interviewed had knowledge of Pamir Energy and its activities. Nearly everyone noted that the most significant social and economic problems in the region are high unemployment rates and low income. A number of stakeholders interviewed specified that the best communication method with village residents and community members would be through Pamir Energy electricity inspectors, who they see on a regular basis (once a week or so) when inspectors visit households to read electricity consumption gauges. Every interviewee expressed interest participating in further meetings, consultations and public hearings for the proposed project.

Pamir Energy also organized and carried out a series of scoping meetings and consultations with institutional stakeholders in early 2019.[5] The scoping consultation process involved identification of key project stakeholders in Dushanbe and GBAO, meetings with state and local authorities in Dushanbe and Khorog (Houkumat, Jamoat), meetings with regional NGOs and academic research

[5] Consultations and discussions dealt with the full World Bank Rural Electrification Project, which includes the Sebzor hydropower plant, 18km connecting transmission line, off-grid connections in GBAO and Khatlon, and this 63km transmission line.

institutes and universities in Dushanbe and Khorog cities (e.g. University of Central Asia and Pamir Biological Institute in Khorog). The main objectives of the consultations included:

- To identify and verify interests of project stakeholders and to establish working dialogues between Pamir Energy and the stakeholders
- To disclose information about the proposed project
- To understand stakeholders' expectations about the project and their respective levels of interest in continued communication and participation in future Pamir Energy activities associated with the proposed project.
- To receive feedback, comments, and concerns from stakeholders about the project and on prospective regional electricity supply schemes in general
- To obtain feedback on major environmental, social and economic problems in Roshtqala, Shughnon, Rushon and Ishkashim districts and overall across GBAO.

9.2.3. Stakeholder Engagement Plan

Pamir Energy has prepared a Stakeholder Engagement Plan (SEP) that outlines how stakeholder engagement will be practiced throughout the course of the project and which methods will be used as part of the process. It outlines the responsibilities of Pamir Energy and contractors in the implementation of stakeholder engagement activities. Details on the ESIA stakeholder consultation are also presented in the SEP. The SEP is considered to be a live document that will be updated throughout the ESIA process and will continue to evolve as the project proceeds through the construction, operation and decommissioning phases.

SEP activities have been targeted at project affected persons (people affected by land acquisition, people residing in project areas, Jamoats), as well as at other interested parties (Ministries and government agencies, NGOs, business and workers' organizations, press and media, general public, tourists, jobseekers, academic institutions, among others). The SEP outlines special considerations that will be given to ensure outreach to and engagement of disadvantaged and vulnerable groups. SEP activities include establishment and management of a project-wide grievance redress mechanism, public meetings, trainings and workshops, media and social media communication, disclosure of written materials, municipal information desks, involvement of project community liaison officers at the municipal level, as well as a survey among affected persons to gauge satisfaction with the quality of citizen engagement and share additional concerns.

9.3. Public Disclosure of and Consultations for the ESIA

This ESIA was prepared to meet requirements of the World Bank and also the requirements of Tajik laws on Environmental Protection and Law on Environmental Expertise. The ESIA documentation includes this ESIA, a Stakeholder Engagement Plan (SEP), and a Resettlement Policy Framework (RPF). The availability of this draft ESIA and other documents were announced in the regional/state newspaper ("Asia Plus") and local newspaper "Badakhshon". It was also announced on Pamir Energy's web page (http://pamirenergy.com/en/presscenter/public.php)

Besides the draft disclosure documents (and the final documents in future), project brochures and updates will be prepared and made available. In addition, the site will provide details about the

Grievance Redress Mechanism (Subsection 9.5) and contact details of the Community Liaison Officer. Pamir Energy will update and maintain the website regularly, at least quarterly.

Paper copies of all ESIA documentation have been in Jamoats and advertisements placed on the notice boards in the villages. Electronic copies are available at the website above. Addresses where the ESIA documents could be reviewed prior to consultation meetings included the following:

- Pamir Energy Company, 75 Gulmamadova Street, 736000 Khorog, GBAO, Tajikistan
- Administration (Khoukumat) of GBAO in Khorog, address: city Khorog, Lenin street 47, Tajikistan
- Administration (Khoukumat) of Roshtqala district in Roshtqala; address: Khorog, Committee for Environmental Protection (CEP), Lenin street 46, Tajikistan

9.4. Stakeholder Engagement during Project Implementation

Engagement will continue through the life of the project. The SEP provides details of the program that will be used to present information to stakeholders and to receive information and opinions from stakeholders. In summary, there will be:

- Public / community meetings
- Mass/social media communication
- Distribution of information materials
- Grievance redress mechanism
- Project tours for media, civil society, and local representatives
- Information desks at each municipality
- Citizen perceptions surveys
- Trainings and workshops to raise awareness on key topics of interest such as EMF, impacts on land and compensations, code of conduct for project staff, grievance redress mechanism, or other topics of interest to citizens.

9.5. Grievance Redress Mechanism

In compliance with the World Bank's ESS10, a project-specific grievance mechanism is being set up to handle complaints and issues, and this will be in addition to the normal Jamoat and village-level processes that are available to citizens. Issues and complaints can arise during the course of the project due to actions by Pamir Energy or its contractors and subcontractors. At present, Pamir Energy operates a "customer hotline" that is used to report power outages and other issues. During construction, Pamir Energy will establish a separate mechanism to deal with construction-related issues, including issues regarding compensation and resettlement.

The Grievance Resolution Mechanism (GRM) is intended to address issues and complaints from external stakeholders in an efficient, timely, and cost-effective manner. A separate mechanism will be used for worker grievances. Pamir Energy will be responsible for managing the stakeholder GRM, but many or most grievances are likely to result from actions of the construction contractors and so

will need to be resolved by the contractors themselves, with Pamir Energy oversight. Typical grievances for the Sebzor project could include issues related to:

- Land acquisition and compensation
- Construction damages to property, crops, or animals
- Traffic
- Environmental impacts such as erosion
- Construction nuisances such as dust or noise
- Worker misbehavior
- Reduction in water flows in the river.

The GRM will be in place and operational before Pamir Energy begins construction activities and will function until the completion of all construction activities and beyond, at least until the contractor's defect liability period ends. Compensation for land and property needed for the project will be completed before construction begins. People who reside near the line and others who may be affected will be informed, in meetings and with brochures, of the GRM's purpose, functions, procedures, timelines and contact persons. Additional measures will be taken to inform those who are determined to be eligible for compensation

The GRM will be in place and operational by the time Pamir Energy begins construction activities and will function until the completion of all construction activities and beyond, till the contractor's defect liability period ends. People who reside near the line and others who may be affected will be informed, in meetings and with brochures, of the GRM's purpose, functions, procedures, timelines and contact persons.

The project GRM will include three successive tiers of extra-judicial grievance review and resolution:

- The first tier would be the Pamir Energy E&S team, including the Community Liaison Officer. It is expected they could deal quickly with issues that can be quickly resolved, such as dust or traffic.
- The second tier would be a Grievance Resolution Committee (GRC1) that included representatives of Pamir Energy, village, and Jamoat. They would deal with issues that could not be resolved in the first tier.
- The third tier would be a Grievance Redress Commission (GRC2) that included one or more senior Pamir Energy managers and one or more Jamoat and/or village leaders.

Grievances will be handled as described in the SEP. In summary, grievances would be assigned to a Pamir Energy staff person to be responsible for handling the issue through resolution. The person who submitted the grievance will be informed within seven days that the grievance is being handled, and will be kept informed on a weekly basis thereafter. The goal will be to resolve grievances as quickly as possible, and if at all possible within seven days. When the grievance is resolve, the person who submitted it will be informed and asked to acknowledge they have been informed. If they are satisfied with the resolution, that will end the matter.

A grievance will be considered "closed" when a resolution satisfactory to both parties has been reached, and after any required corrective measures have been successfully implemented. When a

proposed solution is agreed by the complainant, the time needed to implement it will depend on the nature of the solution. Once the solution is being implemented or is implemented to the satisfaction of the complainant, the complaint will be closed out and acknowledged in writing by both the complainant and Pamir Energy.

In certain situations, it may not be possible to reach a satisfactory resolution. This could occur if a complaint cannot be substantiated or is proved to be speculative or fraudulent. In such situations, Pamir Energy's efforts to investigate the grievance and to arrive at a conclusion will be well documented and the complainant advised of the situation. It is also possible that a complainant is not satisfied with the proposed resolution. In such cases, if Pamir Energy cannot do more, the complainant will be asked to acknowledge refusal of the proposed resolution in writing. Pamir Energy will then decide whether to implement the resolution without the agreement of the complainant and the complainant will decide whether to pursue legal remedies.

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