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JSC "Rogun HPP"

State Enterprise "Directorate for Flooding Zone of Rogun HPP"

Project Management Group for Energy Facilities Construction under the President of the Republic of Tajikistan

ROGUN HYDROPOWER PROJECT – UPDATED ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Volume I – Environmental & Social Impact Assessment

VOL1-REV06-ENGLISH
DECEMBER 2023

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LIST OF ACRONYMS AND ABBREVIATIONS

Term	Definition
ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
ALARP	As Low As Reasonably Practicable
AMSL	Above Mean Sea Level
AoI	Area of Influence
ATPZ	Atypical Zone
CASA	Central Asia-South Asia project
CBD	UN Convention on Biological Diversity
CBRN	Chemical, Biological, Radiological and Nuclear (CBRN)
CEMP	Construction Environmental Management Plan
CEP	Committee for Environment Protection
CFP	Chance Find Procedure
CFRD	Concrete Face Rockfill dam
CHSSP	Community Health, Safety and Security Plan
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoC	Code of Conduct
CME	Coronal Mass Ejections
CRC	Convention on the Right of the Child
db	Decibels
DFZ	Directorate of Flooding Zone of Rogun HPP
DLEO	District Livelihood & Engagement Officer
DNSH	'Do No Significant Harm' (DNSH)

Term	Definition
DSPoE	Dam Safety Panel of Experts
E&SPoE	Environmental and Social Panel of Experts
EBRD	European Bank for Reconstruction and Development (EBRD VOL 2)
ECoW.	Ecological Clerk of Works
ECS	Environmental, Climate and Social
EDB	Eurasian Development Bank
EFLOW	Environmental Flows
EFTA	EU and European Free Trade Area
EHS	Environmental, Health and Safety Guidelines
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMZ	Electromagnetic Zone
EPC	Engineering, Procurement and Construction
ERP	Emergency Response Plan
ESCP	Environmental and Social Commitment Plan
ESF	Environmental and Social Framework
ESG	Environmental, Social and Governance
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Environmental and Social Policy
ESPOE	Environmental and Social Panel of Experts
ESHS	Environmental, Social, Health and Safety
ESS	Environmental and Social Standards
ESSF	Environmental and Social Sustainability Framework
EU	European Union
FSL	Full Supply Level

Term	Definition
GAP	Gender Action Plan
GBVH	Gender-Based Violence and Harassment
GDP	Gross Domestic Product
GIIP	Good International Industry Practice
GBD	Global Burden of Disease
GRM	Grievance Redress Mechanism
GW	Gigawatts
GWh	Gigawatt-Hour
GWP	Global Warming Potential
GWSP	Global Water Security and Sanitation Partnership
HESG	Hydropower Sustainability ESG Gap Analysis Tool
HH	Household
HPP	Hydropower Project
HSAP	The Hydropower Sustainability Assessment Protocol
HWSD	Harmonised World Soil Database
ICWC	Inter-State Commission for Water Coordination of Central Asia
IED	Industrial Emissions Directive
IFAS	International Fund for the Aral Sea
IHA	International Hydropower Association
ILO	International Labor Organization
IPCC	Intergovernmental Panel on Climate Change
IPPC	International Plant Protection Convention
IsDB	Islamic Development Bank
IUCN	International Union for the Conservation of Nature
JSC	Joint Stock Company
KFAED	Kuwait Fund for Arab Economic Development

Term	Definition
KfW	Kreditanstalt für Wiederaufbau
LFPR	Labor Force Participation Rate
LNAPL	Light Non-Aqueous Phase Liquids
LRP	Livelihood Restoration Plan
MCE	Maximum Credible Earthquake
MW	Megawatt
NGO	Non-Governmental Organization
NTS	Non-Technical Summary
O&M	Operation and Maintenance
OHL	Overhead Lines
PAPs	Project Affected Persons
PIC	Rotterdam Convention on Prior Informed Consent
PIU	Project Implementation Unit
PMF	Probable Maximum Flood
PMG	Project Management Group
PO	Project Owner
PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
RAP	resettlement action plan
RCC	Gravity Roller Compacted Concrete Dam
RPF	Resettlement Policy Framework
RTS	Remote Tunnel Spillways
RTS	Reservoir triggered seismicity (RTS)
SDG	Sustainable Development Goals
SEA	Sexual Exploitation and Abuse
SECO	Swiss State Secretariat for Economic Affairs

Term	Definition
SEE	State Ecological Expertise
SEP	Stakeholder Engagement Plan
SFD	Saudi Fund Development
SGM	DFZ Senior Grievance Manager
SH	Sexual Harassment
SPS	Safeguard Policy Statement
TA	Technical Assistance
TEAS	Techno-Economic Assessment Studies
TGEM	TajikHydroElectroMontazh
TMP	Traffic Management Plan
ToR	Terms of Reference
TSC	Total System Costs
UN	United Nations
UN CCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
US	United States
UXO	Unexploded Ordnance
VC	Valued Components
WB	World Bank
WBG	World Bank Group
WB SPDs	World Bank Standard Procurement Documents
WFD	Water Framework Directive
WHO	World Health Organization
WWTP	Wastewater Treatment Plant

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1. INTRODUCTION

1.1. PROJECT PROPONENT

1.1.1. This Environmental and Social Impact Assessment (ESIA) has been prepared for the Rogun Open Joint Stock Company (JSC) (hereafter referred to as 'Rogun JSC') by WSP UK Limited (hereafter referred to as 'WSP') for the Rogun Hydropower Project (HPP) (hereafter referred to as 'the Project').

1.1.2. The Government of Tajikistan established Rogun JSC to own and operate the Project. Tajikistan also established the Project Management Group (PMG) for Energy Facilities Construction under the President of the Republic of Tajikistan, which is the implementing entity for construction of the Project.

1.2. INTRODUCTION TO THE PROJECT

1.2.1. The Project when complete will include a total of six 630 megawatt (MW) turbines. The installation and commissioning of the turbines is being completed incrementally. As of 2023, two 400 MW turbines have been installed and are currently operational. This phase of the Project is referred to as Stage 1 throughout the ESIA. Stage 1 power generation is currently limited to 200 MW per turbine (in light of the current reservoir levels), providing a cumulative 400 MW of power to the grid.

1.2.2. Stage 1 turbines have been installed with temporary impellers. The impellers will ultimately be replaced by Voith (Austrian) as part of the Lot 1 Engineering, Procurement and Construction (EPC) contract, increasing the capacity of the existing turbines from 400 MW to 630 MW each.

1.2.3. Once complete, the dam will have an overall height of 335 meters (m), with a generation capacity of 3,780 MW and an average annual generation of over 17,000 gigawatt (GW) hours. Construction of the Project (hereafter referred to as Stage 2) is ongoing and is expected to be completed in 2029, with full inundation levels expected to be reached by 2036.

1.2.4. The Project is located approximately 100 kilometers (km) east of Dushanbe on the Vakhsh River. The river is intensively developed and accommodates five existing HPP developments, of which the Project is the uppermost. The Vakhsh hydropower cascade currently includes the Nurek HPP, located 70 km downstream from the Project location and, downstream of Nurek, the Baipaza, Sangtuda 1, Sangtuda 2 and Golovnaya dams.

1.2.5. The Project was first conceived in the Soviet Union in the 1950s and 1960s as part of the regional development of what are now independent states. The initial purpose of the Project was to provide water regulation for irrigation in Uzbekistan and Turkmenistan as well as the power supply for Soviet Central Asian countries. Due to economic and political changes in the country, the priorities for the Project have changed.

1.2.6. The primary purpose of the Project is to generate electricity to help the Republic of Tajikistan overcome critical shortages of electricity throughout the winter months and to meet future energy demand, while respecting the water needs of downstream riparian countries.

1.2.7. The Project will also provide other tangible benefits including:

- Downstream flow regulation potential – the addition of storage capacity provided by the Project will help alleviate shortages in downstream areas in dry years.
- Electricity production for export – the Project will allow for the sale of power to neighboring countries.
- Flood routing – the Vakhsh cascade, including the Nurek dam, is currently not designed to handle the Probable Maximum Flood (PMF) for the Vakhsh river. The Project is designed to withstand the PMF and will therefore provide flood routing capacity and protection to Nurek and downstream dams.
- Retention of sediments – retention of high sediment load which would otherwise reach and fill Nurek reservoir. The Project will effectively extend the life of the Nurek HPP and Vakhsh cascade by over 100 years.

1.2.8. The Project has an expected life of 115 years, dependent on the sediment inflow. The reservoir will take approximately 16 years to fill to a maximum storage capacity of 13,300,000mm^3 and flood 170 km^2 of land at the full supply level (FSL).

1.2.9. The Project has a long history and dates back to 1967 when site investigation first started. **Figure 1-1** presents a chronology of events in the development of the Project.

1.2.10. A large number of Project Affected Persons (PAPs) have already been or will need to be relocated because of the Project. Resettlement is managed by the State Enterprise of the Directorate of Flooding Zone (DFZ) and is planned in phases in line with the inundation levels of the reservoir..

1.2.11. The resettlement programme includes a total of 69 villages from the Rogun, Nurobod, and Rasht districts affecting an estimated 46,628 PAPs, with almost half from the Rasht district. In 2014, 2,697 PAPs (under RAP1) were resettled from eight villages in the Rogun City and Nurobod District. A total of 13,280 PAPs (under RAP2 2017-2025) are currently being resettled, with 4,682 PAPs completely relocated under RAP2 (as of November 2023). Further RAPs will be developed by DFZ. All resettlement activities are due for completion by 2032.

CURRENT WORKS

1.2.12. At the time of writing this ESIA (2023), large scale construction activity was ongoing on site. **Table 1-1** presents the current status of works at the project site.

Table 1-1 Current Status of Construction Works

Construction Stage	Description	Scheduled Duration From 2014	Status
Pre-cofferdam	Start of the river diversion to allow construction to proceed, improving the access road and internal roads, and finalising diversion tunnel No. 3.	Approximately 28 months	Complete

Cofferdam	Construction of cofferdam to crest at 1050 m asl.	Approximately 36 months to complete (inclusive of the eight months for the pre-cofferdam)	Complete
Stage 1 Dam	Construction of dam to crest at 1110 m asl. This is an intermediate stage to allow early electricity generation.	Estimated to be completed in 58 months, inclusive of previous stages	Complete
Stage 2 Dam	Construction of dam to crest at 1300 m asl and the reservoir level will be at 1290 m asl filling over a 16-year period (approx. 2036).	Scheduled completion in 163 months from the start of construction, in about 2029	On-going

1.2.13. Works are being undertaken and completed in four lots, including the main supplier (Lot 1) and three engineer-procure-construct (EPC) contracts (Lots 2, 3, and 4), as shown in Table 1-2 below:

Table 1-2 – Description of Lots for Ongoing Works

Contract	Type	Size	Contract Award & Contractor	Scope
Lot 1 Contract	Electro-Mechanical Equipment	€370 million	Jan 2021; Voith Hydro (Austria)	Installation of four new generating units, delivery of two runners for two early generating units. Installation of the balance of plant and control equipment
Lot 2 Contract	Main Dam	US$2.4 billion	Jul 2016; WeBuild (Italy)	Design, procurement and construction of the following works: ▪ Modernization/reconstruction / completion (if necessary) of the Diversion tunnels (DT). ▪ Construction of the cofferdam and river diversion. ▪ Construction of transition sections DT-1 and DT-2. ▪ Treatment of the entire base (salt layer, grout curtain, drainage curtain). ▪ Installation of dam monitoring devices and reservoir monitoring. ▪ Main Dam Phase 1 to el. 1,080 masl ▪ Main Dam (elev. 1300 masl).
Lot 3 Contract	Right Bank Structures	US$1.7 billion	Jul 2021; TGEM (Tajikistan)	Series of tunnels and spillways that provide adequate flood discharge capacity as the height of the main dam increases and lower tunnels can no longer be safely. At present, there are construction works being undertaken as so-called

				Lot 3 “Early works” or “Pre-Construction works”. These comprise underground works, including tunnelling (hydraulic diversion tunnels, transportation tunnels), concrete wall linings and some others. Tractebel will be responsible for supervising construction and Environmental, Social, Health and Safety (ESHS) performance.
Lot 4 Contract	Left Bank Structures	US$789 million	Not awarded yet	Construction works on the construction of a multi-level water intake, six inlet pressure tunnels and shafts to hydraulic units and the corresponding outlet tunnels. AFRY is the prime designer. Similar to Lot 3, pre-construction (preparatory) activities are taking place under Lot 4, involving underground works on tunnelling for water intake areas of the powerhouse, ventilation shafts, etc. These are not being undertaken as part of the EPC contract but by other contractors. As a result, the works are being supervised by Rogun HPP, with future supervision by Tractebel.

1.2.14. Further, more detailed description of the current and future Project, the resettlement program, component specifications, and Project activities undertaken to date are included in **Volume I, Chapter 3**.

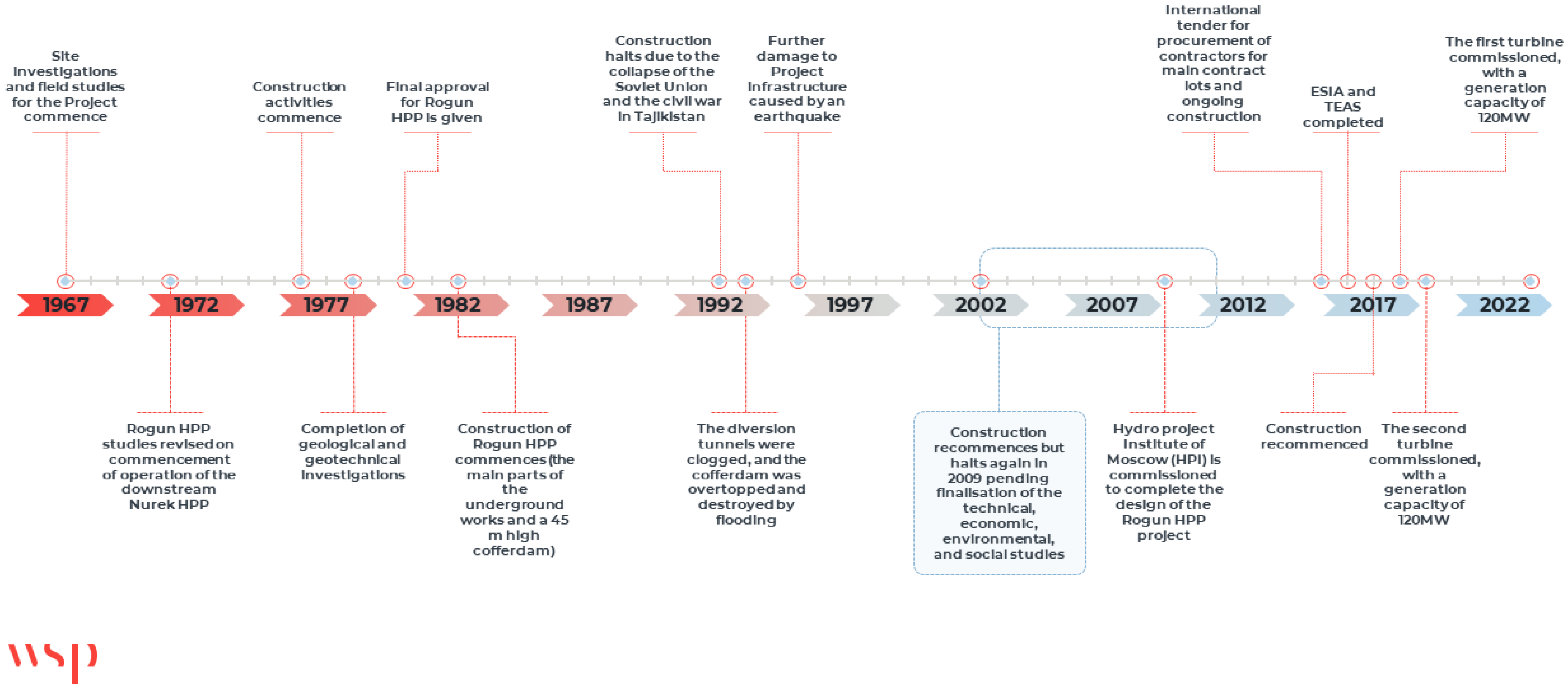


Figure 1-1 – Chronology of the Project

1.3. OVERVIEW OF APPLICABLE STANDARDS

1.3.1. The laws of Tajikistan, including international agreements to which Tajikistan is a party, will apply to the Project.

1.3.2. There are potentially a number of financial institutions (hereafter referred to as 'lenders') involved in the Project, including the World Bank (WB), European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD), Eurasian Development Bank (EDB), Islamic Development Bank (IsDB), Asia Development Bank (ADB), and several others. A full list including an overview of their E&S frameworks is provided in **Volume I, Chapter 2**.

1.3.3. Given the number of potential Lenders involved, a robust appreciation of the various policies, standards and frameworks is required to ensure that all requirements are met. The overarching E&S framework considered in this ESIA is the WB Environmental and Social Framework (ESF), consisting of:

- **Vision for Sustainable Development** which sets out the aspirations of the World Bank for a more Environmentally and Socially sustainable future.
- **WB E&S Policy for Investment Project Financing** which details the mandatory requirements that apply to the Bank.
- **Environmental and Social Standards (ESS)**: a set of 10 standards which together with their annexes set out the mandatory requirements on Borrowers for managing E&S risks on their projects.

1.3.4. These are supported by several relevant guidance and best practice notes prepared by the World Bank Group that also inform the ESIA process.

1.3.5. The underpinning principles of the Lenders' E&S polices are materially consistent with the WB ESF. The general assumption is that, in most cases, compliance with the WB ESF will result in compliance with other lenders policies and standards.

1.4. OVERVIEW OF PREVIOUS ENVIRONMENTAL AND SOCIAL STUDIES AND KEY FINDINGS

1.4.1. From 2011 To 2014, the WB provided financing to assess the technical, environmental, and social aspects of the Project. In 2014, an ESIA, an Environmental and Social Management Plan (ESMP), a Resettlement Policy Framework (RPF), a Phase 1 Resettlement Action Plan (RAP 1), and a Livelihood Restoration Plan (LRP) were prepared by Pöyry Energy Limited.

1.4.2. In August of 2014, the WB E&S Panel of Experts (hereafter referred to as 'the E&S PoE'), prepared their final report to conclude the work undertaken since 2011. In the stated period, the E&S PoE visited the site, prepared ten reports, made presentations during regional consultations in 2011, 2013 and 2014, and interacted closely with the Government of Tajikistan (GoT), the WB, the ESIA and Technical and Engineering (TEAS) Consultants and the Engineering and Dam Safety (EDS) PoE. In their final report, the E&S PoE concluded that the final draft ESIA *'is of acceptable international standard, and subject to some comments on key issues raised in the present report the Panel agrees with the overall conclusion and recommendations made in the ESIA'*.

1.4.3. In 2021, the WB reviewed the ongoing construction to i) evaluate the adequacy and performance of the mitigation and management measures in the Environmental and Social Management Plan

(ESMP); ii) appreciate whether the E&S impacts were being managed to acceptable levels; and iii) evaluate the extent to which Rogun JSC and its contractors were implementing the requirements of the ESMP.

1.4.4. In 2022, the WB approved a Technical Assistance grant to support PMG in updating the 2014 ESIA and other E&S instruments and undertaking other studies needed in order to ensure the Project's technical and E&S planning and execution are in accordance the 2018 ESF and Good International Industry Practice (GIIP).

1.4.5. In 2023, newly constituted E&S PoE, whose role is to provide independent advice regarding the measures to enhance the overall environmental and social outcomes of the Project, has produced two reports, appraising the Project against each of the applicable ESS as per the WB ESF. Additional information on the WB ESF is provided in **Volume I, Chapter 2**.

1.4.6. The E&S PoE reports highlighted a number of key issues, recommendations on organizational arrangements and ES capacity building measures that would require consideration within the scope of the ESIA, Resettlement Policy Framework (RPF), Stakeholder Engagement Plan (SEP) as well as additional E&S studies.

1.4.7. The E&S PoE findings have been considered within the scope of the ESIA.

1.5. THE SCOPE OF THIS ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

1.5.1. This ESIA serves as an update to the previously completed 2014 ESIA for the Project. This ESIA update includes new information and new analysis required to address the issues and concerns raised in recent studies and since the completion of the 2014 ESIA. The aim of the ESIA update is to ensure the Project's E&S planning and execution are in accordance with GIIP and the Project meets the Applicable Standards, as described in **Volume I, Chapter 2**.

1.5.2. The updated ESIA incorporates an impact assessment methodology, characterization of baseline conditions to reflect current conditions, an updated E&S impact assessment, a Cumulative Impact Assessment (CIA), and, amongst other studies a Carbon Footprint Analysis (CFA), Climate Change Risk Assessment (CCRA) and Minimum Flows Study, which are further described in Section 1.6.

1.5.3. Other key E&S instruments include an audit and update of the Phase 2 RAP, development of a Phase 2 LRP, a Stakeholder Engagement Plan, a Labor Management Plan, and a Gender Action Plan. In addition, the Environmental and Social Management Plan (ESMP) includes a number of management measures, as described in more detail in Section 1.6.

1.6. REPORTING APPROACH AND STRUCTURE

1.6.1. This ESIA builds on the findings and information presented in previous studies with a view to enhance and address the key E&S related issues that have materialized since the completion of the 2014 ESIA due to the ongoing construction and development of the Project since that time, as well as updates to the Applicable Standards. The ESIA update is informed by several key documents, including but not limited to:

- ESIA for Rogun Hydro Power Plant (2014) consisting of three Volumes (ESIA, technical annexes and ESMP).
- LRP for Stage 1 (2015).

- RAP and supporting annexes and audits for Stage 1 (2014).
- Techno-Economic Assessment Study (TEAS) (2014).
- Environmental and Social Panel of Experts reports (reports by the previous PoE ending in 2014 and two reports by a new Panel that were prepared in 2023).

1.6.2. Additional Project-related information has been used to form the basis of the Project Description, which is presented in **Volume I, Chapter 3.**

1.6.3. The ESIA report is divided into three interrelated volumes, as follows:

- Volume I: Environmental and Social Impact Assessment.
- Volume II: Technical Annexes.
- Volume III: Environmental and Social Management Plans.

1.6.4. **Volume I: Environmental and Social Impact Assessment** (refer to Table 1-for description of content) is intrinsically supported by **Volume II: Technical Annexes** within which the detailed E&S assessments are contained e.g. air, noise, biodiversity, social etc. The Technical Annexes contain the detailed baseline, methodologies, and impact assessments (qualitative / quantitative) relevant to the topic in question. The technical information contained within the Technical Annexes is ultimately summarized and presented in **Volume I, Chapter 7** and **Volume I, Chapter 8** with reference made to the annexes as necessary and where relevant to do so.

1.6.5. The resulting ESMP and management plans describing the mitigation and management measures explicitly tailored to the Project because of the findings outlined in the ESIA are presented in **Volume III: Environmental and Social Management Plans**.

Table 1-3 Volume I: Environmental and Social Impact Assessment

Chapter	Title	Description
1	Introduction	Sets out the scope, project background and structure of this ESIA.
2	Administrative Framework	Describes the national and international legal frameworks and agreements that form the legislative constraints of the Project. Also defines any applicable international lender standards and guidelines applicable to the Project.
3	Project Description	Provides a description of the current and future development of the Project, the specifications, components, and activities undertaken to date. The purpose of the Project Description is to provide the information required to inform the ESIA and includes qualitative and quantitative information on core Project components and Associated Facilities (Afs).
4	Alternatives to the Project	Presents the analysis of various alternatives considered during the feasibility stage and site selection process and demonstrates the reasoning for the decision to take forward the Project and selected site. Chapter 4 is based on the assessment presented in the 2014 ESIA.
5	Impact Assessment Methodology	Outlines the proposed methodology and approach for undertaking this ESIA.

Chapter	Title	Description
6	Stakeholder Engagement	Presents an overview of stakeholder analysis, communications and consultation activities planned for the Project. Additionally, a summary of the issues identified by stakeholders to date and how these have been addressed.
7	Environmental and Social Baseline	A summary of the environmental and social baseline relevant to the Project Area of Influence (AoI).
8	Impact Assessment	Identification and assessment of potential environmental and social impacts, both adverse and beneficial, associated with the Project, and measures adopted to mitigate and manage impacts, alongside enhancement measures for opportunities for improved environmental and social performance.
9	Risk Assessment	Consideration and high-level assessment of likely significant adverse effects deriving from the vulnerability of the Project to relevant major accidents and/or disasters related to natural hazards or manmade hazards (including operational failure) (hereafter referred to as Major Events).
10	Climate Change Risk Assessment and Greenhouse Gas Assessment	This chapter presents the physical climate risk assessment and the transitional risk assessment prepared for the Project. The chapter also included the greenhouse gas assessment as a separate sub-section to the chapter.
11	Rapid Cumulative Assessment	This is considered a rapid cumulative impact assessment and the final revised ESIA will include an expanded assessment. Assessment of potential cumulative impacts with other existing or future developments within the Area of Influence (AoI).
12	Environmental and Social Management	This chapter introduces the Environmental and Social Management Plan (ESMP) for the Project, the detail of which is presented in Volume III.

Table 1-4 - Volume II: Supporting Technical Annexes

Annex	Technical Aspect
A01	Air Quality
A02	Noise
A03	Soils and Geology
A04	Contaminated Land
A05	Water
A06	Minimum Environmental Flows
A07	Traffic and Transport
A08	Waste

Annex	Technical Aspect
A09	Biodiversity
A10	Ecosystem Services
A11	Social
A12	Gender Assessment
A13	Cultural Heritage
A14	Reservoir Slope Instability

2. ADMINISTRATIVE FRAMEWORK

2.1. INTRODUCTION

2.1.1. This chapter summarizes the Administrative Framework for the Project and covers Project-relevant E&S regulatory requirements. It includes national requirements, including international treaties and conventions ratified by Tajikistan, as well as the E&S standards of the World Bank and other international financial institutions (IFIs) that may provide financing to the Project.

2.1.2. The ESIA is required to check and align the Project with several E&S standards and guidelines, including those administered by Tajikistan and the international laws, policies and guidelines that apply to the Project (hereafter referred to as 'the Applicable Standards') which will include but not limited to the following:

- Tajikistan law, including international agreements to which Tajikistan is a party.
- The World Bank (WB) Environmental and Social Framework (2018), the WB Group (WBG) General Environmental, Health, and Safety (EHS) Guidelines (2007); and the Industry Sector EHS Guidelines which provide guidance on EHS issues in specific industry sectors.
- The European Investment Bank (EIB) Environmental and Social Framework (ESSF), consisting of the E&S policy (2022) and revised E&S standards (2022); and the EIB Environmental, Climate, and Social (ECS) Guidelines on Hydropower Development (2019).
- The European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy and Performance Requirements (PRs) (2019).
- Asian Development Bank (ADB): Safeguard Policy Statement (SPS) (2009) and associated safeguard documents.
- Asian Infrastructure Investment Bank (AIIB): Environmental and Social Framework (2019, 2021, and 2022).
- Other environmental and social standards, objectives and goals prescribed by the Islamic Development Bank, the Eurasian Development Bank (EDB); the Saudi Fund for Development (SFD) and the Kuwait Fund for Arab Economic Development (KFAED).

2.2. NATIONAL POLICY, LEGAL AND REGULATORY FRAMEWORK

NATIONAL ADMINISTRATIVE FRAMEWORK

2.2.1. Table 2-1 provides a list of central government organizations having environmental and social responsibilities.

Table 2-1 Central Government Organizations with Environmental and Social Responsibilities

Government Organization	Responsibility
National Government Organizations	
Committee for Environment Protection (CEP)	The government executive body responsible for environmental protection, sustainable use of resources, forestry and hydrometeorology is responsible for decision-making related to environmental issues such as sustainable land use, deterioration of soil fertility, excessive use of water for irrigation, flooding problems, and obsolete/banned pesticides. On Rogun HPP responsible for supporting site selection for resettlement including associated environmental/geotechnical studies, and for permitting. Also responsible for, inter alia: ▪ Defining the main strategies for the protection, study, conservation, and sustainable use of natural resources, and mitigation of the effects of climate change. ▪ Drafting laws and other regulatory documents, including environmental standards, instructions, and methodologies for the use of resources. ▪ Issuing individual permits for the use of specific resources and withdrawing these if the user violates their terms. ▪ Setting quotas for the hunting and collection of certain species of animals and the importation of ozone-depleting substances. ▪ Carrying out ecological assessments of planned activities. ▪ Defining the system of specially protected territories and maintaining State cadasters of such territories and of forests, factories, water bodies, and hazardous waste. ▪ Regulating the use and protection of waters and the issuance of permits (licenses) for special water usage. ▪ Implementing the Water code in conjunction with the Ministry of energy and Water Resources. ▪ Implementing the requirements of the law of State Environmental Expertise (SEE).
Ministry of Energy and Water Resources - Department of Water Resources and Cadaster	Responsible for the development of guidelines and collection of data in surface and groundwater resources, quality, use, and publication of data.
Ministry of Energy and Water Resources - Committee for Emergency Situations and Civil Defense under the Government of the Republic of Tajikistan	Responsible for the emergency response within Tajikistan to Natural including seismic and man-made disasters. Supports the implementation with the CEP of the water code

Government Organization	Responsibility
Agency of Standardization, Metrology, Certification and Trade Inspection	Responsible for drinking water quality and other standards.
Ministry of Health	Responsible for the development and implementation of policy, regulations, and norms related to public health.
Ministry of Labor	Responsible for developing and implementing policies relating to employment, labor issues, workplace safety, and migration practices.
Committee of Women and Family Affairs	Responsible for gender issues and realization of family-oriented policy.
Architecture and Construction Committee	Responsible for technical advice in relation to water supply and sewage systems, including construction and design standards, contract standards and rules, and regulation of project and construction activities.
State Statistical Committee	Responsible for collecting, filing, and delivering environmental information and drinking water supply and sanitation data.
Local Government Responsibilities	
Local Hukumat at provincial, municipal and district levels	Local executive body of the State Power. A chairperson appointed as a local representative of the President in the implementation national policy and administration of State services and regulations heads each Hukumat.
Jamoat	A Jamoat covers a smaller administrative area than a Hukumat and may include one or more settlements/villages. The Jamoat is responsible for organizing community-based delivery of some basic public services. Jamoats have no budgeting authority and have a very limited independent role. They do have important roles under the Land Code, being responsible for allocating land and also for terminating rights to land and assigning new land.

2.3. NATIONAL ENVIRONMENTAL AND SOCIAL REGULATORY FRAMEWORK

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT IN TAJIKISTAN

2.3.1. Three laws establish the requirements for impact assessment in Tajikistan:

- The Law on Environmental Protection (2011).
- The Law on Ecological Expertise (2012).
- The Law on Environmental Impact Assessment (2017).

2.3.2. State Ecological Expertise (SEE) examines the compliance of proposed activities and projects with the requirements of environmental legislation and standards and with the ecological security of society.

2.3.3. 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. Financing of programs and projects is allowed only after a positive SEE finding.

2.3.4. An Environmental Impact Assessment (EIA) study is a component of the State Ecological Expertise, as set out in the 2011 amendments to the Environmental Protection Law and in the Law on the State Ecological Expertise (2012).

2.3.5. The EIA is the responsibility of the Project and must analyze the short- and long-term environmental, genetic, economic, and demographic impacts and consequences. The State Ecological Expertise for all investment projects is the responsibility of the Committee for Environmental Protection (CEP) and its regional offices, under the Government of Tajikistan. All civil works must be assessed with impacts and proposed mitigation which is reviewed and monitored by CEP.

2.3.6. The SEE must conclude that economic and other activities can be implemented in accordance with existing environmental standards with sufficient environmental protection and mitigation measures.

2.3.7. 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 the contents of the EIA documentation.

2.3.8. The Laws on Environment Protection, on Environmental Impact Assessment and Ecological Expertise stipulate that the Government is to approve a list of activities for which a complete EIA is mandatory.

2.3.9. 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 EIAs are required is already very detailed.

2.3.10. Table 2-2 provides a list of the relevant laws on the protection of the environment, with indications of objectives.

Table 2-2 National Laws on the Protection of the Environment

Legislation	Objective	Relevance to Project
The Constitution of the Republic of Tajikistan	The Constitution of the Republic of Tajikistan recognizes the importance of Environmental Protection and safeguarding of citizen rights includes the following key articles: Free Freedom of Thought (Article 30), Right to Health (Article 39), Environmental Protection (Article 43), Anti-discrimination (Article 14), Safeguarding nature (Article 22), Freedom to associate (Article 32), and Right to petition (Article 37).	Safeguards citizen rights working on or affected by the project.
The Law on Environment Protection (21 July 2011, № 208)	The 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 Protection, local authorities, public organizations, and individuals. The Law also stipulates 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.	Governs the protection of natural resources being impacted by any project which the project must comply with as well as IFI requirements.
The Law on Ecological Expertise (16 April 2012, № 818)	This Law determines the principles and procedure for conducting environmental assessment and is directed to prevention of harmful effects of the planned economic and other activity on the environment and the related social, economic, and other effects of realization of object of environmental assessment.	Sets out the need for independent environmental expertise in undertaking assessments under Tajik law.
Law of the Republic of Tajikistan on Environmental Impact Assessment (18 July 2017, № 1448)	This Law establishes the general provisions for Environmental Impact Assessment, including the principles of evaluation of the impact on the environment; the competencies and powers of state authorities; the procedure for conducting the EIA, including the mandatory requirements and phases of the process. It also defines the roles, rights, and duties of public associations in the EIA and the rights of citizens for access to information on the EIA.	Safeguards the rights of Project Affected People and organizations to receive information on the Project throughout the EIA and construction processes.

Legislation	Objective	Relevance to Project
Law of the Republic of Tajikistan on Specially Protected Natural Areas and Objects (26 December 2011, № 788)	This Law determines legal, organizational, and economic basis of especially protected natural territories, sets their tasks, the mode of activities and zoning.	Potentially relevant to the offsetting strategy.
Law of the Republic of Tajikistan on Fauna (January 5, 2008) (as amended of the Law of the Republic of Tajikistan on 24.12.2022, No. 1937)	This Law establishes the general principles for the protection, recovery, and reasonable use of fauna. It establishes the legal, economic, and social basis of industry with a primary focus on the protection and recovery of resources of fauna	Relevant to the management of the effects on Biodiversity and the development of the various management plans for the project.
Law of the Republic of Tajikistan on Protection and Using of Flora (2004, amended in 2008)	This Law defines principles of the state policy in the field of protection and rational use of flora, determines the legal, economic, and social basis in this area, and is directed at preserving and reproducing of resources of flora.	Relevant to the management of the effects on Biodiversity and the development of the various management plans for the project.
Forest Code of the Republic of Tajikistan (2011)	The Code regulates forestry and is directed at creating use of forests, their safe keeping and protection, conservation and improvement of the natural environment, and protection of timber and agricultural products.	Relevant to the management of the effects on Biodiversity and the development of the various management plans for the project.
Law of the Republic of Tajikistan on Air Protection (2012)	The Law on Air Protection defines the economic mechanism for air protection, including its objectives, sources of financing for air protection measures and payments for air pollution (within and beyond established limits).	Protection of the Workforce on site from adverse air quality during construction and operation, as well as nearby communities.

Legislation	Objective	Relevance to Project
Law of the Republic of Tajikistan on Soil Protection (October 16, 2009)	Determines the basic principles of state policy, the legal basis of activities of public authorities, physical persons and legal entities for the purpose of rational and careful use of soils, preserving quality, fertility and protection of soils against the negative phenomena and governs complex of the relations connected with the protection of soils.	Governs the requirements around preservation of soils where practicable during stripping and stockpiling and reuse.
Law of the Republic of Tajikistan On Production and Consumption Waste (2005, last amended in 2011)	This law establishes the principles for the collection, storage, use, transportation, neutralization, and disposal of waste materials. It defines the public administration, supervision and control in the field waste and is designed to prevent adverse effects on the health of the workforce involved in the waste industry. In addition, the law states that payments for waste disposal depend on the volume of waste and its toxicity.	Governs the requirements around the life cycle of all material use, reuse and disposal during both construction and operation.
The Water Code (2000, last amended 2012)	The Law 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.	Governs the use of water and sustainable use of water resources during both construction and operation for the Project including resettlement.
Law of the Republic of Tajikistan on Hydrometeorological Activity Dushanbe (2002)	This Law sets the legal basis of activities in the field of hydrometeorology. Its aim is directing the support of the needs of the state, physical persons and legal entities in providing hydrometeorological as well as environmental information.	Provision of Environmental information for the Project,
Law of the Republic of Tajikistan on the drinking water and drinking water supply (December 29, 2010)	Establishes legal, organizational, economic, social basis of providing with drinking water and in to assignment, the state guarantees of ensuring needs for drinking water, water disposal, and also their qualities and safety.	Safeguards worker rights as well as resettled households for the provision of safe drinking water and sanitary waste.
Law of the Republic of Tajikistan on Environmental Audit (December 26, 2011)	This law determines the principles and procedures for carrying out environmental audits.	Governs the requirements around reporting and audits

Legislation	Objective	Relevance to Project
		of the Project during construction and operation.
Law of the Republic of Tajikistan on Environmental Monitoring (March 25, 2011)	This law determines organizational, legal, economic, and social basis for ensuring environmental monitoring.	Governs the requirements around monitoring of potential environmental and social effects.
Code of Health Care of the Republic of Tajikistan of May 30, 2017. No. 1413 (as amended of the Law of the Republic of Tajikistan of 29.01.2021 No. 1762)	This Code governs the public relations in the field of health care and is directed to realization of constitutional rights of citizens and health protection.	Safeguards the rights of workers during construction and operation to healthcare, as well as supporting resettlement in provision of levels of healthcare provision.
Law of the Republic of Tajikistan on the protection of population and territories from emergency situations of natural and man-made character (July 15, 2004)	Governs the public relation according to the prevention of origin and development of emergency situations, decrease in the extent of damage and losses from emergency situations, liquidation of emergency situations and the timely notification of the population of danger areas from emergency situations of natural and technogenic nature.	Safeguards the rights of citizens and workers under emergency scenarios during construction and operation including during earthquakes and cascade breach.
Law of the Republic of Tajikistan on the Fire Safety (December 29, 2010)	Determines general legal, economic, social, and organizational basis of ensuring fire safety in the Republic of Tajikistan.	Outlines the requirements for fire prevention and management in buildings for Rogun HPP and emergency response.
Law on the Safety of Hydraulic Structures (2010 as amended in 2018)	Governs requirements for ensuring the safety during design, construction, commissioning, operation, maintenance, reconstruction, and decommissioning of hydraulic engineering structures. Establishes the obligations of public authorities, owners and operators of these structures	Relevant for the construction and operation of the dam.

Legislation	Objective	Relevance to Project
Law of the Republic of Tajikistan on the Land Reform (March 5, 1992)	A set of legal, economic, and organizational and technical measures providing a transition to qualitatively new land relations.	Governs the transition of land for development including the resettlement areas.
Law of the Republic of Tajikistan on the Land Valuation (May 12, 2001)	Establishes the legal basis of land assessment and the Republic of Tajikistan and determines complexity in evaluating the earth.	Established the valuation requirements for land in relation to resettlement.
Law of the Republic of Tajikistan on the Land Management (January 5, 2008, amended 2016)	Requires authorities to perform mapping and monitoring of land quality, including on soil pollution, erosion and waterlogging.	Establishes the requirements around managing the land on the Project especially in relation to pollution.
Law on the Licensing of Certain Types of Activities (2004, amended in 2015)	Includes several types of activities, in particular handling hazardous waste, environmental audits, and collection and processing of scrap metals.	Outlines the requirements around waste management for the project
Code of Administrative Violations (2010)	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. 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.	Establishes the Polluter Pay principles for a wide range of environmental violations during both construction and operation of the project.
Law on Environmental Information (2011)	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.	Safeguards the rights of Citizens to the provision of information on the Project and the level to which information can be provided especially where

Legislation	Objective	Relevance to Project
		sensitive information is requested.
The Land Code (1996, last amended 2016)	The Constitution of the Republic of Tajikistan establishes exclusive state ownership of land. The Law 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, and life-long inheritable tenure	Outlines the rights of citizens and others to land and its use, especially in regard to resettlement
The Law on Subsoil (1994)	This law 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.	Outlines the requirements around extraction of materials, especially in relation to project related borrow areas and quarries.
The Law on Pastures (2013)	This law 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 the effective use of pastures, including the protection of pastures against degradation and pollution.	Sets out the requirements around activities on pastureland, with relevance to inundation and resettlement.
The Law on Dekhkan Farms (2016)	This law provides the legislative basis for the establishment and operation of privately owned commercial farms known as Dekhkan farms. According to the Law of 2009, Dekhkan farms carried out activities without the formation of a legal entity, but 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.	Safeguards the rights of certain farms and farmers, especially relevant for resettlement.

Legislation	Objective	Relevance to Project
The Law about Culture (1997, last amended 2011)	Protection of cultural heritage is grounded in paragraph 44 of the Constitution, which requires all citizens to respect and protect historical and cultural monuments. This law 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.	Outlines the requirements around protection of historic and cultural monuments. Especially relevant in the inundation zone.
The Labor Code (2016)	This Labor Code prohibits forced labor and adult labor. The Labor Code prohibits discrimination in employment and sets the minimum age at which a child can be employed as well as the conditions under which children can work. The Code also establishes rules for minimum wages, leave, overtime, and has provisions for pregnant women and caretakers for children. It also sets the rules for settling disputes between workers and employers. The Labor Code also sets requirements for occupational health and safety. It stablishes the right of workers to work in places that are protected from exposure to dangerous and harmful factors. Employers are required to tell workers of risks and hazards of their jobs and requires employers to provide personal protective equipment. 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 medical 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.	Safeguards the rights of workers and children. Incorporated into the labor management practices for the project.
The Law on Public Associations (2007, last amended 2019)	Under the Law on Public Associations (2007) public association may be formed in one of the following organizational and legal forms: public organization, public movement, or a body of public initiative. 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.	Safeguards the rights of citizens to form public movements (NGOs) with interest in the Project.

Legislation	Objective	Relevance to Project
The Law on Public Meetings, Demonstrations and Rallies (2014)	This law, under Article 10, bans persons with a record of administrative offences (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.	Outlines the requirements for any public demonstrations by citizens. Relevant for any which are organized about the Project.
The Law on Self-Government Bodies in Towns and Villages (1994)	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 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.	Outlines the requirements for local government, especially in relation to resettlement.

2.4. OTHER TAJIK LEGISLATION

2.4.1. Other Tajik legislation that may apply to Project-related activities are listed below:

- The Law on Radiation Safety.
- The Law on Environmental Education of the Population.
- The Law on Biological Safety.
- The Law on Industrial Safety of Dangerous Production Facilities.
- The Law on Equality and Elimination of Discrimination (2022).
- The Law on Appeals of Physical and Legal Entities (2016).
- The Law on Emergency Response Services, Emergency Rescue Teams and Rescue Worker Status.
- The Law on Control of Civil Purpose Explosives.
- The Law on State Social Insurance.
- The Law about Labor Unions.
- The Law on Conformity Assessment.
- The Law on Protection and Use of Historical and Cultural Heritage (2012).

2.5. CENTRAL ASIAN WATER MANAGEMENT AGREEMENTS

2.5.1. Prior to the independence of Tajikistan in 1991, the Soviet Union had concerns about the water crisis in the Aral Sea and allocated water distribution limits among the former Soviet Republics of the Aral Sea Basin, establishing a series of protocols and resolutions.

2.5.2. Water distribution limits for the Amu Darya Basin were established by The Scientific and Technical Council of the Ministry of Water Resources of the Soviet Union on March 12, 1987. Protocol 566 was formally endorsed on September 10, 1987, in Moscow among the riparian states of the Amu Darya Basin, now known as Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Protocol 566 is still used today as a reference document for discussions on water allocation and water-sharing principles between the nations of the Amu Darya basin.

2.5.3. Table 2-3 outlines the water distribution limits in the Amu Darya Basin.

Table 2-3 Water distribution limits in the Amu Darya Basin

Country	Maximum allocation (millions m3 / year)	Share Percentage (%)
Kyrgyz Republic	400	0.7
Tajikistan	9,500	15.4
Uzbekistan	29,600	48.1
Turkmenistan	22,000	35.8
Total for basin	61,500	100

2.5.4. After the independence of the former Soviet states, a joint declaration was issued on October 12, 1991, for compliance and continuity in the allocation of water to the various Republics. The Almaty Agreement was signed on February 18, 1992, for an "agreement on cooperation in joint management, use and protection of interstate sources of water resources" to maintain and adhere to the sharing of the transboundary water resources set out in Protocol 566 for the Amu Darya. In addition to establishing an Interstate Commission for Water Coordination (ICWC) and designating it as the body responsible for the definition of seasonal allocations in line with the annual agreements.

2.6. TRANSBOUNDARY CONSIDERATIONS

2.6.1. Formal agreements between Tajikistan and Uzbekistan are in place that manage expectations and/or obligations of both countries in the management of issues of mutual concern.

2.6.2. A Memorandum (dated 2022) between the government of the Republic of Tajikistan and the government of the Republic of Uzbekistan sets out the intentions of cooperation between both governments with regards to the generation of energy from Rogun HPP. This document sets out both governments intention for long-term export/import of energy from Rogun HPP within summer months from Tajikistan to Uzbekistan under mutually beneficial terms.

2.6.3. Transboundary impacts that extend to countries beyond Tajikistan are included within **Volume I, Chapter 8**.

2.6.4. To date, Afghanistan has not been formally involved in discussions regarding the allocation of the waters of the Amu Darya.

2.7. INTERNATIONAL STANDARDS AND GUIDELINES

INTERNATIONAL OBLIGATIONS

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

- Vienna Convention for the Protection of the Ozone Layer, 1996, as updated by Montreal Protocol on Substances that Deplete the Ozone Layer.
- 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).
- 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).

2.7.2. In addition, Tajikistan has ratified several core labor related conventions and standards of the International Labor Organization (ILO), including the following:

- Tripartite Consultation (International Labor Standards) Convention (2014).
- Labor Inspection Convention (2009).
- Convention for the Safeguarding of the Intangible Cultural Heritage (2006).
- Convention on the Rights of the Child (CRC) (1993).
- Employment Policy Convention (1993).
- Occupational Safety and Health Convention (1981).
- Convention on the Elimination of All Forms of Discrimination Against Women (1979).
- International Covenant on Economic, Social and Cultural Rights (1976).
- Forced Labor (C029) and Abolition of Forced Labor (C105).
- Minimum Age (C138) and Worst Forms of Child Labor (C182).
- Discrimination (C111).
- Freedom of Association and the Right to Organize (C087).
- Right to Organize and Collective Bargaining (C098).
- Equal Remuneration (C100).

WORLD BANK ENVIRONMENTAL AND SOCIAL FRAMEWORK

2.7.3. Given the number of potential lenders, a robust appreciation of the various policies, standards and frameworks is required to ensure that all requirements are met. The overarching E&S framework considered in this ESIA is the WB Environmental and Social Framework (ESF), consisting of:

- **Vision for Sustainable Development** which sets out the aspirations of the World Bank for a more Environmentally and Socially sustainable future.
- **WB E&S Policy for Investment Project Financing** which details the requirements that apply to the Bank.
- **Environmental and Social Standards (ESS):** a set of 10 standards which together with their annexes set out the mandatory requirements on Borrowers for managing E&S risks on their projects.

2.7.4. The underpinning principles of the Lenders' E&S polices are materially consistent with the WB ESF. The general assumption is that, in most cases, compliance with the WB ESF will result in compliance with other lenders policies and standards. The implementation of this "*common approach"* is consistent with ESS1.

2.7.5. **Table 2-4** outlines the WB ESSs and their relevance to the Project. Table **2-5** outlines the key gaps between National Tajik legislation and WB ESS requirements.

Table 2-4 World Bank Environment and Social Standards

ESS No.	Title	Relevance	Comments
ESS1	Assessment and Management of Environmental and Social Risks and Impacts	Relevant to the whole Project for both construction and operation	Identification, assessment, evaluation and management of environmental and social risks and impacts, including identification of applicable requirements and monitoring outcomes, including Associated Facilities.
ESS2	Labor and Working Conditions	Relevant to the whole project for construction and operation	Labor management procedures, occupational health and safety, workforce protection, worker grievance mechanism, with specific requirements for contractor and subcontractor employees within the primary supply chain.
ESS3	Resource Efficiency and Pollution Prevention & Management	Especially relevant for the construction phase around use of all materials for extraction, use, and disposal. Also relevant for climate change risk. Sets out the need for the Assessment of Alternatives.	Sustainable use of resources and minimization of adverse impacts on human health and the environment through management of wastes, chemicals and hazardous materials.
ESS4	Community Health and Safety	Especially for protecting communities close to the Project area during construction and operation as well as along the logistics routes	Avoidance and control of risks and impacts on communities from project activities and workers, emergencies, security, and other factors.
ESS5	Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	Relevant to all resettlement and livelihood restoration undertaken as part of the project.	Identification, avoidance and mitigation of impacts from project related land acquisition that may cause physical displacement (relocation, loss of shelter) and economic displacement (loss of assets or access to assets, leading to loss of income sources or other means of livelihood), or both. Resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation and informed participation.

ESS No.	Title	Relevance	Comments
ESS6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Especially relevant in the inundation zone and downstream of the Rogun Dam between Rogun and Nurek.	Protection and conservation of biodiversity and habitats, support to the livelihoods of local communities.
ESS7	Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not relevant to the Project	No Indigenous Peoples are present in the Project area.
ESS8	Cultural Heritage	Especially relevant in the inundation zone for loss of any tangible heritage, and for resettlement around loss of intangible heritage.	Protection of tangible and intangible cultural heritage from potential adverse impacts of project activities and support its preservation.
ESS9	Financial Intermediaries	Not relevant to the Project	Financial Intermediaries do not apply since Bank funding is not being provided to financial institutions for further on-lending.
ESS10	Stakeholder Engagement and Information Disclosure	Relevant to all stages of the Project including Construction, Operation, and especially during resettlement periods.	Identification and engagement of local and other stakeholders throughout the project life cycle, disclosure of project information, and grievance redress mechanism for project stakeholders.

Table 2-5 – Comparison of World Bank ESS against Tajik Law

(where ESS guidelines have been scoped out in Table 2.4 these have been omitted in the comparison of standards)

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
ESS1 – Assessment and Management of Environmental and Social Risks and Impacts.	Scope	ESSs apply to Associated Facilities	Associated facilities not covered by Tajikistan law as such, except to the extent that all activities in Tajikistan are subject to laws
	E&S Framework	The Project may use the Borrower's framework if can meet objectives of ESSs. The Rogun HPP requires application of World Bank and other lender requirements.	No provision for alternative requirements except that international standards take precedence if agreements are in place
	ESIA	▪ 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
	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.
	Monitoring	▪ Monitor proportionate to nature of project, risks and impacts, and compliance requirements. ▪ Reports to World Bank	Monitoring required but less emphasis is required with limited feedback mechanisms.

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
	Stakeholder Engagement	Engage stakeholders through life cycle	Generally consistent but no requirement for project-specific stakeholder engagement plan
ESS2 – Labour and Working Conditions	Scope	ESS2 applies to workers employed by PMG, Rogun JSC, Rogun HPP who work on the Project, as well as all contracted workers, primary supply workers, and community workers	Labor Code applies to all workers in Tajikistan, including foreign workers. The requirements apply to the employer but do not extend to the prime contractor.
	Working conditions & Labor Relations	Requirements include: ▪ Written labor management procedures including Terms and conditions of employment. ▪ Non-discrimination and equal opportunity ▪ Right to set up Worker's organizations	Generally consistent
	Protecting the Workforce	Specific requirements around child and 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 is prohibited. There are no workers under the age of 18 on Rogun HPP.
	Grievance Mechanism	Grievance mechanism has to be provided for all direct and contracted workers	No specific requirement for grievance mechanism for workers
	Occupational H&S	▪ Measures relating to occupational health and safety must 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 must be implemented. ▪ Provide safe working environment.	Generally consistent but less detailed

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
		▪ Workers allowed to report safety issues and refuse to work under certain circumstances in a blame-free environment. ▪ Provide appropriate facilities (canteens, toilets, etc.) and ensure accommodations meet needs of workers. ▪ All employers to collaborate on applying OSH requirements. ▪ Monitor OSH performance	
	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
	Community Workers	Requirements for working conditions and OHS applied to community labor	Labor Code applies to employers and employees, not volunteers
	Primary Supply chain	Depending on level of control/influence, assess risk of child labor, forced labor, and safety issues and require suppliers to address significant risks	Tajikistan law applies if work is done in Tajikistan. There is no obligation on employers in other countries or requirements for the prime contractor.
ESS3 – Resource Efficiency & pollution Preventions	Scope	Borrowers must apply feasible resource efficiency and pollution prevention measures in accordance with mitigation hierarchy	Some limited requirements but not comprehensive.
	Energy Use	Adopt measures in EHS guidelines if project is significant energy use	No specific limits. No significant energy usage.
	Water	Assess water use and impacts and communities and adopt mitigation measures as needed	Permits required for water usage
	Materials	Use GIIP to reduce significant resource usage	Resource usage requires permits

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
	Pollution Prevention & management	General requirements to minimize risk, no specific requirements for services, ecosystem services, emergencies, etc.	▪ Specific standards for different pollutant type including emission limits. ▪ Detailed requirements for hazardous and other wastes ▪ Regulations on hazardous materials ▪ Signatory to international conventions ▪ No requirements to verify haulers/contractors
ESS4 – Community Health Safety and Security	Community H&S	▪ Evaluate risks to community health and safety and apply mitigation hierarchy and GIIP to reduce risks. ▪ Consider third-party safety risks in designing 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	
	Security Personnel	▪ Assess and address risks of security arrangements.	▪ No specific requirements

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
		▪ 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	
	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.	▪ No equivalent requirements
ESS5 – Land Acquisition, restriction on land use and Involuntary Resettlement	Applicability	▪ Assess need during ESIA process. ▪ Applies to permanent and temporary displacement, listing types of infringements. ▪ Limitations on applicability ▪ Applies to land users and owners	▪ All land in state ownership ▪ Rights to use land granted with legal certificates. ▪ May be used only as authorized. ▪ Legal users may lease land for authorized uses
	General	▪ Affected people: landowners, users with legal claims, and users with no legal claims. ▪ Design project to avoid/minimize displacement.	▪ Only those with legal rights eligible for replacement land or compensation ▪ Replacement land preferred option ▪ No requirement for assistance

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
		▪ 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	▪ Detailed requirements for committee memberships and actions ▪ Compensation based on established rates for trees or other items lost
	Displacement	▪ Detailed requirements for physical displacement ▪ Includes for depreciation. ▪ Detailed requirements for economic displacement, including livelihood restoration	▪ Replacement with equivalent land and houses preferred over compensation. ▪ No requirement to cover depreciation costs. ▪ Compensation for lost profits required, but not livelihood restoration
	Collaboration	Collaborate with other involved agencies, provide support as needed; include arrangements in Plan	Committee membership and responsibilities defined in Land Code
	Technical and Financial Assistance	World Bank may provide support to resettlement planning	No requirements
	Annex 1: Involuntary resettlement instruments	Detailed requirements for resettlement plans, resettlement frameworks, and process frameworks	No detailed requirements
ESS6 – Biodiversity Conservation and Sustainable	General	▪ Consider direct, indirect, & cumulative impacts in ESS1 EIA ▪ Characterize baseline conditions.	▪ Requires protection of biodiversity but less detailed in specific requirements.

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
Management of Living Natural Resources.		▪ 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. ▪ 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	▪ No specific requirements for assessment of ecosystem services ▪ No specific requirements around Primary Supply chain.
ESS8 – Cultural Heritage	Scope	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
	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 finds procedure
	Consultation	▪ 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 to information

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
	Legally Protected assets	Comply with regulations and plans, consult with sponsors	Generally consistent
	Specific types of 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. ▪ Identify and protect movable cultural heritage	Less detailed requirements but generally consistent
	Commercial Use	Not relevant for this project	n/a
ESS10 – Stakeholder Engagement and Information Disclosure	General	▪ 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
	Engagement during Project Phases	▪ 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. ▪ Engagement and disclosure of information to continue throughout implementation, following Plan	▪ No requirement to analyze stakeholders. ▪ No formal plan required. ▪ Early disclosure required. ▪ No specific requirement for continuing engagement

ESS	Specific topic/area	ESS Requirement	Tajik Legal requirements/gaps
	Grievance Process	▪ 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
	Organizational Capacity	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	No specific requirements

2.7.6. The WB ESF also states that 'Borrowers and projects are also required to apply the relevant requirements of the WB Group Environmental, Health and Safety Guidelines (EHSGs). These are technical reference documents with general and industry specific examples of GIIP.

EUROPEAN INVESTMENT BANK

2.7.7. The EIB ESSF is an overarching policy framework that focuses on sustainable and inclusive development, committing to a just and fair transition and supporting the transition to economies and communities that are climate and disaster-resilient, low-carbon, environmentally sound and more resource efficient.

2.7.8. The EIB ESS set out standards and obligations in each area and identifies key pieces of EU legislation that should be applied. As the Project is located outside the jurisdiction of the EU and European Free Trade Area (EFTA), the EIB ESS specify that the Project should comply with the core principles and essential procedural elements laid down by the relevant EU legislation. There are 10 ESS's, including:

- Standard 1: Environmental and Social Impacts & Risks.
- Standard 2: Stakeholder Engagement.
- Standard 3: Resource Efficiency & Pollution Prevention.
- Standard 4: Biodiversity and Ecosystems.
- Standard 5: Climate Change.
- Standard 6: Involuntary Resettlement.
- Standard 7: Vulnerable Groups, Indigenous Peoples & Gender.
- Standard 8: Labor Rights.
- Standard 9: Health, Safety & Security.
- Standard 10: Cultural Heritage.

2.7.9. The EIB has also published ECS Guidelines on Hydropower Development (2019) which set out the EIB's objectives for investments in hydropower projects, establishing sector-specific standards and criteria, which promoters should meet. They also summarize best practice recommendations for integrating social, biodiversity, natural resource management and climate considerations into hydropower projects.

THE EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT

2.7.10. EBRD's Environmental and Social Policy (ESP) and Performance Requirements (PRs) (2019) aim to ensure that the Project is designed and operated in compliance with good international practices relating to sustainable development. The EBRD has ten PRs, including:

- PR1: Assessment and Management of Environmental and Social Risks and Impacts.
- PR2: Labor and Working Conditions.
- PR3: Resource Efficiency and Pollution Prevention and Control.
- PR4: Health, Safety and Security.
- PR5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement.

- PR6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- PR7: Indigenous Peoples.
- PR8: Cultural Heritage.
- PR9: Financial Intermediaries.
- PR10: Information Disclosure and Stakeholder Engagement.

ASIAN DEVELOPMENT BANK

2.7.11. The ADB SPS (2009) and associated safeguarding documents aim to avoid, limit, and compensate for negative project impacts.

2.7.12. The ADB SPS builds upon three previous safeguard policies on:

- The environment.
- Involuntary resettlement.
- Indigenous peoples.

2.7.13. The SPS brings the three safeguards' policies into one single policy that enhances consistency and coherence and more comprehensively addresses environmental and social impacts and risks.

2.7.14. The SPS aims to promote the sustainability of project outcomes by protecting the environment and people from projects' potential adverse impacts by:

- Avoiding adverse impacts of projects on the environment and affected people, where possible.
- Minimizing, mitigating, and/or compensating for adverse project impacts on the environment and affected people when avoidance is not possible.
- Helping borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

ASIAN INFRASTRUCTURE INVESTMENT BANK

2.7.15. The Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (2019, 2021 and 2022) aims to help create environmentally and socially sustainable developments for the Bank and its clients. This is achieved through the integration of good environmental and social planning, alongside management of risks and impacts, which all feed into all stages such as preparation, decision-making and implementation, on supported projects.

2.7.16. The framework includes three key documents:

- Environmental and Social Policy.
- Environmental and Social Standards.
- Environmental and Social Exclusion List.

EURASIAN DEVELOPMENT BANK

2.7.17. The EDB was established under an intergovernmental agreement signed on 12 January 2006 by authorized representatives of the Russian Federation and the Republic of Kazakhstan.

2.7.18. The key strategic objectives of the EDB include promoting the United Nations (UN) Sustainable Development Goals and Environmental, Social and Governance (ESG) approaches in the Bank's corporate governance.

2.7.19. The EDB is principally interested in financing projects with an 'integration affect', to promote the development of international infrastructure with a mission to 'help strengthen the market economies of its member states, foster their sustainable economic growth and expand trade and other economic ties through investment.'

ISLAMIC DEVELOPMENT BANK

2.7.20. The Islamic Development Bank (IsDB) aims at bettering lives, delivering impact, boosting recovery, tackling poverty, and building resilience and driving green economic growth.

2.7.21. The Islamic Development Bank (IsD) has made the 17 United Nations (UN) Sustainable Development Goals (SDGs) a key factor in their investment decision-making as they state that the high-level SDGs and the 169 specific targets, encompassing the social, economic, and environmental dimensions of development and these aspirations for human dignity, is in line with the principles and objectives of development from an Islamic perspective.

2.7.22. The United Nations (UN) has created 17 Sustainable Development Goals (SDG) and 169 specific targets, encompassing the social, economic, and environmental dimensions of development. aimed at guiding development in a well-rounded approach, covering social issues such as poverty and gender inequality, environmental issues such as climate action and access to clean water, and economic issues.

SAUDI FUND OF DEVELOPMENT

2.7.23. The Saudi Fund for Development (SFD) was established as a governmental institution to provide support in the form of soft loans to finance development projects in developing countries. SFD's has defined is goal to unify efforts with leading global organizations and contribute to sustainable development.

2.7.24. Through the unlimited support of the Government of the Kingdom of Saudi Arabia (KSA), and as defined in its law, the SFD main objective is to 'contribute to financing development projects in the developing countries by granting them the necessary loans, the technical aids necessary for financing studies and institutional support.'

2.7.25. SFD has played a significant role in enhancing renewable energy in Asia and has signed six loan agreements for renewable energy in Pakistan and Nepal, all of which relate to four hydropower plant developments. Since its establishment, SFD has made important contributions through its loans towards mitigating climate change, such as by supporting various solar and hydropower projects. By the end of 2021, it funded 15 development loans for the renewable energy sector in nine developing countries, worth a total of $650.6 million.

2.7.26. According to the SFD and UNDP joint workshop on Climate changes (27 June 2023) SFD officials highlighted the Fund's commitment to assisting sustainable development through clean energy, afforestation, and greening initiatives in developing countries.

2.7.27. The SFD provide loans for developing countries, which they define as countries with limited economic and financial resources, which are:

- Less developed.

- Heavily poor.
- In need of fundamental development assistance.
- Landlocked and non-coastal.
- Facing economic and social challenges such as lack of natural resources and high population growth rates.
- The SFD loans are directed towards the following economic and social sectors within developing countries.
- Developing basic infrastructure by expanding transport and communication networks.
- Strengthening protection against diseases and epidemics by supporting health sector.
- Developing human resources.
- Providing energy for all.
- Ensuring food and water security.
- Preserving the environment and public Health.
- Providing adequate housing for low-income groups.
- Developing industry and mining.

KUWAIT FUND FOR ARAB ECONOMIC DEVELOPMENT

2.7.28. The KFAED was established to assist Arab and other developing countries in developing their economies. No geographic, ethnic, religious, caste or cultural barrier restricts benefiting from the Fund's loans and assistances.

2.7.29. The KFAED provides technical assistance to finance the costs of feasibility studies of projects and subscribers in the capital of international and regional development institutions.

2.7.30. The KFAED supports projects that have a strong public sector element and be of a developmental nature. The KFAED's assistance is not limited to a particular sector. The project may be in any of the following sectors: infrastructure, agriculture, irrigation, transport, communications, energy, water supply, sewage treatment, education, and health.

2.7.31. In a news article dated 26 June 2023, the KFAED states the importance of encouraging joint efforts to combat the impacts of climate change and its challenges, with the Group members contributing to investments in the energy sector.

2.7.32. Other funding IFIs, development funds and export financiers are also being sought. These may include KFW (German Development Bank) and others.

2.8. GOOD INTERNATIONAL INDUSTRY PRACTICE

WORLD BANK GROUP ENVIRONMENTAL, HEALTH AND SAFETY GUIDELINES

2.8.1. The WBG has developed EHS Guidelines that are technical reference documents containing industry-specific examples of GIIP and are referred to in the WB ESF. The WBG requires Borrowers to apply the relevant measures of the EHS Guidelines.

2.8.2. The General EHS Guideline (2007) includes guidelines for environmental controls during facility construction and operation (air and water emissions, hazardous materials management, noise, contaminated land, etc.) and occupational and community health and safety during construction and operation.

2.8.3. The WBG has also outlined Industry Sector Guidelines providing industry-specific examples GIIP. The Industry Sector Guidelines are designed to be used together with the General EHS Guidelines.

2.8.4. The principle EHS Industry Sector Guidelines relevant to the Project, include but are not limited to:

- EHS Guidelines for Construction Materials Extraction (2007).
- EHS Guidelines for Electric Power Transmission and Distribution (2007).
- EHS Guidelines for Toll Roads (2007).
- EHS Guidelines for Waste Management Facilities (2007).
- EHS Guidelines for Water and Sanitation (2007).
- EHS Guidelines for Crude Oil and Petroleum Product Terminals (2007).

WORLD BANK GUIDANCE ON HYDROPOWER OPERATION AND MAINTENANCE

2.8.5. The WB has produced a handbook to provide guidance to 'to raise awareness among utility managers, decision makers, and other stakeholders of the benefits of developing robust operation and maintenance (O&M) strategies for all existing hydropower plants and those under development.'

2.8.6. The handbook was written in collaboration with the International Hydropower Association (IHA) with financial support from the Global Water Security & Sanitation Partnership (GWSP) and the Swiss State Secretariat for Economic Affairs (SECO).

2.8.7. The handbook outlines practical steps and recommendations to prepare *ad hoc* O&M strategies that will help to extend the life expectancy of assets while securing hydropower production in a cost-effective way and preventing high-cost expenditures for rehabilitating facilities that have not been maintained properly.

INTERNATIONAL HYDROPOWER ASSOCIATION

2.8.8. The IHA is a non-profit membership association, operates in over 120 countries, and includes leading hydropower owners and operators, developers, designers, suppliers, and consultants. The IHA has played a leading role in improving understanding about good and best practices in hydropower development and operations.

2.8.9. The IHA, together with several other organizations supported the development of the Hydropower Sustainability Standard, a global certification scheme outlining sustainability expectations for hydropower projects around the world.

2.8.10. The IHA has several assessment tools and guidelines used to design, develop, and assess hydropower projects including:

- The Hydropower Sustainability Guidelines on Good International Industry Practice.
- The Hydropower Sustainability Assessment Protocol (HSAP) - is a tool for assessing projects across a range of social, environmental, technical, and economic criteria.

- The Hydropower Sustainability ESG Gap Analysis Tool (HESG) – a tool which enables hydropower project developers and investors to identify and address gaps against international good practice.
- The Carbon Calculator for Reservoirs (g-res tool) – a tool used to predict greenhouse gas emissions from a reservoir.

3. PROJECT DESCRIPTION

3.1. OVERVIEW

3.1.1. This chapter provides a description of the Project and its activities to inform the ESIA.

3.1.2. The Project currently includes the following elements and plans:

- A dam whose crest is 1,110 meters above sea level (masl).
- A reservoir at elevation 1,065 masl with a surface area of 12 square kilometers (km^2). The reservoir will be raised to 1,110 masl by 2027, and progressively raised to 1,290 by 2036.
- An underground powerhouse that currently has two operating turbines (Units 5 and 6) with generation capacity of 400 megawatt (MW) total and currently operating at about 200MW each. Current runners will be replaced in 2024, bringing their capacity to 630MW each. Turbine Units 1 to 4 will be installed progressively from 2025 through 2029, at which time full capacity will be 3,780MW.
- A substation and two 500 kilovolt (kV) transmission lines that extend connecting the Project to the national grid and Dushanbe.
- Approximately 70km of underground roads.
- Approximately 26km of aboveground roads, mostly unpaved.
- Approximately 15km of water tunnels.
- One main construction camp for over 20 construction contractors, this camp will be flooded by 2026/2027 and contractors will be relocated to new locations.
- A program to resettle an estimated 46,628 people in 69 villages, of which over 7,000 in 14 villages have been resettled to date. Re-settlers have the choice of moving to host communities or new settlements. The resettlement program will be completed in 2032.

3.1.3. The Project once complete in 2029 will consist of:

- A dam with a crest 1,300 meters masl and an overall height of 335 m.
- A reservoir with a full supply level (FSL) at 1,290 m above sea level (asl), a total surface area of 170 km^2, an overall length of approximately 70 km and capacity of approximately 13.3 million cubic meters (m^3).
- A surface spillway, two mid-level and three high-level tunnels to protect the dam and allow safe passage of floodwaters up to the Probable Maximum Flood (PMF).
- An underground powerhouse and transformer room in excavated caverns on the left bank. The powerhouse will contain six 630 MW turbines.
- Approximately 5-6km of aboveground surface roads.
- Six 500 kV transmission lines (two complete and four yet to be constructed) connecting the Project to the national grid and other countries. These are not being directly financed by the Project but are considered associated facilities.

3.1.4. Once complete, the Project will be the largest installation in Central Asia, with a generation capacity of 3,780 MW and an average annual generation of over 17,000 gigawatt-hour (GWh). The Project has an expected life of 115 years, dependent on sediment inflow.

3.1.5. Further information regarding the Project components is provided in Section 3.9.

3.2. PROJECT ORGANISATION

3.2.1. The current organization will change once financing has been received.

3.2.2. The organizations currently responsible for the ESHS management of the Project include:

- **Project Management Group (PMG) for Energy Facilities Construction**: under the President of Tajikistan has been appointed to coordinate all parties involved in Rogun HPP, including liaison with international lenders.
- **Employer/Owner: OJSC Rogun HPP (aka Rogun JSC)**: responsible for ongoing operation of Rogun HPP and for construction of the Project. Rogun JSC provides supervision of Lot 3 EPC, Lot 4 early works contractors, other smaller contractors and of the Employer's Representative, Tractebel ELC. Rogun JSC is ultimately accountable for all parties' compliance with Tajikistan Law and, in future, International Standards.
- **Project Management Consultant (PMC)** provides overall supervision of E&S compliance monitoring, and will be appointed from 2024.
- **EPC Contractor for Lot 1: Voith Hydro GmbH & Co (Voith Hydro)** is responsible for installation of four new generating units, delivery of two runners for two early generating units. Installation of the balance of plant and control equipment. Voith Hydro will mobilize to site at the beginning of 2024.
- **EPC Contractor for Lot 2**: **WeBuild (formerly Salini Impregilo SpA),** responsible for design, procurement, and construction of the coffer dam and main dam, including treatment of the dam base (salt layer, grout curtain, drainage curtain).
- **EPC Contractor for Lot 3**: **TajikGidroElectroMontazh (TGEM)** responsible for a series of tunnels and spillways on the right bank that provide adequate flood discharge capacity as the height of the main dam increases, and lower tunnels can no longer be used for that purpose.
- **EPC Contractor for Lot 4**: to be appointed upon completion of tender. Lot 4 is expected to be awarded in 2024. The contractor will be responsible for completion of works on the left bank.
- **Lot 4 'early works' contractors:** two main contractors EMZ and Tunnel Sadd Ariana (Ariana) are implementing preparatory tunnelling and other works in advance of appointment of the Lot 4 EPC contractor. Both contractors will vacate the site upon appointment of the EPC contractor for Lot 4. Performance is supervised by Rogun JSC.
- **Other non-EPC contractors**: A number of smaller contractors (approx. 20 plus) are undertaking various preparatory and maintenance works and are supervised by Rogun JSC.
- **State Enterprise (DFZ)**: is responsible for developing and implementing the resettlement and livelihood restoration program. They employ two main contractors, one for construction at new resettlement sites and another for demolition of relocated villages. DFZ also employs the Forestry Agency, which carries out land clearance works in advance of flooding, and another contractor who transports property of resettled households to designated resettlement sites.

3.2.3. The organizational structure will somewhat change once there is a commitment to international financing, expected in 2024. The changes will include:

- In preparation of financing, PMG is tendering and selecting contractors for Lots 3a and 4. These will be awarded as soon after financing as practicable.
- The works being undertaken by non-EPC contractors ('early works' and others) not completed will be assumed by Lots 3a and 4 EPC contractors. The non-EPC contractors will no longer be employed at the site.
- Rather than having an Employers Representative, a Project Management Consultant (PMC) will be appointed to supervise the ESHS performance of all four main EPC contractors.

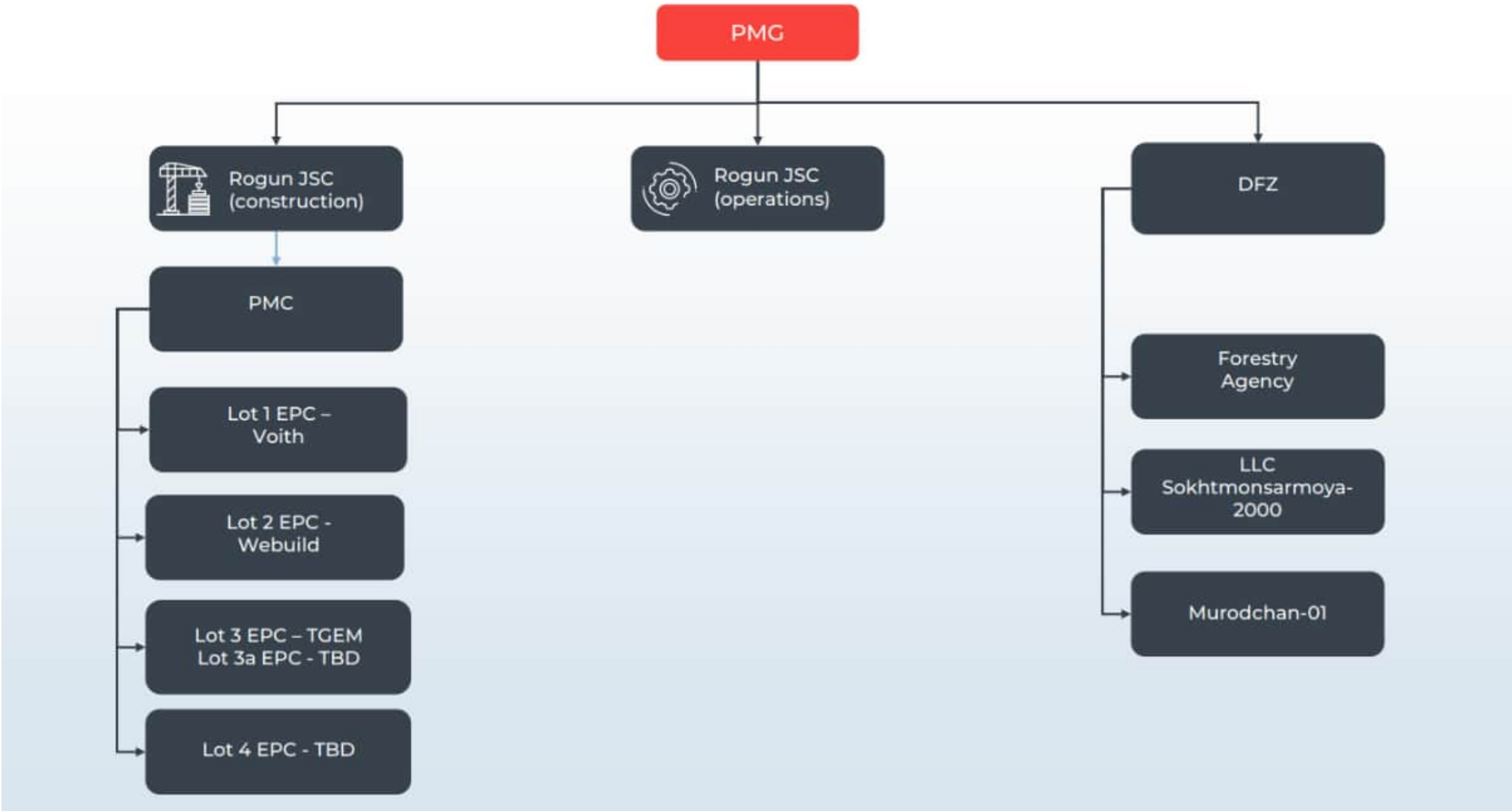
3.3. ORGANISATIONAL STRUCTURE, ROLES AND RESPONSIBILITY

3.3.1. As of mid-2023, approximately 12,000 to 14,000 workers are employed for the construction of the Project and resettlement planning and implementation, the maximum number expected to be upwards of 20,000. About 95 percent of the workforce is Tajik and the remainder expatriates. Construction of the Project will be complete in 2029, with the resettlement program continuing through 2032.

3.3.2. The current organizational structure of the Project to manage ESHS is presented in Figure 3-1. The Project is currently understaffed with regards to resources for supervising and implementing ESHS requirements.

3.3.3. The organizational structure will change once international financing becomes available and the supervision of Rogun HPP construction with the supervision of Rogun HPP construction will be consolidated and greatly simplified. The Environmental and Social Management Plan (ESMP) will require adequate staffing by all organizations.

Figure 3-1 – Current Organizational Structure of the Project



3.4. PROJECT LOCATION AND CONTEXT

STUDY AREA

3.4.1. The Republic of Tajikistan is a landlocked nation in Central Asia, with an area of 142,326 km² (54,952 sq. mi). Dushanbe is the country's capital and largest city. On 9 September 1991, Tajikistan declared itself an independent sovereign nation from the Soviet Union.

3.4.2. Tajikistan is divided into four administrative regions or provinces. These regions are:

- Sughd province.
- Khatlon province.
- Gorno-Badakhshan Autonomous province.
- Region of Republican Subordination.

3.4.3. The Project is located within the Region of Republican Subordination and within the Amu Darya basin, which is one of the two main tributaries of the Aral Sea.

3.4.4. The Amu Daryn basin is shared between Kyrgyzstan, Afghanistan, Tajikistan, Turkmenistan, and Uzbekistan. The Amu Darya is the largest river in Central Asia with a total length from the origin of Pyanj river of 2,540 km draining a catchment area of 543,739 km². It is called the Amu Darya downstream of the point where Pyanj and Vakhsh rivers meet.

3.4.5. Four large right bank tributaries (Kafirnigan, Surhan, Sherabad and Zeravshan) and one left bank tributary (Kunduz) flow into the Amu Darya within its middle reach. Currently, the Zeravshan does not reach the Amu Darya since its water is being used for irrigation within the territory of Uzbekistan. Further downstream towards the Aral Sea the river has no more tributaries. It is fed largely by water from melted snow, thus maximum discharges are observed in summer and minimum ones in January-February.

3.4.6. The Project site is located approximately 100 km east of the Tajik capital of Dushanbe on the Vakhsh river. The Project site is in the Rasht region, which is divided into seven districts (rayons), namely Fayzabad, Rogun, Nurobod, Rasht, Tavildara, Tajikabod and Jirgital. The Project will directly affect Rogun, Nurobod and Rasht districts.

3.4.7. One of the tributaries of Vakhsh river, the Kizil-Su, originates in Kyrgyzstan, flows through the Pamir-Alai mountains of Tajikistan, and joins the Muk-Su, forming the Surkhob river. Vakhsh river is formed by the confluence of Surkhob with Obihingou; it then joins the Pyanj river after 520 km to form Amu Darya; Pyanj and Amu Darya form the border between Tajikistan and Afghanistan.

3.4.8. The drainage area of the Vakhsh river in Tajikistan is 31,200 km^2. Most of the river runs through very mountainous territory. At the Project site, about 340 km upstream of the confluence with the Pyanj river, the river flows through a narrow, 400 to 500 m deep V-shaped gorge with gradients of the valley sides up to 50°.

3.4.9. In its upper reaches, the Vakhsh River flows through a narrow valley with a steep gradient but, on a few sections the valley is wider and almost flat, and here the river has formed extensive floodplains. The floodplain near Komsomolobod and another near Novobod is located within the future reservoir. The confluence of the Surkhob and Obihingou tributaries will also be submerged by the reservoir.

3.4.10. The Vakhsh river is intensively developed and accommodates five existing hydropower dams (of which the Project is the furthest upstream, in a cascade that includes the Nurek HPP, located 70 km downstream from the Project and, downstream of Nurek, the Baipaza, Sangtuda 1, Sangtuda 2 and Golovnaya Dams. The Rogun HPP forms part of this cascade and will be located at the upstream end (refer to **Table 3-1**).

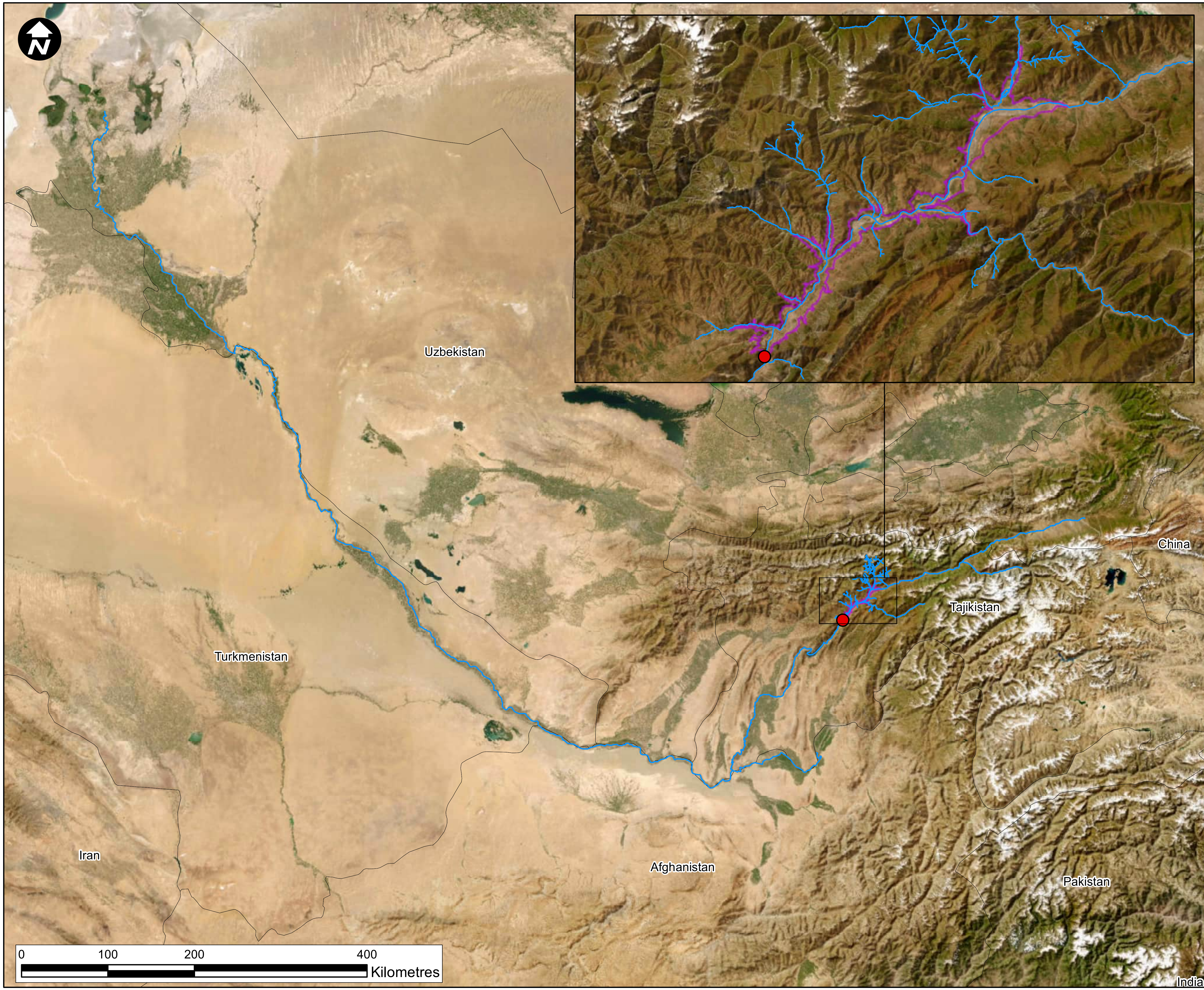
3.4.11. Planning for the Shurob HPP began in the Soviet era, and details of design and timing are yet to be determined. It was planned to be on the Vakhsh river between Rogun HPP and the Nurak reservoir.

Table 3-1 - Vakhsh Cascade

	Rogun	Nurek	Baipaza	Sangtuda 1	Sangtuda 2	Goluvnaya
Stage	Under construction	In operation since 1979, now under rehabilitation	In operation since 1986	In operation since 2009	In operation since 2011	In operation since 1963, now under rehabilitation
Live Storage (hm^3)	10,300	4,200	87	18	5	4
Installed Capacity (MW)	3,780	2,600 (2019) 3,300 (by 2028)	600	670	220	240
Regulation	Inter-annual	Inter-annual	Weekly	Daily	Daily	Daily

3.4.12. Although the Vakhsh River lies within Tajikistan, the Amu Darya basin is shared between Kyrgyzstan, Afghanistan, Tajikistan, Turkmenistan, and Uzbekistan and is one of the two main tributaries of the Aral Sea. On the 18th February 1992, the Almaty Agreement (previously Protocol 566) was ratified to manage the water allocation and water-sharing principles between the nations of the Amu Darya basin, with the exception of Afghanistan, which is not party to the Agreement.

3.4.13. **Figure 3-2** presents the location of the Project in Tajikistan.



Legend

- Rogun Dam Site Location
- Vakhsh River
- 1290m Inundation Boundary

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri

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PROJECT TITLE

Rogun HPP E&S Support and Monitoring for World Bank

DRAWING TITLE

Figure 3-2
Overview of Project Location

DRAWING STATUS
FOR INFORMATION

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1:4,000,000	10/6/2023	P01

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ROGUN-WSP-DR-GI-0005

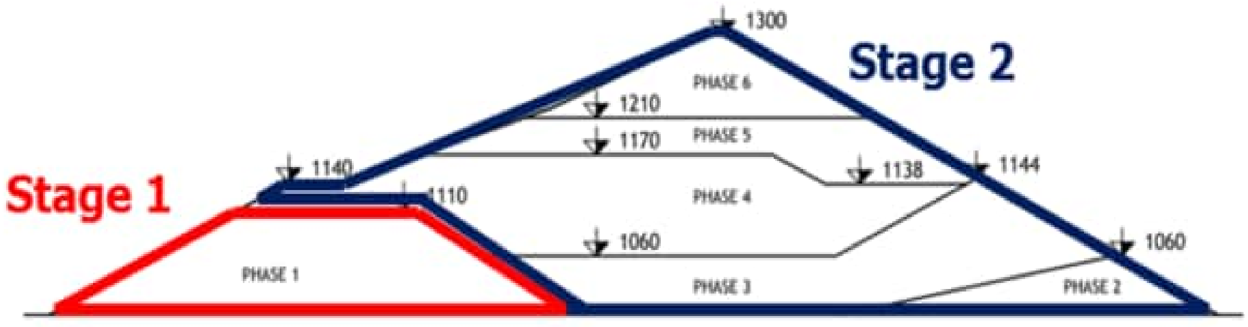
3.5. PROJECT OVERVIEW

3.5.1. The Project has a long history and was first proposed under the Union of Soviet Socialist Republics (USSR) in 1959. In 1978, a technical design of a 335 m dam and six power units of 630 MW each installed in an underground power plant was prepared. The final construction decision was granted in 1980, and the main construction work began in 1982. Construction of the main components of the underground works and a 45 m hydraulic cofferdam progressed until 1990 when work was suspended due to political changes and the independence of Tajikistan. In 1993, there was a flood during which the diversion tunnels were blocked, and the cofferdam was destroyed.

3.5.2. The Government of Tajikistan announced the construction of the Project to resume in May 2008. Limited construction and maintenance activities were resumed until 2011, when a Techno-Economic Study (TEAS) was written by Coyne et Bellier, which was reviewed by the 2014 Dam Safety Panel of Experts. An overview of previous studies and key findings is presented **in Volume I, Chapter 1** of this ESIA**.**

3.5.3. The Project is being constructed in two stages (refer to **Figure 3-3**), with details of each stage discussed in Sections 3.6 and 3.7, respectively. Stage one was constructed between 2014 and 2018; Stage 2 commenced in 2019.

Figure 3-3 - Overview of Construction Stages and Phases



Source: Techno-Economic Assessment Study For Rogun Hydroelectric Construction Project. Phase II Report (Draft Final): Project Definition Options Volume 1: Summary, June 2014.

3.5.4. The construction of the Project is proceeding in stages as described in **Table 3-2**. The works are being undertaken and completed in four lots (Lots 1, 2, 3, and 4) (refer to **Table 3-3**).

Table 3-2 - Construction Schedule

Construction Stage	Description	Scheduled Duration From 2014	Status
Pre-cofferdam	Start of the river diversion to allow construction to proceed, improving the access road and internal roads, and finalizing diversion tunnel No. 3.	Approximately 28 months	Complete
Cofferdam	Construction of cofferdam to crest at 1,050 m asl.	Approximately 36 months to complete (inclusive of the eight months for the pre-cofferdam)	Complete
Stage 1 Dam	Construction of dam to crest at 1,110 m asl. This is an intermediate stage to allow early electricity generation.	Estimated to be completed in 58 months, inclusive of previous stages.	Complete
Stage 2 Dam	Construction of dam to crest at 1,300 m asl and the reservoir level will be at 1,290 m asl filling over a 16-year period (approx. 2036).	Scheduled completion in 2029.	On-going

Table 3-3 - Construction Lots

Contract	Type	Size	Contract Award & Contractor	Scope
Lot 1 Contract	Electro-Mechanical Equipment	€370 million	Jan 2021; Voith Hydro (Austria)	Installation of four new generating units; and delivery of two runners in 2024 for the two existing early generating units. Installation of the balance of plant and control equipment No works are being undertaken on site as of mid-2023, but turbines are being manufactured and assembled elsewhere. Once preparation and installation begin, the works will be supervised by a Project Management Consultant (PMC) and completed by 2027.
Lot 2 Contract	Main Dam	US$2.4 billion	Jul 2016; WeBuild (Italy)	Design, procurement, and construction of the following works: ▪ Modernization/reconstruction / completion (if necessary) of the Diversion tunnels (DT). ▪ Construction of the cofferdam and river diversion. ▪ Construction of transition sections DT-1 and DT-2. ▪ Treatment of the entire base (salt layer, grout curtain, drainage curtain).

Contract	Type	Size	Contract Award & Contractor	Scope
				▪ Installation of dam monitoring devices and reservoir monitoring. ▪ Main Dam Stage 1 to elev. 1,080 m asl; and ▪ Main Dam Stage 2 to elev. 1,300 m asl. Lot 2 works, including E&S performance, are being supervised by an Employer's Representative, a consortium of Tractebel-ElectroConsult. In the future, supervision will be by the future PMC.
Lot 3 Contract	Right Bank Structures	US$1.7 billion	Jul 2021; TGEM (Tajikistan)	Series of tunnels and spillways that provide adequate flood discharge capacity as the height of the main dam increases and lower tunnels can no longer be safely. At present, works are supervised by JSC Rogun but will ultimately be supervised by the PMC. Works not yet completed under Lot 3 will be retendered as Lot 3a once finance has been received.
Lot 3a	Right Bank Structures		International tendering in 2023/2024 for balance of works not completed at the time of financing.	
Lot 4 Contract	Left Bank Structures	US$789 million	Not awarded yet. International tendering in 2023/2024.	Construction works on the construction of a multi-level water intake, six inlet pressure tunnels and shafts to hydraulic units and the corresponding outlet tunnels. AFRY is the prime designer. Pre-construction (preparatory) activities are taking place by two major 'early works' contractors, involving underground works on tunnelling for water intake areas of the powerhouse, ventilation shafts, etc. Current works are being supervised by Rogun HPP, with future supervision of the ultimate Lot 4 EPC Contractor by the future PMC.

3.5.5. After the Project receives financing in 2024, early works contracts will be terminated and all works will be completed under EPC contracts based on FIDIC and World Bank Standard Procurement Documents (SPDs).

3.5.6. The existing ongoing accommodations and work camps for existing contractors are on construction site 1 (refer to Figure 3-6). This area will be flooded in 2027, before which accommodation and work camps will be relocated to new areas within Construction Site 2 and Area 5 (refer to Figure 3-6).

3.5.7. On the new construction camps, the EPC contractors will design and construct accommodations, shops and working areas and contracts will include requirements to meet the appropriate international standards (e.g., the IFC / EBRD standards for worker accommodation).

3.6. STAGE 1 DAM

3.6.1. The Stage 1 Dam was constructed between 2014 and 2018 and is operational in its current form. A staged construction was planned to allow generation of electricity during the construction phase of the Stage 2 Dam between 2018 to 2029.

3.6.2. The Stage 1 development includes a 143 m high (above foundation) dam to a crest level of 1,110 m asl. Additional details of Stage 1 are presented in **Table 3-4**.

Table 3-4 - Details of Stage 1 Dam and Reservoir

Stage 1 - Dam	
Dam crest level / elevation	1,110 m asl
Dam height above foundation	143 m
Dam height above thalweg	100 m
Dam length at crest	714 m
Dam width at crest	20 m
Stage 1- Reservoir	
Normal water level	1,100 m asl
“Overtopping” water level	1,100 m asl
Water volume	0.5 km^3
Surface at normal water level	12 km^2

3.6.3. The installation and commissioning of the turbines is being completed incrementally. Since late 2019, turbines unit No. 5 and No.6 have operated at limited capacity.

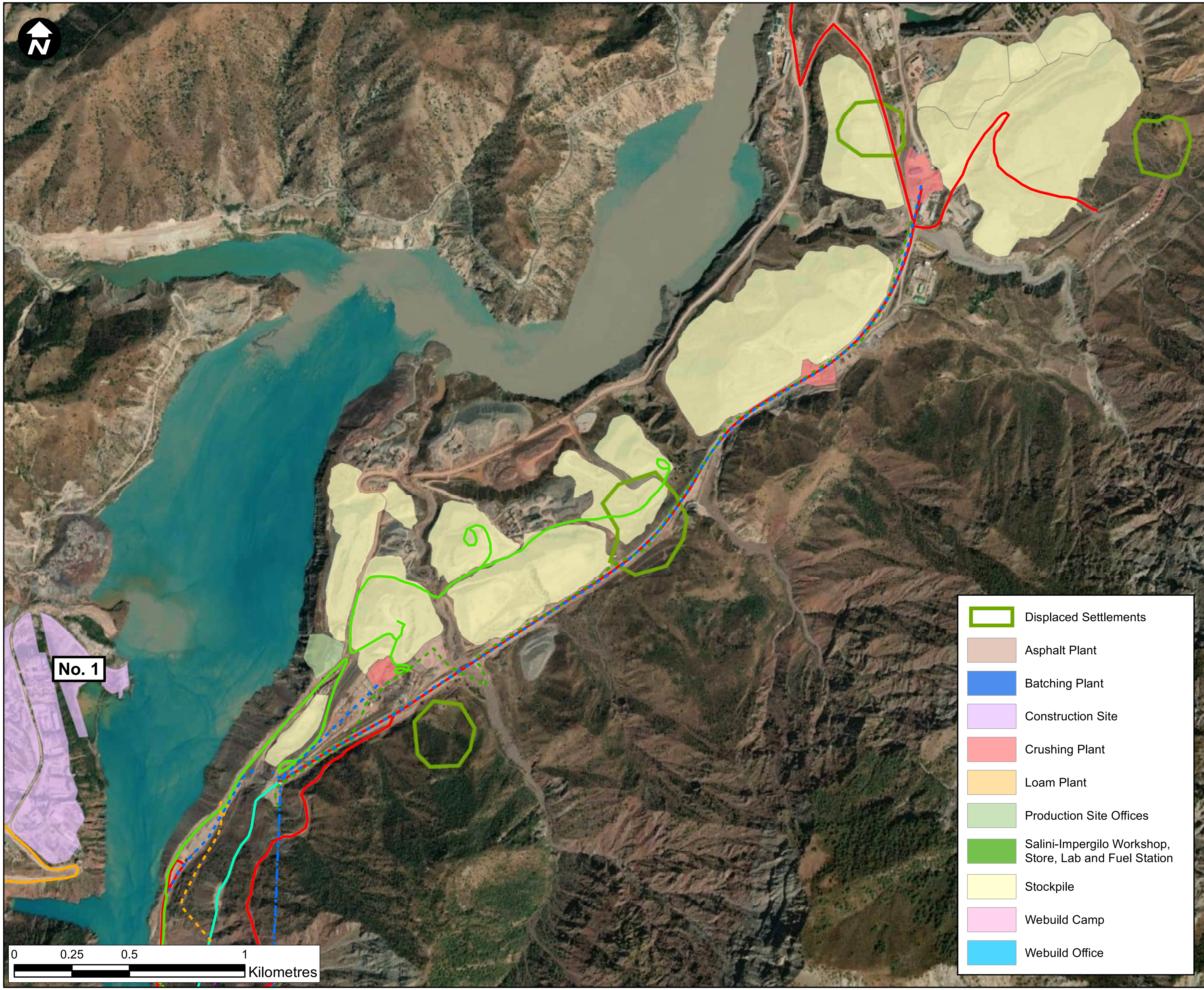
3.6.4. The current turbines have been installed with temporary impellers. The impellers will be replaced in 2024, increasing the capacity of the existing turbines from 400 MW to 630 MW each.

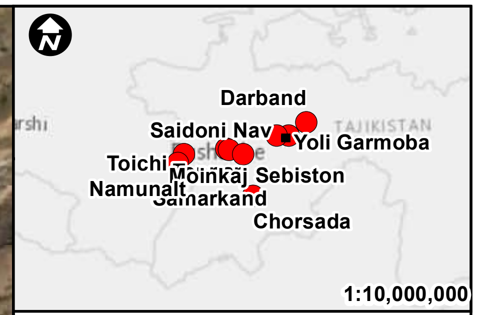
3.6.5. The total actual electricity production of the Stage 1 Dam is presented in **Table 3-5**.

3.6.6. The current sub-station has the capacity to manage the entire 3,780MW capacity of the Project once fully constructed.

Table 3-5 - Electricity Production for Stage 1 Dam between November 2018 to July 2023

Month		2018	2019	2020	2021	2022	2023
January	thousand kWh	-	81,327	95,086	96,052	97,510	105,749
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*
February	thousand kWh	-	254	89.255	88,526	89,255	111,777
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*
March	thousand kWh	-	0	120,041	127,502	169,468	181,359
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*
April	thousand kWh	-	0	128,395	168,452	187,895	187,805
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*
May	thousand kWh	-	23,448	115,463	189,484	187,797	192,219
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*
June	thousand kWh	-	107,404	53,989	94,627	184,758	184,791
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*
July	thousand kWh	-	117,404	55,905	102,252	83,301	94,783
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*
August	thousand kWh	-	112,899	85,315	98,313	2,842	-
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	-
September	thousand kWh	-	79,148	156,011	113,784	173,603	-
	Reservoir Level (m)	-	*1,055*	*1,055*	*1,070*	*1,070*	-
October	thousand kWh	-	113,055	161,200	160,196	181,515	-
	Reservoir Level (m)	-	*1,055*	*1,070*	*1,070*	*1,070*	-
November	thousand kWh	16,306	104,365	130,299	134.660	165,061	-
	Reservoir Level (m)	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*	-
December	thousand kWh	74,021	107,592	108,919	109,058	131,441	-
	Reservoir Level (m)	*1,055*	*1,055*	*1,070*	*1,070*	*1,070*	-
Total Production (thousand kWh)		90,374	846,896	1,299,806	1,482,906	1,654,446	1,058,483





Legend

- Main Filters And Transportation Route Via Trucks
- Main Filters And Transportation Route Via Trucks (Tunnel)
- Main Alluvium Transportation Route Via Trucks
- Main Alluvium Transportation Route Via Trucks (Tunnel)
- Main Access Road to
- New Upstream Access Road For Transportation of Alluvium, Filters & Transition (Under Construction)
- Conveyor Belts (Tunnel)
- Temporary tunnels to be completed under Lot 2 contract
- Temporary roads to be completed under Lot 2 contract
- Temporary roads done under Lot 2 contract
- Conveyor Belt

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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PROJECT TITLE

Rogun HPP ESIA Support and Monitoring for World Bank

DRAWING TITLE

Figure 3-4a
Project Overview - Dam and Upstream View

DRAWING STATUS

FOR INFORMATION

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JO	CB	RP	AB

SCALE @ A3 SIZE	DATE	REVISION
1:15,000	10/6/2023	P00

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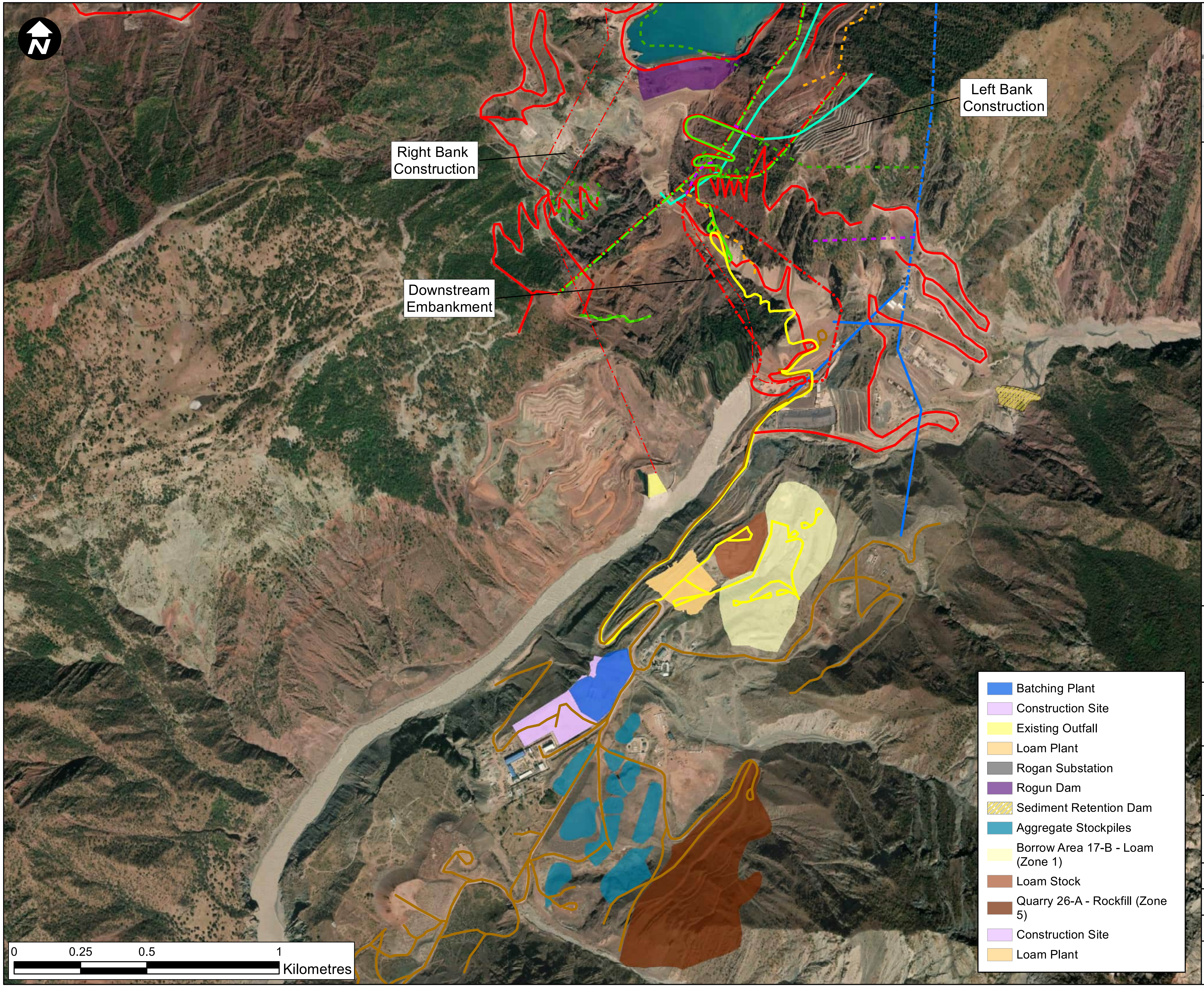
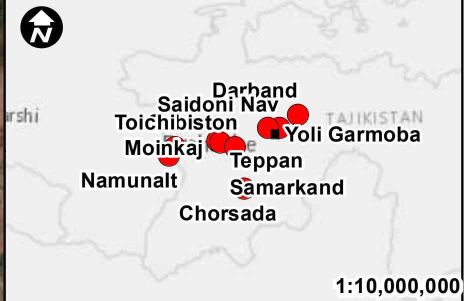
ROGUN-WSP-DR-GI-0062





Legend

- Main Filters And Transportation Route Via Trucks
- Main Filters And Transportation Route Via Trucks (Tunnel)
- Main Alluvium Transportation Route Via Trucks
- Main Alluvium Transportion Route Via Trucks (Tunnel)
- Tunnel T3
- Main Rockfill Transportation Route Via Trucks
- Main Loam Transportation Route Via Trucks
- New Upstream Access Road For Transportation of Alluvium, Filters & Transition (Under Construction)
- Conveyor Belts
- Conveyor Belts (Tunnel)

wsp

PROJECT TITLE
Rogun HPP ESIA Support and Monitoring for World Bank

DRAWING TITLE
Figure 3-4b
Project Overview
Downstream View

DRAWING STATUS
FOR INFORMATION

DRAWN	CHECKED	APPROVED	AUTHORISED
RH	CB	RP	AB

SCALE @ A3 SIZE	DATE	REVISION
1:13,000	06/10/2023	P00

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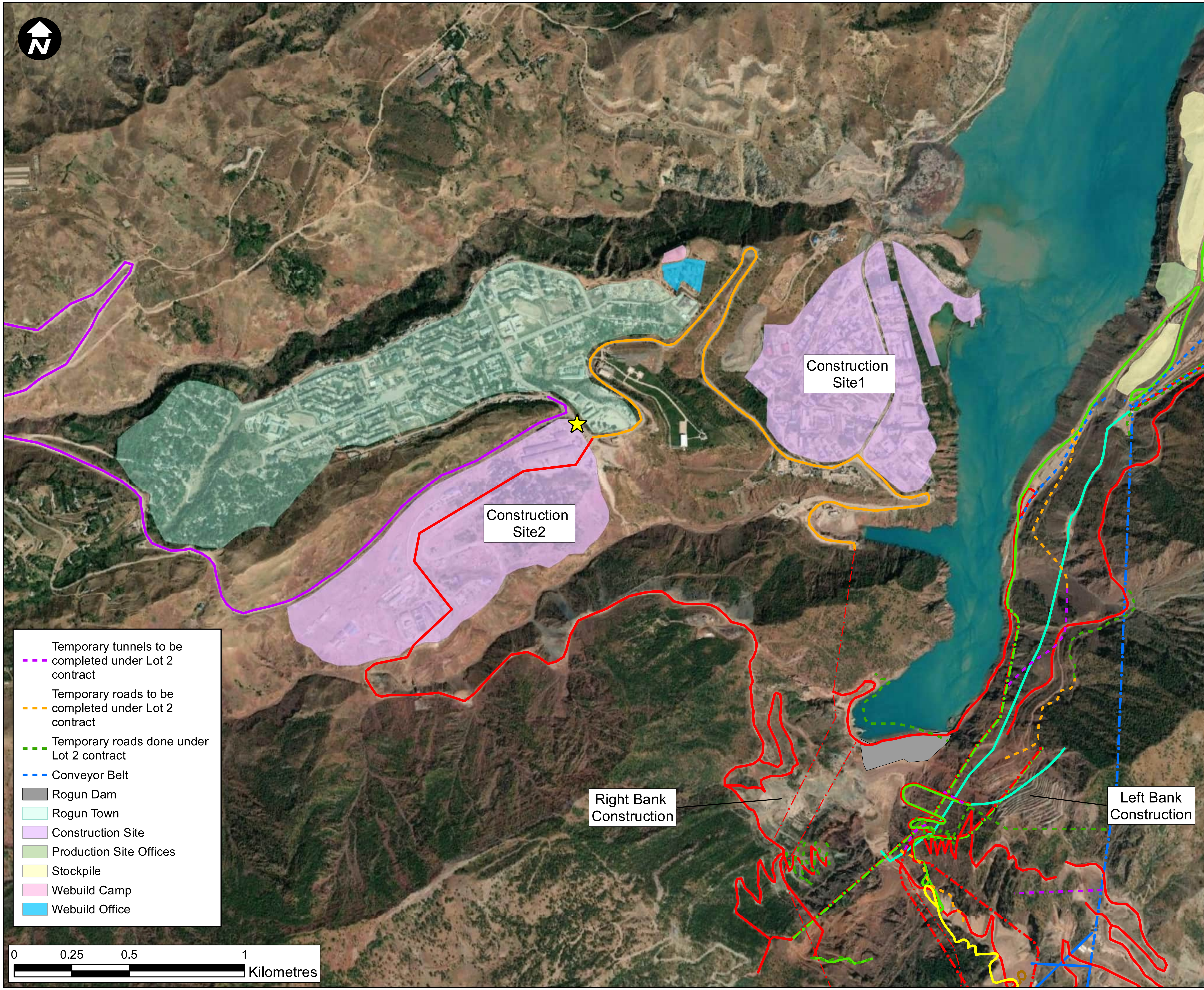

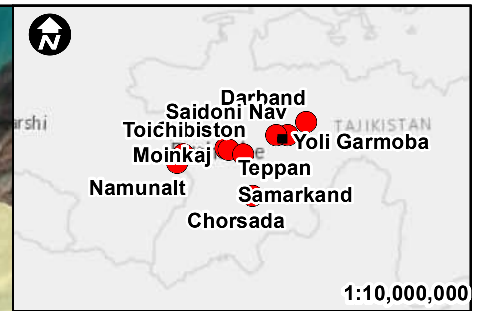

Legend

- Site Entrance Gate
- Main Filters And Transportation Route Via Trucks
- Main Filters And Transportation Route Via Trucks (Tunnel)
- Main Alluvium Transportation Route Via Trucks
- Main Alluvium Transportion Route Via Trucks (Tunnel)
- Tunnel T3
- Main Access Road from International Highway
- Main Access Road to Site
- Main Rockfill Transportation Route Via Trucks
- Main Loam Transportation Route Via Trucks
- New Upstream Access Road For Transportation of Alluvium, Filters & Transition (Under Construction)
- Conveyor Belts
- Conveyor Belts (Tunnel)

wsp

PROJECT TITLE
Rogun HPP ESIA Support and Monitoring for World Bank

DRAWING TITLE
Figure 3-5
Project Overview - Construction Area and Town View

DRAWING STATUS
FOR INFORMATION

DRAWN	CHECKED	APPROVED	AUTHORISED
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SCALE @ A3 SIZE	DATE	REVISION
1:15,000	06/10/2023	P00

DRAWING NUMBER
ROGUN-WSP-DR-GI-0064

3.7. STAGE 2 DAM

3.7.1. The Stage 2 Dam (also referred to as the Main Dam) will be raised between 2018 to 2028, and commissioning of all turbines progressively through to 2029.

3.7.2. The Rogun HPP site presents significant geological constraints to the layout of the dam as well as the existing assets. The preferred option was identified for construction of the highest dam with the largest generating capacity.

3.7.3. The 2014 TEAS studies demonstrated that it is technically possible and economically feasible to operate Rogun and the cascade within the existing water management agreements and practices. Alternatives with three (3) different dam heights and three (3) different total installed capacities were selected. Further details of the alternatives to the Project, are presented in **Volume I, Chapter 4**.

3.7.4. The Full Supply Level (FSL) 1,290 m asl alternative was preferred and recommended in the TEAS 2014 studies and agreed by the 2014 DSPoE and was taken forward for further detailed consideration. The dam height considers the need to retain the PMF which accounts for Climate Change predictions. Additional studies for Climate Change and Hydrology will be completed at the recommendation of the new DSPoE. These may result in changes to the design and operation of the Project.

3.7.5. The FSL 1,290 m asl alternative has the following main characteristics, presented in **Table 3-6**. An overview of the Stage 2 Project is presented in Figure 3-5.

3.7.6. Images of the site as of mid-2023 are presented in Figure 3-6.

Table 3-6 - Stage 2: FSL 1,290 m asl

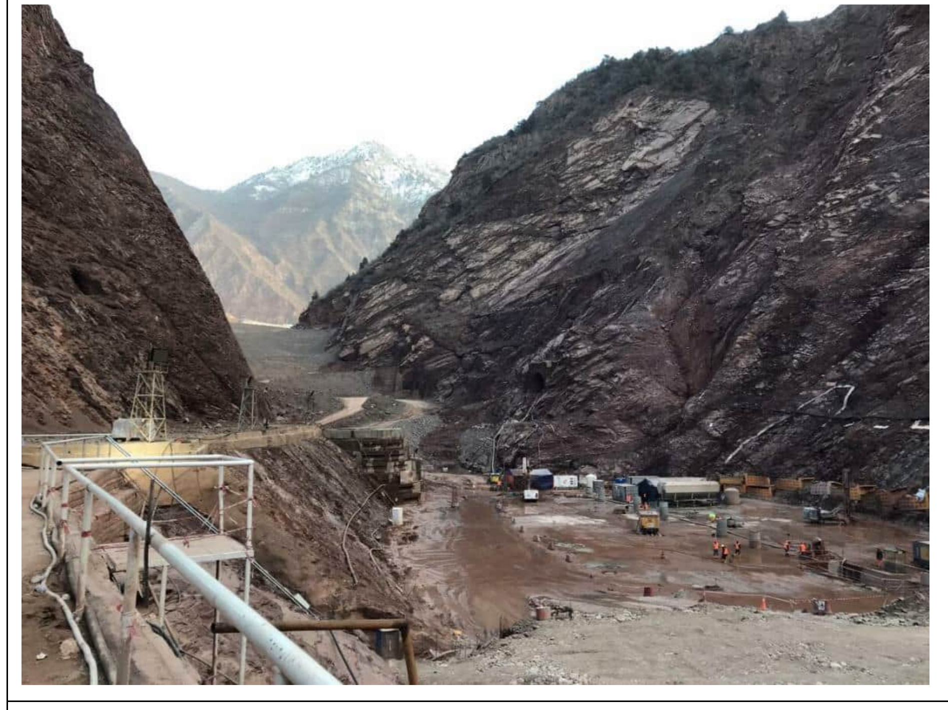
	FSL = 1,290 m asl
Dam crest level	1,300 m asl
Dam height	335 m
Total reservoir capacity	13,300 hm^3
Reservoir active storage	10,300 hm^3
Total installed capacity	3,780 MW
Crest length	660 m
Crest width	20 m
Crest level	1,300 m asl
Maximum water level	1,290 m asl
Minimum operational level	1,185 m asl

Figure 3-6 - The Current Project Site (2023)

Dam Site

Construction Camp 1

Current reservoir and stockpile areas



Dam Site

Downstream of the Stage 1 dam

Inside Tunnel

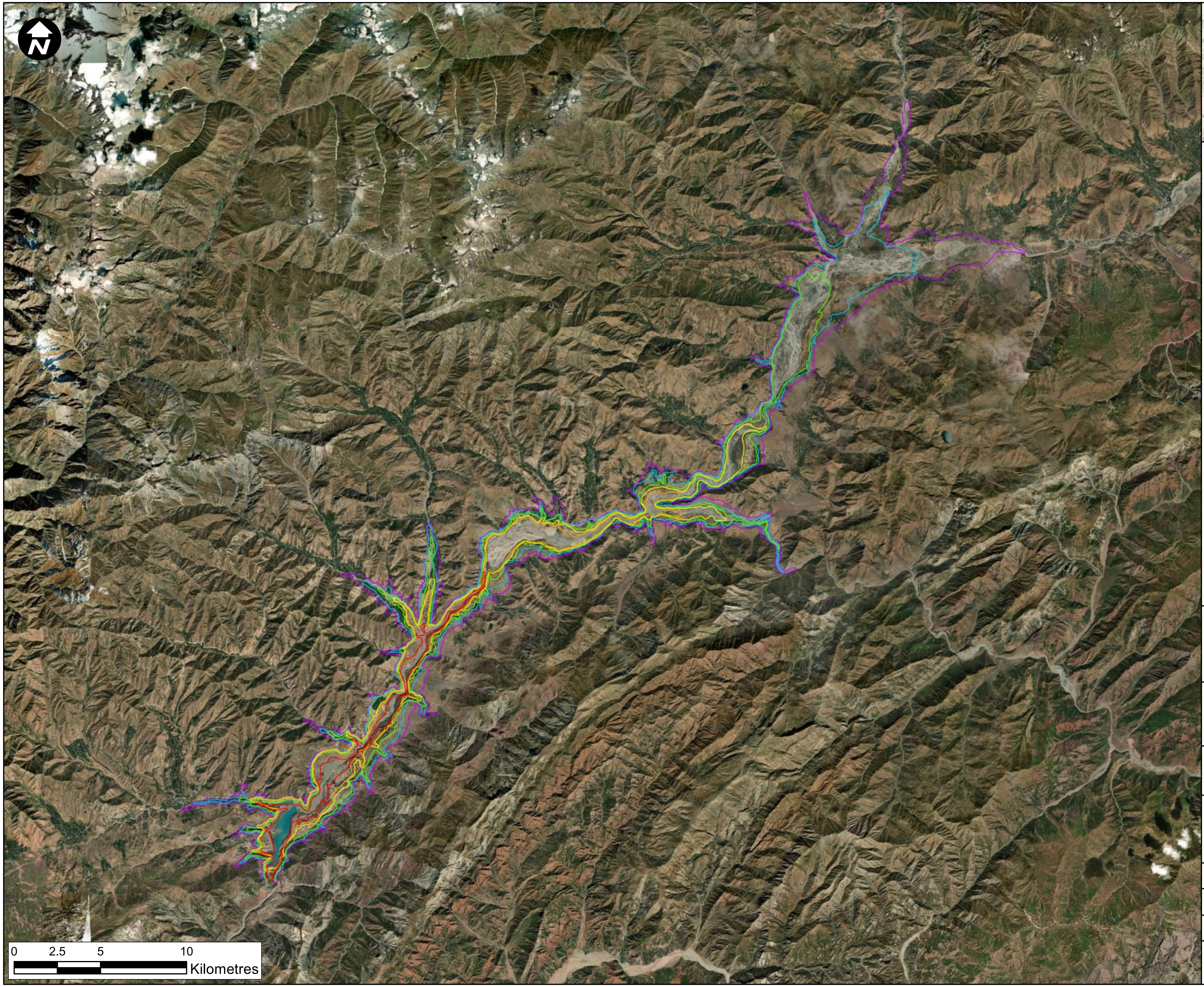
3.7.7. The Project reservoir will not be filled immediately but rather over a period of approximately 16 years to accommodate downstream users and allow for the continued operation of the Nurek HPP. The Project reservoir will reach the FSL by approximately 2036 and will flood an area of 170 km² and 51 km² at the minimum operating level. The maximum storage capacity is 13,300,000m^3.

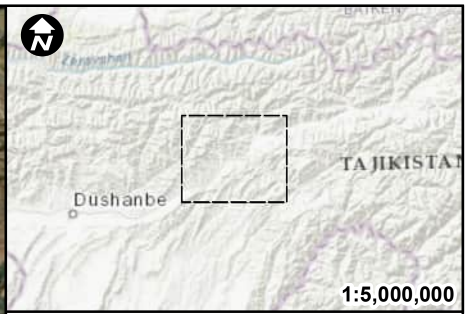
3.7.8. The footprint of the reservoir is shown in **Figure 3-7**.

3.7.9. The reservoir elevations shown in **Figure 3-7** are the maximum levels, which would be experienced in the autumn of each year, with levels falling through the winter and spring as the reservoir is drawn down for power generation. The amount of water used to fill the reservoir in each year will not exceed the annual allocation granted to Tajikistan under the Almaty Agreement.

Table 3-7 - Reservoir Inundation Levels by year

Year	Maximum Reservoir Elevation (m asl)	Maximum Reservoir Volume (hm^3)	Surface Assets to be Flooded
2024	1,100	470	Quarry 15
2025	1,150	1,526	
2026	1,175	2,467	Construction Camp 1
2027	1,186	3,033	Stockpiles and conveyor and right bank road.
2028	1,207	4,268	
2029	1,223	5,468	
2030	1,237	6,668	
2031	1,249	7,868	
2032	1,259	9,068	
2033	1,269	10,268	
2034	1,278	11,468	
2035	1,286	12,668	
2036	1,290	13,238	





Legend

Inundation

- 1110m
- 1165m
- 1185m
- 1220m
- 1255m
- 1290m

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

PROJECT TITLE

Rogun HPP E&S Support and Monitoring for World Bank

DRAWING TITLE

Figure 3-7
Reservoir Inundation Levels

DRAWING STATUS

FOR INFORMATION

DRAWN	CHECKED	APPROVED	AUTHORISED
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SCALE @ A3 SIZE	DATE	REVISION
1:200,000	11/08/2023	P00

DRAWING NUMBER

ROGUN-WSP-DR-GI-0007

DAM CONSTRUCTION

3.7.10. ESHS management planning and practices varies significantly among the contractors.

3.7.11. The Lot contractor, WeBuild, has an extensive series of management plans and procedures, whereas other contractors have less advanced programs. Similarly, this is reflected in staffing levels where WeBuild staffing is generally adequate to meet international ESHS standards, whereas others are short-staffed, including the employer and the employer representative.

3.7.12. Tunnelling on the left and right banks and raising of the dam requires a large fleet of vehicles and equipment to move a substantial amount of material including spoil and material to be used for dam construction, to transport workers and other supplies. As an example, the WeBuild fleet for dam construction includes the equipment listed in **Table 3-8**.

Table 3-8 List of Machinery and Equipment

ITEM	EQUIPMENT	MODEL	UNITS
1	Articulated dump truck	XDA40 (or equivalent CAT 745, XGA5900D3T)	20
2	Mixer Truck 10 [m3]	SHACMAN 10 m3 (or equivalent (VOLVO 10 m3)	1
3	Dozer with rubber pads, 6 ways blade & laser guidance system LEICA (or equivalent)	CAT D6N or equivalent	2
4	Vibratory roller 12 tons with single drum	XS122 (or equivalent CAT CS533)	2
5	5 Vibratory roller 3,7 tons with double drums	XMR303 (or equivalent (CAT CB34) 2	2
6	Vibratory roller 1 ton	ATLAS COPCO LP750 or equivalent	2
7	Vibratory roller 160 Kg		2
8	Vibrating plates	ATLAS COPCO LG400 or equivalent	2
9	9 Vibrating plates 150 Kg ATLAS COPCO HC450 or equivalent 2	ATLAS COPCO HC450 or equivalent	2
10	Vertical compactor	-	2
11	Hydraulic Excavator 41 kW	CAT 308C or equivalent	1
12	Wheel Excavator 101 kW equipped with blade	R140W-9S (or equivalent CAT 315D) 1	1
13	High pressure pump 750 bar	-	2
14	Grouting plant (mixer, agitator, injector…)	-	1
15	Vacuum truck	Pump JOHNSTON or equivalent	2
16	Tractor with blade	NEW HOLLAND TL90 or equivalent	1
17	Crane 60 tons	QY70K-I (or equivalent EREX A600 Mobile)	1
18	Core Drilling Machine ϕ150 [mm]	YGL-150 (or equivalent SOILMEC SM5)	1

ITEM	EQUIPMENT	MODEL	UNITS
19	Saw cutting machine ϕ1600 [mm]	TYROLIT FZ-4S or equivalent	1
20	Skid steer loader (wheel or rubber)	XC760K (or equivalent CAT 226B3 (42kw))	1
21	Formwork panels	PERI Formworks	1
22	Nuclear density gauge	MC-3 ELITE	2

Salt Wedge Treatment

3.7.13. The Rogun dam site and reservoir are affected by the action of several faults rooted in a Jurassic salt formation which has been dragged close to surface elevation in each fault. Dissolution of the salt sheets/wedges at the core of the faults could result in reservoir leakage, as these faults daylight both in the reservoir and outside of the reservoir. The most prominent faults near the dam site are Vakhsh Fault, Ionakhsh Fault and Gulizindan Fault. The potential impact on the Dam from the Salt Wedge has been studied since the initial design during Soviet times in the 1970s.

3.7.14. The Salt Wedge that fills the Ionakhsh Fault, which crosses the site in the upstream part of the dam axis, is about 10 m thick at the top (about 950 m asl) and increases in thickness with depth. The area is tectonically very active, and geodetic measurements carried out before 1978 demonstrate that both the Ionakhsh Fault and Fault 35 were creeping at a rate of about 1.5 to 2 mm per year. When it comes to evaporites, and especially salt, leaching is a phenomenon that may be very rapid and could have significant consequences to the Project.

3.7.15. The 2014 Engineering and Dam Safety Panel of Experts for Rogun HPP reviewed the Geological and Geotechnical Investigation of the Salt Wedge in the Dam Foundation and Reservoir as set out in the TEAS 2014. The following mitigation was proposed:

- Hydraulic and ground barriers.
- Installation of a monitoring system to follow-up performance of the treatment works during reservoir filling and operation.
- The monitoring system triggers pre-defined indicators.
- Contingency plans which identify remedial measures to be implemented.

3.7.16. With the implementation of hydraulic and grouting barriers, related monitoring system, and the ability to undertake remedial works when required, the EDSPoE 2014 concluded that the Project is feasible.

3.7.17. Additional investigations by LOT2 Contractor WeBuild were undertaken in 2017 for the Salt Wedge to estimate rock permeability at the Riverbed, with the implementation of ongoing Salt Wedge Monitoring in 2020. The new DSPoE is reviewing all available information and will make further recommendations as appropriate.

3.7.18. Additional studies regarding seismic issues have been planned and will be completed at the recommendation of the new DSPoE.

3.8. OPERATION PHASE

3.8.1. The reservoir will continue to rise throughout and after the construction phase until 2036, when the reservoir is expected to reach FSL 1,290 m asl. The two turbines commissioned (No.5 and No.6) in

November 2018 as part of the Stage 1 Dam will continue to operate and generate electricity throughout the period of 2023-2036. Following the completion of the Stage 2 Dam in approximately 2029, all six 630 MW turbines can be operational from 2032.

3.8.2. A summary of the expected electricity production between 2023-2032 is presented in Table 3-10. The expected electricity production is an estimate from additional agreement no.1, forming part of the LOT 2 contract dated 30th July 2022.

3.8.3. By full operation of the Project, beyond 2036 and a seasonal FSL at 1,290 m asl, the hydropower project is expected to average electricity generation in excess of 17 billion kWh per year.

3.8.4. Rogun HPP will significantly enhance supply security in Tajikistan by producing an average of 30% of domestic electricity demand between 2020 and 2050.

Table 3-9 - Expected Electricity Production for Stage 2 Dam between 2023-2032

Month		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
January	**thousand kWh**	**105,749**	**107,880**	**141,360**	**186,000**	**208,320**	**223,200**	**238,080**	**267,840**	**282,720**	**297,600**
	Reservoir Level (m)	*1,070*	*1,070*	*1,100*	*1,150*	*1,175*	*1,187*	*1,207*	*1,228*	*1,249*	*1,269*
	Capacity (MW)	*145***	*145*	*190*	*250*	*280*	*300*	*320*	*360*	*380*	*400*
February	**thousand kWh**	**111,777**	**97,440**	**127,680**	**181,440**	**215,040**	**235,200**	**241,920**	**268,800**	**295,680**	**322,560**
	Reservoir Level (m)	*1,070*	*1,070*	*1,100*	*1,150*	*1,175*	*1,187*	*1,207*	*1,228*	*1,249*	*1,269*
	Capacity (MW)	*145***	*145*	*190*	*270*	*320*	*350*	*360*	*400*	*440*	*480*
March	**thousand kWh**	**181,359**	**148,800**	**186,000**	**297,600**	**349,680**	**372,000**	**409,200**	**453,840**	**468,720**	**483,600**
	Reservoir Level (m)	*1,070*	*1,070*	*1,100*	*1,150*	*1,175*	*1,187*	*1,207*	*1,228*	*1,249*	*1,269*
	Capacity (MW)	*200***	*200*	*250*	*400*	*470*	*500*	*550*	*610*	*630*	*650*
April	**thousand kWh**	**187,805**	**97,920**	**360,000**	**518,400**	**604,800**	**648,000**	**720,000**	**792,000**	**864,000**	**907,200**
	Reservoir Level (m)	*1,070*	*1,074*	*1,107*	*1,154*	*1,177*	*1,190*	*1,210*	*1,231*	*1,252*	*1,272*
	Capacity (MW)	*260***	*136*	*500*	*720*	*840*	*900*	*1000*	*1100*	*1200*	*1260*
May	**thousand kWh**	**192,219**	**104,160**	**401,760**	**565,440**	**699,360**	**1,413,600**	**1,488,000**	**1,711,200**	**1,785,600**	**1,934,400**
	Reservoir Level (m)	*1,070*	*1,079*	*1,114*	*1,158*	*1,179*	*1,193*	*1,213*	*1,234*	*1,255*	*1,275*

Month		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
	Capacity (MW)	*260***	*140*	*540*	*760*	*940*	*1900*	*2000*	*2300*	*2400*	*2600*
June	**thousand kWh**	**184,791**	**158,400**	**208,800**	**259,200**	**705,600**	**1,584,000**	**1,728,000**	**1,800,000**	**1,814,400**	**2,160,000**
	Reservoir Level (m)	*1,070*	*1,084*	*1,121*	*1,163*	*1,181*	*1,196*	*1,217*	*1,238*	*1,259*	*1,279*
	Capacity (MW)	*130***	*220*	*290*	*360*	*980*	*2200*	*2400*	*2500*	*2520*	*3000*
July	**thousand kWh**	**94,783**	**163,680**	**238,080**	**595,200**	**758,880**	**2,008,800**	**2,529,600**	**2,678,400**	**2,678,400**	**2,678,400**
	Reservoir Level (m)	*1,070*	*1,089*	*1,129*	*1,167*	*1,184*	*1,199*	*1,221*	*1,242*	*1,263*	*1,283*
	Capacity (MW)	*130***	*220*	*320*	*800*	*1020*	*2700*	*3400*	*3600*	*3600*	*3600*
August	**thousand kWh**	**96,720**	**163,680**	**245,520**	**595,200**	**758,880**	**2,008,800**	**2,589,120**	**2,678,400**	**2,678,400**	**2,678,400**
	Reservoir Level (m)	*1,070*	*1,093*	*1,137*	*1,170*	*1,185*	*1,202*	*1,225*	*1,245*	*1,266*	*1,286*
	Capacity (MW)	*130*	*220*	*330*	*800*	*1020*	*2700*	*3480*	*3600*	*3600*	*3600*
September	**thousand kWh**	**187,200**	**158,400**	**504,000**	**648,000**	**972,000**	**1,080,000**	**1,260,000**	**1,296,000**	**1,332,000**	**1,440,000**
	Reservoir Level (m)	*1,070*	*1,097*	*1,144*	*1,173*	*1,186*	*1,205*	*1,227*	*1,247*	*1,268*	*1,289*
	Capacity (MW)	*260*	*220*	*700*	*900*	*1350*	*1500*	*1750*	*1800*	*1850*	*2000*
October	**thousand kWh**	**178,560**	**230,640**	**431,520**	**520,800**	**520,800**	**565,440**	**632,400**	**669,600**	**744,000**	**818,400**

Month		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
	Reservoir Level (m)	*1,070*	*1,099*	*1,148*	*1,175*	*1,187*	*1,207*	*1,228*	*1,249*	*1,269*	*1,290*
	Capacity (MW)	*240*	*310*	*580*	*700*	*700*	*760*	*850*	*900*	*1000*	*1100*
November	**thousand kWh**	**129,600**	**172,800**	**288,000**	**331,200**	**360,000**	**396,000**	**468,000**	**475,200**	**489,600**	**518,400**
	Reservoir Level (m)	*1,070*	*1,100*	*1,150*	*1,175*	*1,187*	*1,207*	*1,228*	*1,249*	*1,269*	*1,290*
	Capacity (MW)	*180*	*240*	*400*	*460*	*500*	*550*	*650*	*660*	*680*	*720*
December	**thousand kWh**	**141,360**	**141,360**	**238,080**	**282,720**	**282,720**	**312,480**	**357,120**	**372,000**	**386,880**	**386,880**
	Reservoir Level (m)	*1,070*	1,100	*1,150*	*1,175*	*1,187*	*1,207*	*1,228*	*1,249*	*1,269*	*1,290*
	Capacity (MW)	*190*	190	*320*	*380*	*380*	*420*	*480*	*500*	*520*	*520*
Total Predicted Electricity Generation (thousand kWh)		**733,440***	**1,745,160**	**3,370,800**	**4,981,200**	**6,436,080**	**10,847,520**	**12,661,440**	**13,463,280**	**13,820,400**	**14,625,840**

*Actual Electricity Generation for January 2023 – July 2023, excluded from 2023 'Total Predicted Electricity Generation.'

**Installed Capacity (MW) for January 2023 – July 2023 are estimated figures

3.9. PROJECT COMPONENTS

3.9.1. This section describes the built components of the Project and describes the areas immediately surrounding the dam and reservoir.

3.9.2. The features of the dam and reservoir are constrained by the geology and topography of the surrounding area and the design specification for the dam wall was confirmed by the TEAS study in 2014. This was accepted by the initial DSPoE. The current DSPoE completed a comprehensive review of the dam design in 2023 and prepared a risk management plan that is now being implemented.

3.9.3. The Project components considered in the ESIA are described in **Table 3-10**. Details of the associated facilities for the Rogun HPP are provided in **Table 3-11.** These are the facilities that are not directly funded by Project but would not have been constructed without the project. These facilities are either in construction or will be constructed in the future as part of the overarching project development. The environmental and social impacts of these facilities have already been assessed as part of ongoing or published ESIAs. Where these are not being financed by an IFI, these developments will require assessment in accordance with International Standards prior to the commencement of construction.

3.9.4**.** Details of the primary supply chain are provided in **Table 3-12.**

Table 3-10 Rogun HPP Project Components

Component	Description
Dam (Stage 2) and Reservoir	The Stage 2 Dam consists of an earth-rock-filled dam. The cofferdams form part of the main embankment body. It has an inclined loam core, with upstream and downstream fine and coarse filter zones (or a transition zone below the upstream minimum operating level). The shells consist of granular alluvium with rockfill placed on the outside of the shell. Information regarding the dam is presented in **Section 3.7**. Total land area under the reservoir – 16,880 hectares: ▪ Agricultural – 9,190 hectares. ▪ Irrigated - 1,970 hectares. ▪ Forests and bushes – 1,070 hectares. ▪ Others – 6620 hectares.
Powerhouse and Turbines	▪ Total Installed Capacity: 3,780 MW. ▪ Number of Turbine Units: 6. ▪ Located in a sedimentary complex constituted by sandstone and siltstone. ▪ Powerhouse Cavern: 220 x 20 x 70 m. ▪ Transformer Cavern: 220 x 20 x 70 m. ▪ Powerhouse and transformer cavern will have 200 m vertical by 800 m horizontal by 12 m diameter tunnel/shaft for ventilation. At present, temporary equipment provides ventilation which is poor. Under Lot 4 contract, permanent forced-air equipment will be installed (forced-air in, natural exhaust), expected in approximately 2025.
Intakes	**High Level Outlet 1 (HLO-1)** ▪ HLO-1 spillway consists of an intake, 600 m long and 12 m in diameter pressurized tunnel equipped with maintenance gate and radial service gate followed by a 200 m long free surface flow tunnel before entering a vertical vortex shaft which is followed by a 350 m long tunnel.

Component	Description
	High Level Outlet 2 (HLO-2) ▪ HLO-2 spillway consists of an intake, some 310 m long 12 m in diameter pressurized tunnel equipped with maintenance gate and radial service gate which is followed by a 14 m in diameter 3.2 km long free surface flow tunnel that is followed by a chute type structure. ▪ HLO-1 and HLO-2 remain in operation until they lose functionality due to siltation and are replaced by Remote Tunnels Spillways. **Remote Tunnel Spillways (RTS)** ▪ The RTS features an ogee-shaped intake structure equipped with radial gate, followed by a roughly 4 km long horseshoe-shaped tunnel, 13 m in width and height, that is terminating in a stilling basin with an ogee at its outlet followed by a chute section terminating in a ski jump. ▪ The discharge capacity is higher than HLOs 2400 m^3/s per RTS, to cope with PMF without considering flood lamination due to siltation. All flood releasing facilities are to be constructed through the right abutment featuring a large geologically atypical zone (ATPZ) about 2 km long and 1.5 km wide.
Transportation Routes	A single gate provides access to the Project site. Approximately 80 km of underground transport routes. Over 70 km will be converted to water tunnels or plugged as the reservoir rises. 6 km of underground roads will remain after construction. Currently 26 km of surface roads, most unpaved. Approximately 5-6 km of this will remain after construction. Concrete and other supplies arrive from Dushanbe on public roads.
Headrace Tunnels	The primary purpose of headrace tunnels is to convey water from the reservoir or intake structure to the powerhouse, where it drives turbines to produce electricity. Once all six turbine units are operational in the powerhouse, the maximum discharge capacity is 1626 m^3/s.
Diversion Tunnels	Diversion tunnels for diverting of the river during construction or repair of other hydraulic structures are part of the hydropower complex. There are currently four diversion tunnels operating on site known as DT-1, DT-2, DT-3 and DT-4. DT-1 and DT-2 will work under a maximum head of 120 m, and their maximum discharge should preferably not exceed 1,600 m^3/s/tunnel.

Component	Description
	A maximum head of 120 m is tolerated in tunnels during the construction period. This value can be overpassed by 30 m, i.e., 150 m, in extreme conditions such as high floods or seismic events.
Power Supply (Back up)	A back-up power supply is necessary beyond the construction phase for electricity usage for operational site facilities. A direct power source from the 6 x 630 MW turbines will be used as power supply in normal circumstances. Back-up power is currently supplied by the existing turbines 5 and 6, diesel generators and a direct power source from Nurek HPP.
Current accommodation	In March 2023, 12,000 people were identified as being engaged as workers on-site, and peak employment is likely to reach 15,000-20,000 people during the period between 2025-2028. Of current workers, approximately 2,000 are office workers who work 8am to 5pm, approximately 5,000 work 12-hour day shifts in shops and other locations, and the remainder work 12-hour day/night shifts on a 15 day on/off schedule; therefore, only one fourth of this remainder alternate day/night shift every 15 days. Each shift includes 1-hour for lunch. With the exception of some WeBuild employees and a few small camps, all accommodations are on Construction Site 1 (refer to Figure 3-5) and will only be used as long as the non-EPC contractors are on site. As noted, the non-EPC contracts will be terminated as soon as practicable after financing is available. Current accommodation sites will be demolished and rehabilitated before being flooded in 2026. Due to the nature of the Project, accommodation camps are provided by each contractor to house their employees, however there is varying quality of accommodation across each contractor on-site, and the EPC contractors (in particular WeBuild) accommodation is superior to the non-EPCs. Buses transport workers to and from their workplaces to their accommodation on Construction Site 1. Most of the contractors have their own buses, which collect workers from designated locations around half an hour before the start of their shift and transfer them to their construction site area. The designated pickup locations vary depending on the contractor, but usually, contractors collect workers in either Rogun City or by the worker accommodation camps. Approximately 300-400 live outside of Rogun city within 30km and are transported to and from their villages. Some contractor workers and office staff hire accommodation in Rogun City (approximately 2km uphill from the main worker accommodation area). Rogun JSC provides accommodation for their staff in four tower block buildings in Rogun City. Each contractor is responsible for collecting sanitary waste, with liquids from sewage going into sumps which drain into the ground and solids periodically removed for disposal to the Rogun Municipal Wastewater Treatment Plant (WWTP). Rogun JSC is in the process of designing and installing water treatment facilities for all of Construction Camp 1. Non-EPC contractors will be required to remove all structures and meet legal requirements for land rehabilitation before their contracts are terminated, which should occur when financing is available. Photos of on-site accommodation camps are presented in Figure 3-8, Figure 3-9 and Figure 3-10.

Component	Description
Future accommodation	Before Construction Camp 1 is flooded in 2026, all four EPC contractors will design and construct accommodations and other facilities on land to be allocated by Rogun JSC. This will be in two new construction camps in Construction Camp 2 and Site 5 (refer to Figure 3-5). Contracts will require accommodations and facilities to meet Project Standards.
Medical Facilities	Most major contractors provide medical facilities on-site. For the contractors that do not have their own medical facility, there are central Rogun Medical Centers that can be utilized by all workers. For any serious injuries or operations, workers are transported off-site to the closest medical centers in Rogun City or to a hospital in Dushanbe. Across all medical centers on-site, there is: ▪ 27 Doctors ▪ 13 Paramedics ▪ 6 Nurses ▪ 38 Healthcare Professionals ▪ 1 Dentist ▪ 45 Drivers ▪ 4 Janitors ▪ 11 Emergency Vehicles Details of Health Centers and First-Aid Points on-site, include: • Health Center of the Department of Affairs - JSC "Rogun HPP" on Construction Site No. 1. • Health Center of the Department of Affairs - JSC "Rogun HPP”. • Medical Center of the JSF "Sokhtmoni Asosi". • Medical Center of JSC "Tojikhydromontazh". • JSC "TGEM" Medical Center - Construction Site No.1. • Medical Center of JSC "TGEM" - Quarry 15.

Component	Description
	• Medical Center of JSC "TGEM" - Koni 26. • Medical Center of JSP "ZTM (EMZ) Norak. **LOT2 Contractor - WeBuild Medical Facilities.** ▪ The medical center of LOT2 contractor WeBuild has the capacity to deal with more significant accidents amongst other site workers on a triage basis. Limited surgical procedures can be carried out and designed to meet International GIIP standards. ▪ Medical Centers under LOT2 Contractor WeBuild include: • WeBuild Medical Center. • WeBuild Medical Hospital. • First Aid Point - Construction Site No. 5. • WeBuild Medical Center - Koni 15 asphalt plant. • WeBuild Medical Emergency Brigade and Intensive Treatment Room Photos of selected on-site medical facilities are presented in **Figure 3-9**.
Borrow Pits / Quarries	▪ Three quarries are currently operational on the Rogun site by Lot 2 contractor WeBuild, but under the subcontractor TGEM working within the quarries. ▪ There are currently up to 6 batching plants operating on site, these are managed by WeBuild, TGEM, Ariana, MEZ, and TGM. **Quarry 15** ▪ Extracted material for use in construction of dam wall such as sand and gravel – alluvium sedimentation. ▪ As of November 2023, a total of 46 million m3 of material was extracted. Of this, 20 million m3 has been used (mostly in construction of the dam). The remaining 26 million m3 of extracted material is stored in three open stockpiles, comprising of sand and gravel (alluvium material). This is transported using a 7km covered conveyor to the batching plants. ▪ Another 5 million m3 will be extracted from the Right Bank area until May 2024. Approximately, 5 million m3 of extracted material will be moved to the Left Bank stockpiles, as the Quarry 15 and stockpiles will be inundated by the reservoir with no rehabilitation.

Component	Description
	■ During the Soviet era, approximately 10 million m3 of stone, sand and gravel material was extracted from Quarry 15a, this area is now inundated by the reservoir, and crushed for use in the batching plant. 5 million m3 of material remains and is stored in 2 stockpiles on the Left and Right Bank and is planned for use in the batching plants. **Quarry 17** ■ Quarry 17 is extracting Loam (clay and sand) material and is located downstream of the Dam, with use of a small stockpile area. A total of 20 million m3 of material will be extracted, of which; 7 million m3 of fine material for dam core backfilling, and the remaining 13 million m3 used for a later stage of dam construction. ■ As of November 2023, a total of 1 million m3 of fine material has been extracted at Quarry 17. This is expected to be operational until 2029/2030. Quarry 17 is not within the inundation zone for the reservoir, and there are no current plans to rehabilitate or use the land beyond operation. **Quarry 26** ■ Quarry 26 is located on the Kishrog River right bank in the downstream area of the dam, 2.5 km from the site. Extracting rock mass material for use in the dam construction, and is divided into 3 sections: • Quarry 26 is no longer operational. • Quarry 26A is currently operational. • Quarry 26B designated for any additional material if required. ■ A total of 15 million m3 of material to be extracted from Quarry 26, with approximately 3 million m3 material already extracted. ■ Quarry 26 is outside the inundation zone, and there are no current plans for future uses or rehabilitation of the area. ■ The working Quarry 26A has a height of up to 210 m. The quarry is planned to develop by 10 m high benches and a slope of 70º between the 6 m wide berms.
Stockpiles and material transfer	There are several stockpiles onsite used to store extracted and processed materials. Locations of stockpiles are presented in **Figure 3-5**. ■ Materials from upstream quarries and stockpiles are carried to the dam and to stockpiles downstream of the dam by a 7km covered conveyor, and a new 8-9km covered conveyor (called the ‘flying belt’) will take materials from the downstream quarry and stockpiles to the dam site. The existing conveyor has reduced traffic by about 100 trucks per hour and the new conveyor will also reduce traffic. ■ Spoil from the ongoing tunnelling which is not suitable for use in the dam is carried by trucks to piles within the future reservoir footprint.

<table>
<tr><th>Component</th><th>Description</th></tr>
<tr><td></td><td>
Stockpiles include spoil piles with material that cannot be reused as well as material stockpile for future use and dam construction.
Inundated Stockpiles at Quarry 15
Quarry 15 and associated stockpiles are due to be inundated by the reservoir in 2024, there is currently approximately 26 million m3 of stockpiled material with a further 5 million m3 to be excavated, this material is currently being utilized for construction. It is estimated approximately 12 million m3 will remain by inundation in 2024. The remaining 12 million m3 of extracted material will be relocated to a new stockpile to the east of Quarry 17.
</td></tr>
<tr><td>Fuel Storage Areas</td><td>
Rogun JSC has an old storage area in Construction Site 1 for its own and minor contractor use and includes:
Underground seven diesel storage reservoirs/tanks.
Above-ground three diesel and petrol storage reservoirs/tanks.
The major contractors each have their own fuel storage areas.
Selected photos of the Fuel Storage Areas are presented in Figure 3-9.
</td></tr>
<tr><td>Crushing Facilities</td><td>
There are six crusher facilities currently under operation:
One closed area crusher facility with 1 million m^3 / year aggregate production capacity.
Five open area crusher facilities with an aggregate production of between 12 to 15 m^3/month each.
Lot 2 WeBuild - RCC Crushing Plant – Left Bank Upstream ~1198 m amsl
The system is fed by alluvium type material (Labydors) taken from stockpile area at Quarry No.15. The Crushing Plant has been set with nets of predetermined dimensions suitable for to produce aggregates [0-5 mm], [5-20 mm] and [20-40 mm] as designed for the RCC mixes to be used for the Main Dam RCC Pad.
Main mechanical components of the Crushing Plant:
Feeder – METSO Nordberg VF661 – Initial Screening.
Jaw Crusher - METSO Nordberg C140 – Primary Crushing.
2-story screening - METSO Nordberg CVB2661 – Primary Crushing.
Cone-shaped Crusher - METSO Nordberg GP500S – Secondary Crushing.
</td></tr>
</table>

Component	Description
	■ 3-Story Screening - METSO Nordberg TS5.3 (x2) – Secondary Crushing.
Concrete Batching Facilities	■ 1,000 tonnes of concrete arrive per day from Dushanbe which equates to about 30 trucks per day. ■ There are eight concrete batching plants with an effective capacity of 40 m^3/h. ■ There are approximately 25 concrete mixers with an average capacity of 6 m^3/h. ■ A disused but not decommissioned batching plant exists in Construction Site 2 and was observed to have dumped cement down a long slope toward the reservoir.
Power Supply (non-grid)	A power supply is necessary throughout the construction phase for electricity usage on site. Prior to 2018, a direct power source from diesel generators and a direct power source to Nurek HPP was used. Following the completion of the Stage 1 Dam in 2018, the operation of the existing Unit 5 and 6 turbines allow direct power from Rogun HPP.
Waste Storage Areas	The construction works are being undertaken in four main work packages, with each contractor providing its own waste storage areas and disposal facilities. **LOT2 Construction – WeBuild Contractor** ■ Facilities for waste storage areas within LOT2 construction are managed by the contractor WeBuild, and include a tank farm, maintenance yard and garage, warehouses, crushed-ore storage, and a washing facility. ■ The domestic waste storage area is constructed of concrete brick, fitted with concrete flooring, however, there is no roofing, and hence no protection from rain, wind or snow. ■ Hazardous waste is stored in the workshop service area prior to uplift by the waste contractor. The storage area is constructed from concrete and is covered with corrugated roofing. ■ Waste is stored within open-top intermediate bulk containers (IBCs) or on top of wooden pallets within the concrete cubicles. Signs and labelling of waste are noted within the storage area. **LOT3 Construction – TGEM Contractor** ■ The storage area shown in Appendix A is for un-contaminated construction waste, however, the photograph indicates that there appears to be hydrocarbon staining within the concrete cubicles. The storage area is not fitted with containment or protected from precipitation. ■ Hazardous waste is stored in metal barrels fitted with lids, which in turn are kept inside larger containers. **LOT4 Early Works Construction**

Component	Description
	Sadd Ariana Co. Contractor ▪ Hazardous wastes are reportedly removed from site by a waste contractor for disposal at a certified waste disposal site; and ▪ Septic tanks are installed on site for the collection of sewage waste. **EMZ, Contractor** ▪ No information was received from this Contractor. **Other non-EPC Contractors** ▪ No information available but could be expected to be very minor waste generation. **Non-hazardous waste / construction debris** ▪ All contractors reportedly had their non-hazardous wastes transported by licensed hauler to the Rogun landfill. This landfill originally included a deep excavation which is now full so that waste is spread across the surface of the land. There appeared to be relatively little organic matter but at least some construction debris including plastic and metals which may have included containers for hazardous materials. ▪ To the north of Construction Site 1 is in a barren expanse of piles of what appear to be rock rejects (including some piles of unusual, crushed shale that is apparently unsuitable for anything) interspersed with a number of small loads of construction debris. There was also an overpowering smell of sewage in one location where at least one load of liquid had been dumped for infiltration into the ground. Rogun JSC is in the process of designing a repository for construction debris and other non-hazardous waste. ▪ Downstream of Area 5 is a small expanse of rock piles interspersed with truckloads of construction debris, including damaged drums, empty Liter oil bottles, wire, pipe, empty bags that had held plasticizer additives for concrete, and the like. There is relatively little organic matter. ▪ At both areas, unidentified contractors have dumped wastes rather than taking it for proper disposal. **Hazardous waste** ▪ A licensed hauler takes away hazardous waste for recycling (batteries and some others), treatment or disposal at facilities in Dushanbe. **Medical waste** ▪ In the past, medical waste from the HPP's central clinic went to Obigarm, where there was no proper management so it was burned with local medical waste. Since earlier in 2023 the Rogun hospital has had a new UNICEF-financed facility for medical wastes; an ampule crusher and dry sump for crushed-glass storage and incinerator with 1m^3 capacity and burn temperature of 700-1000 degrees centigrade. Medial waste accumulates and is burned every one or two days, and medical waste from the Rogun HPP site is brought three to four times per week. Rogun contributes only a small part of what they receive.

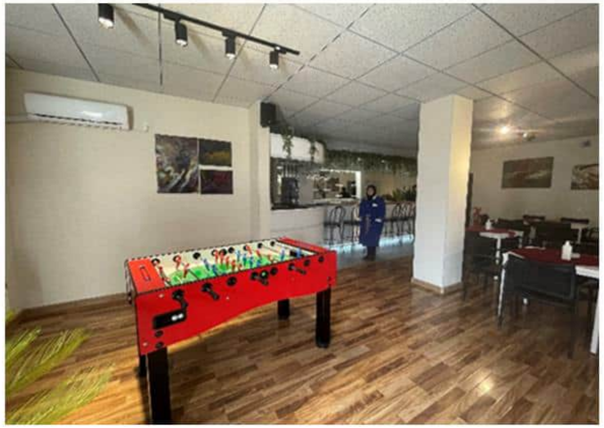
Component	Description
Sewage Disposal (non-municipal)	Each contractor's sewage waste is managed in ponds / sumps. Liquid is generally infiltrated into the ground and solids are reportedly removed by a hauler for treatment in the Rogun town Wastewater Treatment Plant (WWTP). A contractor is installing a treatment system plant to treat sanitary water from Construction Camp 1 and is expected to be online in late 2023. It will be removed before flooding in 2026 and presumably relocated for use elsewhere. The HPP also has a small plant that will be sufficient through full operation.

Figure 3-8 Temporary Facilities – LOT2 WeBuild

Camp Canteen - WeBuild

Self-Contained Flat - WeBuild

Landscaped Garden by Accommodation Blocks - WeBuild



Games Room - WeBuild

Figure 3-9-Temporary Facilities – Accommodations, Medical Facilities and Fuel Storage

Standard Dormitories - Inventor

Accommodation Toilets - Inventor

WeBuild Medical Facilities

Shared Kitchen in Self-Contained Male Dormitory - Nekzod

Shared Male Bedroom - Nekzod

Underground Fuel Storage Tanks

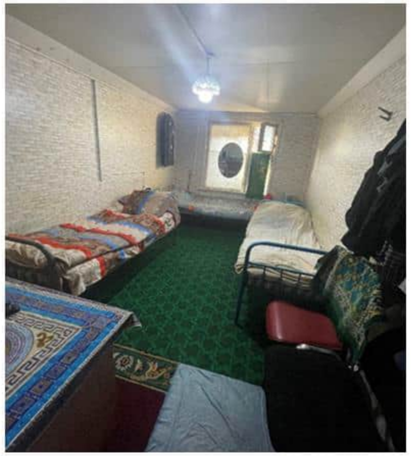
Oil Drums

Figure 3-10 Temporary Facilities – Accommodation & LOT4 Tunnel Sadd Ariana


Camp *Male Toilets - Sohili Nur*


Standard Bedroom - Sohili Nur


External View of Worker Accommodation Camp - Tunnel Sadd Ariana


Standard Bedroom - Soktmoni Asnsi


Camp Toilet—Soktmoni Asnsi


Toilets - Tunnel Sadd Ariana


Standard Bedroom - Tunnel Sadd Ariana

Figure 3-11 Temporary Facilities – Potable Drinking Water, Site Transport & Accommodations

On-site drinking water—Farrob

On-site drinking water - TGEM

Overcrowded rooms—causing workers to sleep on the floor—Khokrud

Toilets - Nekzod

Exposed Drinking Water—Soktmoni Asnsi

Worker Site Transport - WeBuild

Table 3-11 - Details of the Associated Facilities

Component	Description
International Highway - (Vakhdat - Jirgital)	The main road from Dushanbe to Obi Garm (M41) branches shortly before reaching Obi Garm to access the Rogun HPP site. Shortly after Obi Garm, short stretches of this road will be submerged in Stage 1 of the reservoir filling while, at later stages of impoundment, longer distances including the only bridge suitable for heavy traffic crossing the river, will disappear. This road is an important international and national road and will be replaced and, where required, road and bridge access to villages lying at higher elevations which will not be relocated will be provided. Two major new roads were planned for the area surrounding the reservoir. One along the left bank of the lower part of the reservoir, from the dam to the main bridge which will cross the reservoir, the other on the right bank, upper part of the reservoir, between the bridge and the village of Gharm, located approximately 50 km to the north-east. The new alignment of the M41, will relocate the connection between Obi-Garm and Nurobod in three Packages of construction. ▪ **Package 1:** Obi-Garm – Tagikamar: Two tunnels, (Kandak and Karagach), four new bridge constructions and two bridge rehabilitations and approximately 30km of local access roads. This Package is being financed by Asia Development bank (ADB). An ESIA was prepared to ADB standards and was approved in 2019. ▪ **Package 2:** Tagikimar – Nurobod: Tunnel 3 (Tagikamar), 6 new bridge constructions, 1 bridge rehabilitation approximately 40km of local access roads. This Package is being financed by the European Bank for Reconstruction and Development (EBRD). An ESIA was prepared to EBRD standards and was approved in 2019. ▪ **Package 3:** Long Bridge at Darband (known as Bridge 14), forms part of this Project but assessed in an ESIA separately. The new International Highway is presented within Figure 3-4 showing details of the new highway. The highway is expected to be completed by 2025.
International Highway Bridge (over reservoir)	Package 3 will be financed by USD 40 million loan from Asian Infrastructure Investment Bank (AIIB) and covers the long permanent bridge (760 m) over the Rogun HPP Reservoir at Darband over the Surkhob River. The dimensions of the permanent bridge will be approximately 760 m long and 11.5 m wide. Prior to construction of the long bridge across the reservoir / Surkhob River (Package 3), a temporary bridge will be installed (as part of Package 2) at the east end of the alignment. An ESIA was prepared to AIIB standards and was approved in 2019.

Component	Description
Transmission Line (High Voltage)	**CASA-100** ▪ One 123 km 500 kV line from Rogun HPP to Sangtuda is part of the CASA 1000 project and is under construction. This line is being financed by a consortium of lenders including World Bank, Islamic Development Bank, European Bank for Reconstruction and Development and European Investment Bank and ESIA was prepared in 2011. ▪ The surplus power generated from Rogun HPP is proposed for export to Afghanistan and Pakistan through the CASA-1000 (Central Asia-South Asia) cross-border Ultra-High-Voltage (UHV) transmission line. **Domestic Transmission Lines** ▪ Two 100 km 500 kV overhead lines (OHL) currently exist, transporting power from the Project to Dushanbe substation. ▪ An additional two 500 kV OHL are planned to connect the Rogun HPP with Saikhun 400km to the north, and to Khujand 350km to the north. Detailed planning has not been initiated to date. ▪ The Project will have the ability to provide a sixth 500 kV line (reserve line) to be planned in the future.

Table 3-12 - Details of Primary Suppliers

Component	Description
Concrete supply	Two companies in Dushanbe produce concrete that meet Project specifications, Tajikcement in Dushanbe and Mohir-Cement in Yavan. Under separate contracts for each of the Contractors, the companies transport about 1000 tonnes per day from Dushanbe and Yavan to the site in trucks that average about 30 tonnes per load. Thus, there are about 33 roundtrips between Dushanbe or Yavan and Rogun each day. Because of the national importance of Rogun, it is considered likely that Rogun JSC would have a certain amount of influence on these companies, although not control.
Steel liners	Steel liners for intake and penstock shafts and tunnels. These enormous liners are fabricated by TGM using steel which come from Russia and Iran. Rogun JSC has limited or no control or influence over these suppliers.
No other suppliers are considered to be “primary suppliers” as defined in paragraph and footnote 34 of ESS1 - ‘*primary suppliers are those suppliers who, on an ongoing basis, provide directly to the project goods or materials essential for the core functions of the project. Core functions of a project constitute those production and/or service processes essential for a specific project activity without which the project cannot continue*.’	

3.10. RESETTLEMENT

3.10.1. Resettlement is managed by the Directorate of the Rogun HPP Flooding Zone (DFZ). It has been funded by the Government of Tajikistan to date, but some activities in the future may be financed by one or more international Lenders and as such the program is considered a core Project component.

3.10.2. Resettlement is planned in phases in line with the inundation levels of the reservoir. According to data from DFZ as of March 2023, resettlement of households in the flooding zone is due for completion by 2032. This will include 69 villages from the Rogun, Nurobod, and Rasht districts affecting an estimated 46,628 PAPs. **Table 3-13** presents a summary of the total people, households and villages during past, ongoing, and future resettlement phases.

Table 3-13 - Total Number of People, Households and Villages by Resettlement Phases within the Flooding Zone

Period	Resettlement Phase	Resettlement Action Plan (RAP)	Number of Villages	Total number of Project affected households	Total number of PAPs
2011-2017	Phase 1	RAP 1 (2014)	8	326	2,697
2018-2032	Phase 2	RAP 2 (2017-2025)	16	1,605	13,280
		Future RAPs 3, 4 and 5	45	4,752	30,651
TOTAL AFFECTED			69 villages	6,683	46,628

PHASE 1 RESETTLEMENT

3.10.3. Resettlement comprising eight villages, 326 households, and 2,697 people was guided by RAP 1 developed in 2014, and a Livelihood Restoration Plan 1 (LRP 1) created in 2015. A World Bank audit of Phase 1 resettlement concluded that the program met the principles established in 2014 RPF, 2014 RAP 1, and LRP 1 and was in line with the World Bank previous requirements (WB OP 4.12).

PHASE 2 RESETTLEMENT

3.10.4. Initially, all resettlement after completion of RAP 1 was referred to as Phase 2. DFZ subsequently developed RAP 2 to cover the period 2018-2025 and is in the process of implementing that RAP. This RAP 2 for 2018-2025 is being updated as part of the ESIA process. This will be compliant with the new ESS5 requirements.

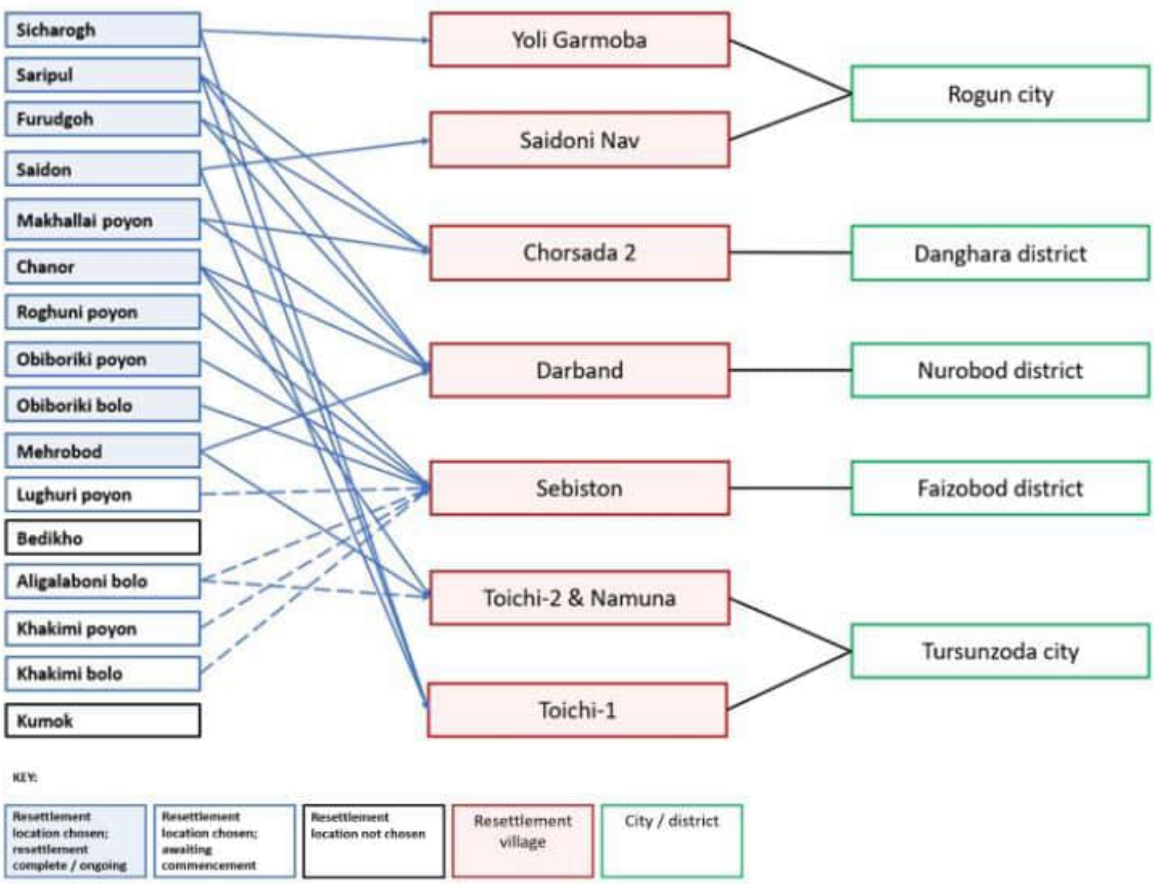
3.10.5. To guide ongoing and future resettlement, a Resettlement Policy Framework (RPF), including a Livelihood Restoration Framework are being developed. The RPF will call for at least two additional RAPs to guide the remainder of the resettlement program which, will be completed in 2032.

3.10.6. RAP 2 is in the process of being implemented. It covers about 1,605 households (more than 13,000 people), of which approximately 500 (over 4,600 people) have already been resettled, and the remainder are due for resettlement by end of 2025.

3.10.7. RAP 2 is being developed to ensure the program complies with the updated standards in the World Bank's 2018 ESF. This updated RAP 2 will apply retroactively to households resettled since 2017 and also to those that will be resettled through 2025.

3.10.8. Relocation of villages under RAP 2 is illustrated by **Figure 3-12**.

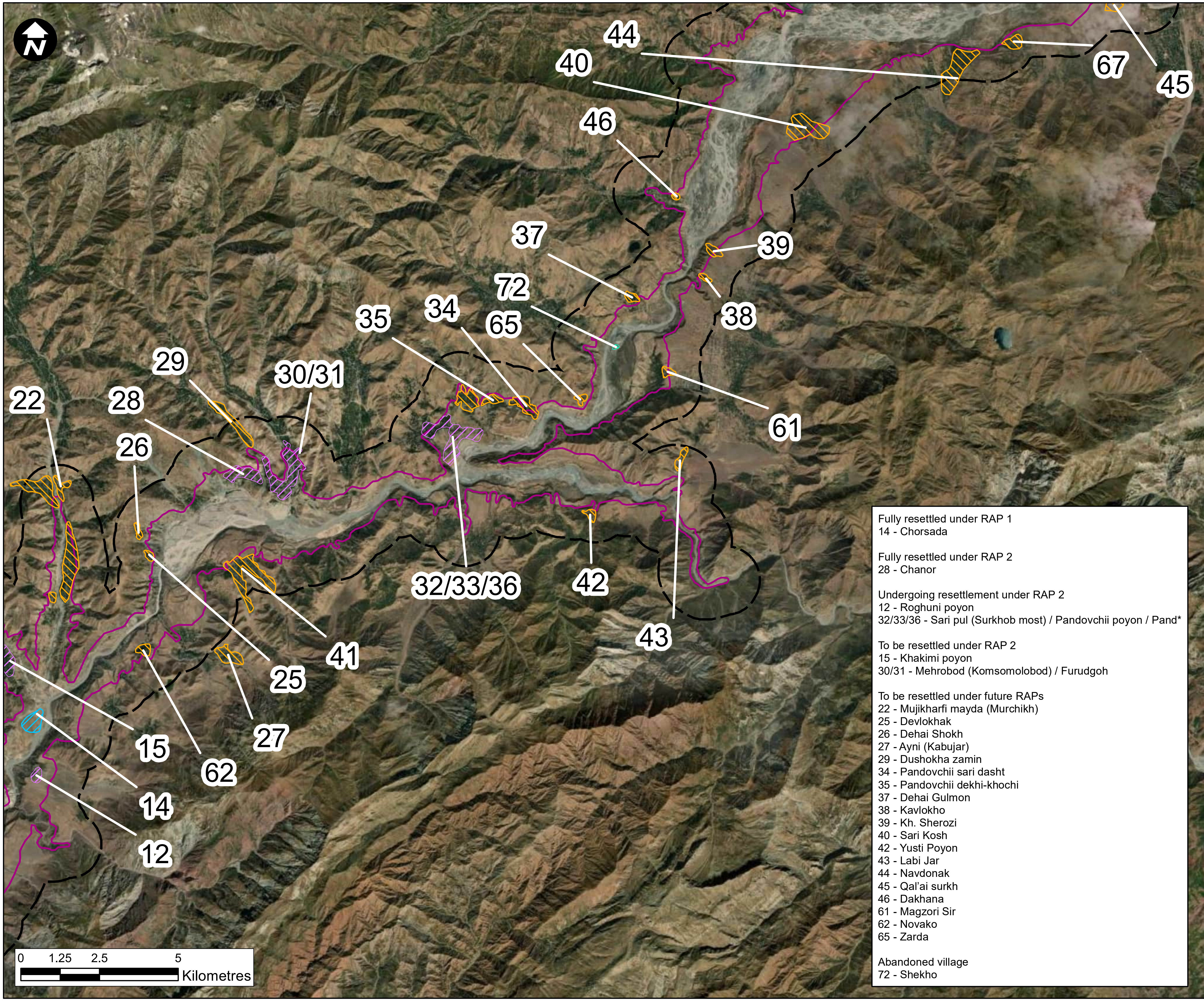
Figure 3-12 – Resettlement of Villages Under RAP 2 (Source: DFZ data)

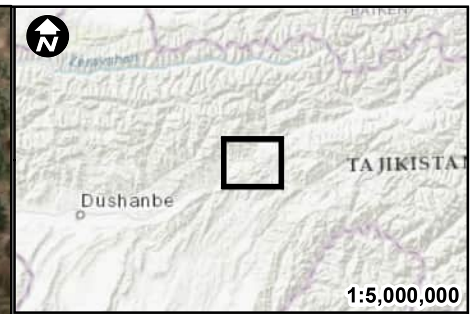


MULTIPLE DISPLACEMENT IMPACTS

3.10.9. People in some villages that will be affected by resettlement for the Project, may also be impacted by other projects, including:

- Elements of the CASA-1000 rural electrification project, which required land to be acquired in, among other things, Tursunzoda and Rudaki;
- Obi Garm-Nurobod road project – (ADB & EBRD) required land acquisition in Rogun city and Nurobod district;
- Dushanbe-Tursunzoda-Uzbekistan border road project (ADB) required land acquisition, in particular, in Tursunzoda City; and
- Dushanbe-Bokhtar road project (ADB & JICA) required land acquisition in Rudaki district.





Legend

- Fully resettled under RAP 1
- To be resettled under RAP 2
- Abandoned village
- To be resettled under future RAPs
- 1290m Inundation Boundary
- 1290m Inundation Boundary 1km Buffer

PROJECT TITLE

Rogun HPP ESIA Support and Monitoring for World Bank

DRAWING TITLE

Figure 3-13
Areas to be Resettled
Central View

DRAWING STATUS

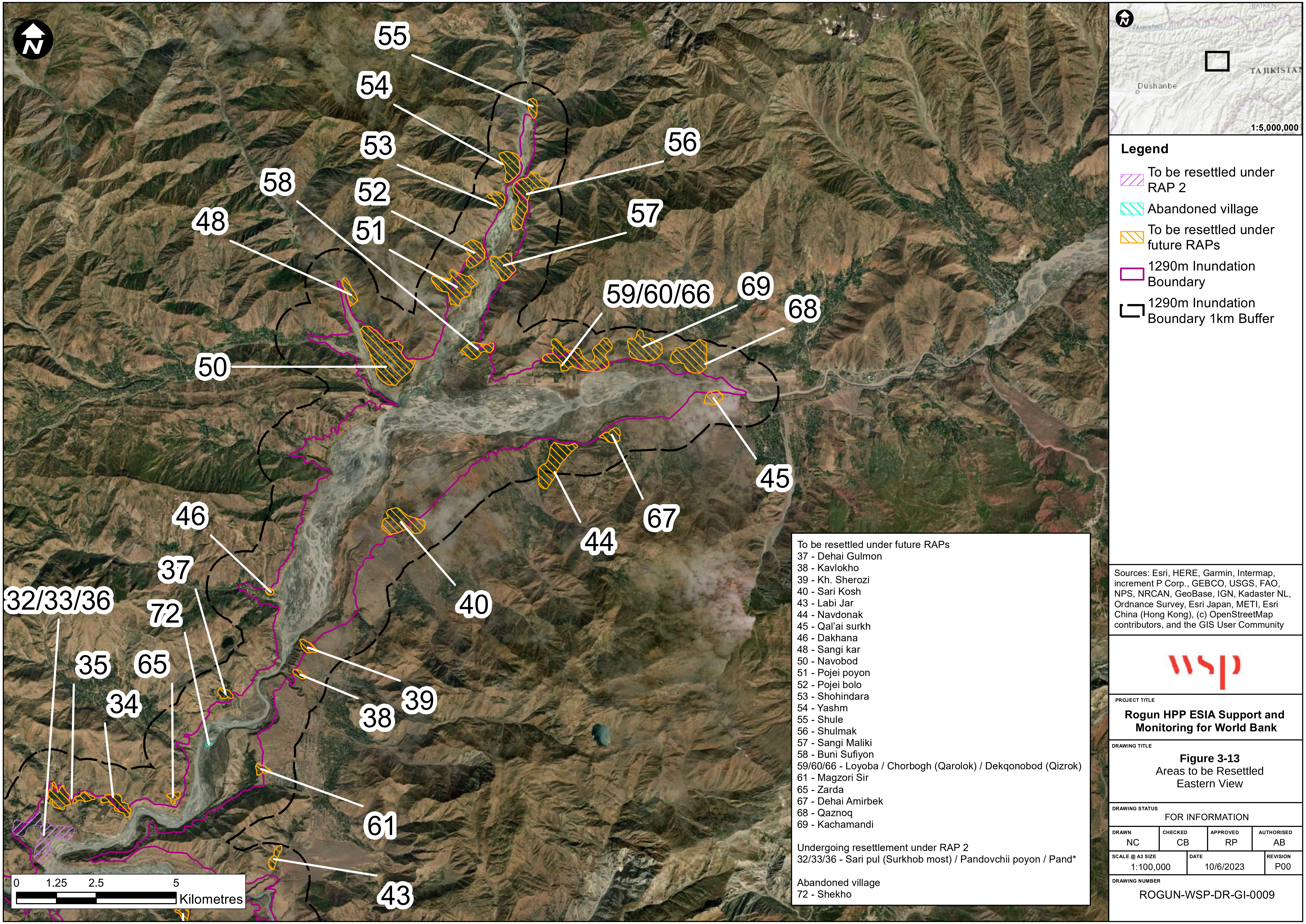
FOR INFORMATION

DRAWN	CHECKED	APPROVED	AUTHORISED
NC	CB	RP	AB

SCALE @ A3 SIZE	DATE	REVISION
1:110,000	10/6/2023	P00

DRAWING NUMBER

ROGUN-WSP-DR-GI-0059



To be resettled under future RAPs
37 - Dehai Gulmon
38 - Kavlokho
39 - Kh. Sherozi
40 - Sari Kosh
43 - Labi Jar
44 - Navdonak
45 - Qal'ai surkh
46 - Dakhana
48 - Sangi kar
50 - Navobod
51 - Pojei poyon
52 - Pojei bolo
53 - Shohindara
54 - Yashm
55 - Shule
56 - Shulmak
57 - Sangi Maliki
58 - Buni Sufiyon
59/60/66 - Loyoba / Chorbogh (Qarolok) / Dekqonobod (Qizrok)
61 - Magzori Sir
65 - Zarda
67 - Dehai Amirbek
68 - Qaznoq
69 - Kachamandi

Undergoing resettlement under RAP 2
32/33/36 - Sari pul (Surkhob most) / Pandovchii poyon / Pand*

Abandoned village
72 - Shekho

Legend

- To be resettled under RAP 2
- Abandoned village
- To be resettled under future RAPs
- 1290m Inundation Boundary
- 1290m Inundation Boundary 1km Buffer

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

PROJECT TITLE
Rogun HPP ESIA Support and Monitoring for World Bank

DRAWING TITLE
Figure 3-13
Areas to be Resettled
Eastern View

DRAWING STATUS			
FOR INFORMATION			
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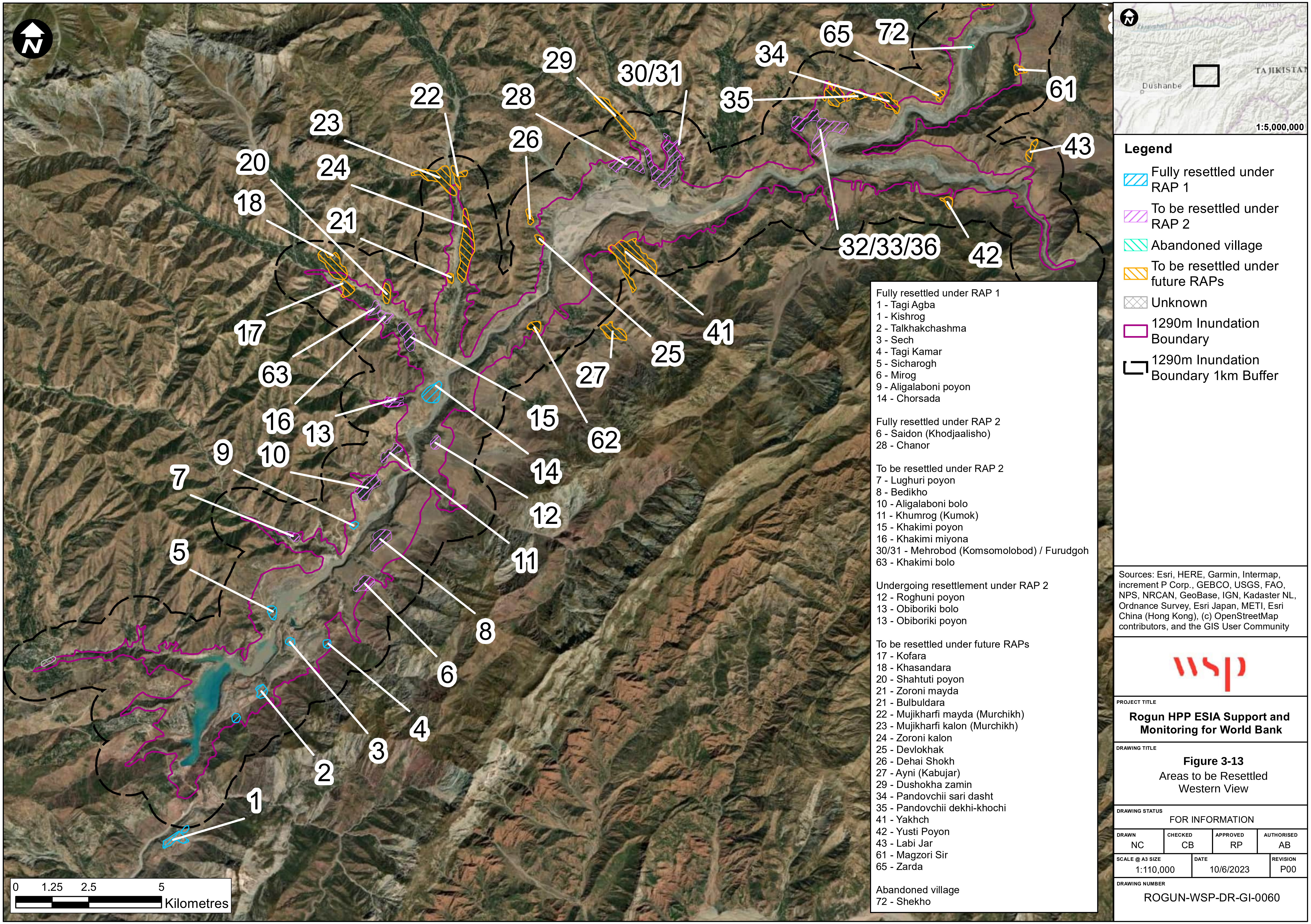


Figure 3-13
Areas to be Resettled
Western View

IDENTIFICATION AND PREPARATION OF RESETTLEMENT SITES

3.10.10. The State Committee on Land Management and Geodesy are responsible for identifying suitable land for resettlement sites. The land is requested via the local authorities and must be approved by the Jamoats and local community before resettlement can proceed.

3.10.11. Before the land acquisition for the development of resettlement sites can begin, the site must be approved as safe and suitable by government ministries and agencies with appropriate competences (e.g., the Ministry of Environmental Protection confirms that the site is not vulnerable to, and will not cause, significant environmental risks). Once all necessary approvals have been granted, relocation to the site can begin.

3.10.12. Resettlement sites are selected in areas where the additional population will not cause strain on local resources, earthquake risk is low, and where there is sufficient agricultural and pastureland of sufficient quality to accommodate new arrivals. All new and existing residents have the right to unrestricted use of common pasture lands. As an example, in Tursunzoda, additional common pastureland for host communities was also provided to accommodate pre-existing population growth. In some cases, the initial allocation of land was inadequate resulting in the need for additional land to be made available.

3.10.13. Under RAP 2, five new resettlement sites have been identified in Nurobod region in June 2023, besides those already in use. All new sites consist primarily of agricultural fields and pastureland. These new sites will accommodate approximately 2,600 land plots (320 hectares).

PUBLIC INFRASTRUCTURE AND SERVICES IN RESETTLEMENT SITES

3.10.14. DFZ’s mandate is to ensure that the construction of all public infrastructure (i.e., water supply, health centers, education facilities, roads, electricity lines, etc.) and utility services in resettlement sites is complete before settlers physically move in. While this has generally been the case, there have been instances when households relocated before all infrastructure was in place.

3.10.15. Construction of these facilities is the responsibility of the relevant ministry. In some cases, when resettled people move to host communities, the existing infrastructure is expanded or improved. Connection to utilities is provided at no cost at new resettlement sites.

4 ANALYSIS OF ALTERNATIVES

4.1 INTRODUCTION

4.1.1 The WBG ESF (2018), and specifically ESS1 Assessment and Management of Environmental and Social Risks and Impacts requires an 'Analysis of Alternatives' as part of an ESIA.

4.1.2 ESS1 requires the 'Analysis of Alternatives' to include:

- A systematic comparison of feasible alternatives to the proposed project site, technology, design, and operation—including the "without project" situation—in terms of their potential environmental and social impacts.
- An assessment of the alternatives' feasibility of mitigating the environmental and social impacts; the capital and recurrent costs of alternative mitigation measures, and their suitability under local conditions; and the institutional, training, and monitoring requirements for the alternative mitigation measures.
- Quantification of the environmental and social impacts of the alternatives to the extent possible and the economic values where feasible.

4.1.3 The Analysis of Alternatives enables E&S risks to be considered in the early stages of project planning as well as the later stages of design and implementation and describes the basis of selection of preferred alternatives at all stages of the Project.

4.1.4 At the highest level a "without project" scenario is included to identify the need for the Project as well as the key benefits developing the Project will bring. The location, energy and fuel sources and usage, technology used on the Project and design of key facilities are included as the Project progresses to demonstrate the potential benefits as well as adverse effects the proposed development may have on environmental and social receptors.

4.1.5 In 2011 the Government of Tajikistan, with funding from the WB conducted a Technical and Economic Assessment Study (TEAS), for the Project. The objectives of the study were to evaluate the technical and economic feasibility of different operational regimes and project design.

4.1.6 The current chapter has been informed by the Techno-Economic Assessment Study, Phase II Report – Volume 1: Summary – Chapter 3.2: Selection of Site, Powerhouse, Dam Type and Alternative, April 2014; and the ESIA that was also completed in 2014.

4.1.7 The 'without project' scenario has been strengthened with recent information on the energy security and demand situation of Tajikistan and recent trends in fossil fuel usage and increased greenhouse gas (GHG) emissions.

4.1.8 The assessment presented in this chapter discusses the "without project" scenario, and other alternatives, i.e., project location, type of structure and design with various dam heights. It provides a comparison of E&S impacts of various dam height alternatives and the economic and financial cost of the project.

4.2 WITHOUT PROJECT SCENARIO

4.2.1 The 'without project' scenario typically considers the potential environmental and social adverse and beneficial effects of not developing the Project and retaining the site with the original features.

4.2.2 The Rogun HPP project has been in development since the 1970s in this location and therefore this assessment considers the scenario against the changes which have already occurred which include the existing 400MW HPP, the ongoing construction of the 3,600MW HP, the historical legacy and buildings facilities already present on site, and resettlement that has been completed to date. It considers the social, financial, and environmental effects of approving the project versus the effects of not approving the project.

4.2.3 The scenario looks at energy security, use of fossil fuels, cost of electricity, flood protection and sediment control, sustained river flow, and opportunities for tourism and economic growth.

4.3 ENERGY SECURITY IN TAJIKISTAN

4.3.1 The International Energy Agency (IEA) review in 2022 of energy policy in Tajikistan states that the approximately 90% of the Country's electricity needs is supplied by hydropower generation projects (around 9.2GW). This results in a seasonal variability in the generation and supply of electricity, with a surplus during the summer and a shortage during the winter. The rural poor and remote regions, representing around 70% of the population, are most affected by this seasonally variation.

4.3.2 The IEA also state that many existing generation facilities in Tajikistan are reaching the end of their design lifespans. To maintain existing capacity, it is estimated that approximately 80% of the country's HPPs will need to be rehabilitated by 2030.

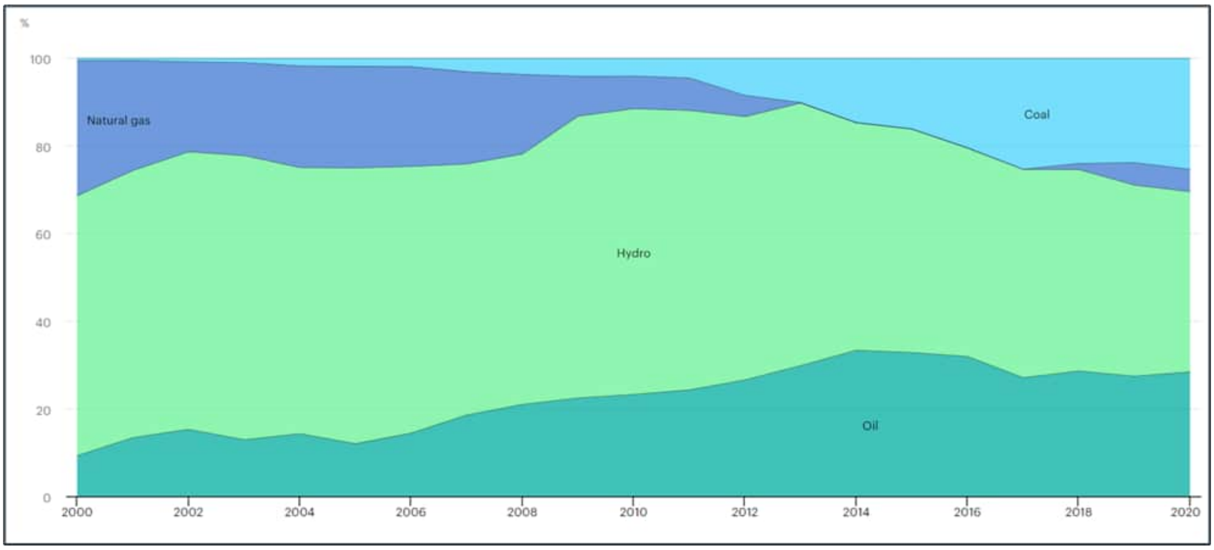
4.3.3 When fully operational, the Rogun HPP Project will have a total installed capacity of 3,600MW and will produce enough electricity to eradicate winter shortages. The Project provide enough energy for domestic consumption, with surplus energy exported during summer months to neighbouring countries via the CASA-1000 Transmission line (refer to Volume I, Chapter 10: Cumulative Impact Assessment for information regarding this project).

INCREASED USE OF FOSSIL FUEL

4.3.4 To reduce volatility in the country's power generation and meet year-round demand, the Government of Tajikistan has been and continues to develop alternative energy sources and diversify the energy production.

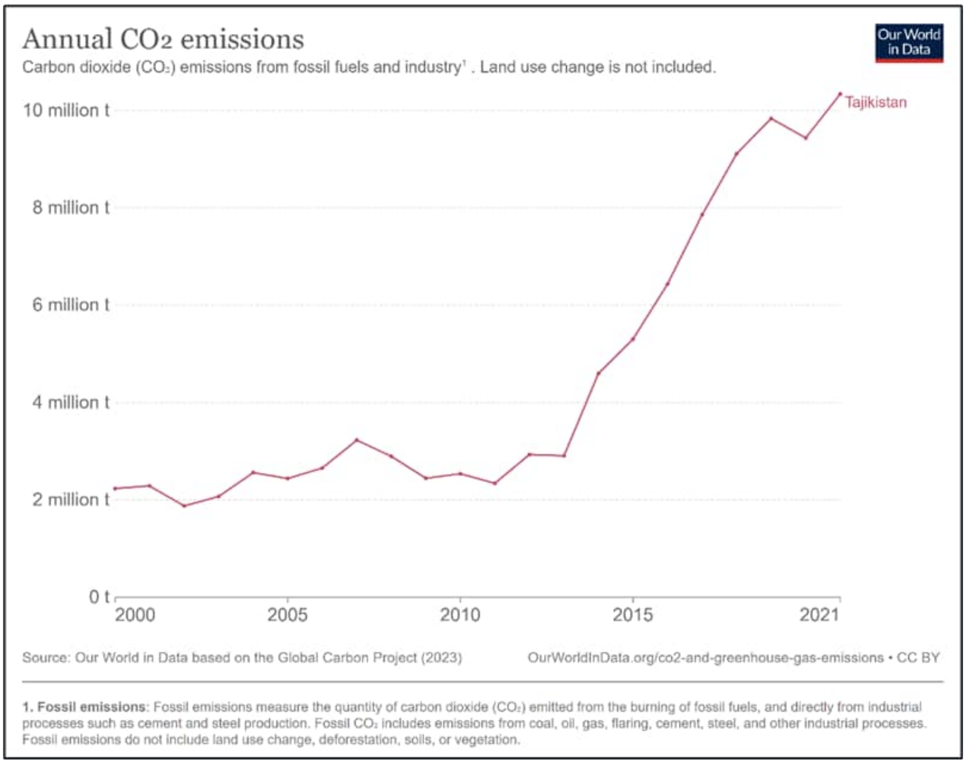
4.3.5 According to the IEA, since 2014 an increasing amount of the country's power demand has been supplied by the combustion of fossil fuels, including oil and coal (refer to **Figure 4-1**). Tajikistan has significant coal reserves, and both the government and large industries have turned to coal as a fuel for resolving severe electricity shortages during winter months. Consequently, Tajikistan's annual carbon dioxide (CO_2) emissions have risen sharply in recent years (refer to **Figure 4-2**).

Figure 4-1 - Total energy supply by source, Tajikistan 2000-2020



Source: https://www.iea.org/countries/tajikistan

Figure 4-2 - Annual CO2 Emissions for Tajikistan



Source: https://ourworldindata.org/co2/country/tajikistan#what-are-the-country-s-annual-co2-emissions

4.4 COST OF ELECTRICITY

4.4.1 About 26% of the Tajikistan population lives below the National Poverty Line (ADB 2023). Electricity is crucial for poverty alleviation, economic growth and improved living standards, and the government has therefore prioritised providing uninterrupted and cost-efficient power to its people.

4.4.2 Electricity has been subsidized by the government since independence in 1991. The TEAS for the Project analysed the Least Cost option for meeting the domestic demand between 2014 and 2050 (TEAS, Phase II: Economic Analysis, March 2014). The assessment established that the economic benefits of the Project exceed those of other feasible HPPs (run-of-river) and thermal plants (both coal and natural gas).

4.4.3 The TEAS also noted that wind and solar energy production cannot make up the shortfall in the electricity supply and remains more expensive than other sources, although the cost has declined steadily in recent years.

4.5 FLOOD PROTECTION AND SEDIMENT CONTROL

4.5.1 The existing HPPs in the Vakhsh river cascade do not have the capacity to handle Probable Maximum Flood (PMF). The TEAS studies estimate that, if the Rogun HPP Project was not constructed, the overall required investment required for immediate implementation of large upgrading works on the existing spillway structures of the cascade is up to one (1) billion United States Dollars (USD).

4.5.2 The Vakhsh river has a very high sediment output. A benefit of the Project is the retention of sediments increasing the life span of the existing Nurek HPP reservoir. Without the Project, no mitigation for sedimentation of the Nurek reservoir would be in place.

4.6 SUSTAINED RIVER FLOW

4.6.1 Amu Darya river is one of the main tributaries feeding to Aral Sea and the Vakhsh river forms a subbasin to the Amu Darya.

4.6.2 The Amu Darya catchment drains five countries namely: Afghanistan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Approximately 80% of the Amu Darya annual flow volumes are estimated to be generated in Tajikistan, with approximately 8% generated in Afghanistan; 6% in Uzbekistan; 4% in Turkmenistan; and 2% in Kyrgyzstan (Pöyry, 2014). These countries have an intercountry agreement which allocates an annual share of Amy Darya water.

4.6.3 The Project will use its allocation of the water in the Nukus Declaration, Protocol 566 agreement until the reservoir reaches its full capacity of FSL 1290 by the year 2036. During the operational phase, the Project is expected to store the Vakhsh river flow in summer, which will consequently reduce flow to Amu Darya during flood period (March to May) and increase flow in drought period of winter. This will provide the opportunity for improved transboundary cooperation within the Amu Darya basin.

4.7 TOURISM OPPORTUNITIES AND ECONOMIC GROWTH

4.7.1 Without the Project, the existing infrastructure in the reservoir area would be unaffected. However, the investment that has gone into the Project (Soviet period and more recently), i.e., construction of the HPP and connection roads, resettlement, would be lost. The future employment opportunity in the area would not exist, and the expected economic benefits for the region would be lost.

4.7.2 The government plans to create infrastructure for tourism which will be beneficial for the economic development of the area.

4.8 ALTERNATIVE PROJECT SITES

4.8.1 Alternative dam sites were investigated during the TEAS. The main reasons for the location of the Project include:

- **Topography**: the very narrow valley at the Project site allows for the construction of a high dam with a minimum quantity of filling material and minimum loss of the land.
- **Seismicity**: The NW-SE trending Ionakhsh and Gulizindan faults run from the Vakhsh fault 10km north of the Rogun Dam to Nurek Dam in the south. After the impoundment at Rogun, these faults will be subject to both Rogun and Nurek impound. The active Ionakhsh Fault along the river axis upstream of the Project site precludes the implementation of a dam core across it. Moving the dam axis would place the dam in a tectonically less stable, and thus higher risk, area.

4.8.2 The environmental and social impacts of the Associated Facilities including Analysis of Alternatives have already been assessed as part of ongoing or published ESIAs. Where these are not being financed by an IFI, these developments will require assessment in accordance with International Standards prior to the commencement of construction.

4.9 ALTERNATIVES FOR THE DAM STRUCTURE

4.9.1 The TEAS considered several types of dams including:

- Clay Core Rockfill dam.
- Concrete Arch dam.
- Gravity Roller Compacted Concrete (RCC) dam.
- Concrete Face Rockfill dam (CFRD).
- RCC arch gravity dam or RCC arch dam.
- Rockfill dam with earth core dam with upstream concrete block cutting the heel; and
- Rockfill dam with earth core dam with downstream concrete block cutting the toe.

4.9.2 The TEAS study presents an assessment and comparison of the above-mentioned dam types, as presented in **Table 4-1**.

4.9.3 An impervious core embankment dam was selected as the preferred dam type based on sensitivity to movements along fault lines, risk from salt fill, rock quality, sensitivity to overtopping and the relative complexity of constructing the impervious core rockfill dam in stages when compared to other dam types.

Table 4-1 – Technical Assessment of Alternative Dam Types (TEAS, 2014)

Dam Type	References of dams higher than 200 m	Sensitivity to movements along faults	Risk related to salt fill of Ionakhsh fault	Sensitivity to rock quality	Sensitivity to overtopping	Regular reservoir rising during construction
Clay Core Rockfill dam						
Concrete Arch dam						
Gravity RCC dam						
Concrete Face Rockfill dam						
RCC Arch Gravity or Arch dam						
Rockfill dam with earth core dam with upstream concrete block cutting the heel						
Rockfill dam with earth core dam with downstream concrete block cutting the toe						

KEY	
	Problematic
	Problematic but can be solved by appropriate measures
	Element to be studied carefully
	Not problematic

Source: Assessment Studies for Proposed Rogun Hydropower Project in Tajikistan (2014) – Technical,

4.10 ALTERNATIVES FOR DAM HEIGHT

4.10.1 The TEAS evaluated three different dam heights, Full Supply Levels (FSL) and installed capacities for each height as presented in **Table 4-2**, and the subsequent E&S impacts of the three options to determine the most appropriate.

Table 4-2 - Alternatives Considered for Dam Height and Capacity

Alternative	FSL 1290	FSL 1255	FSL 1220
Dam crest level (msl)	1300	1265	1230
Dam height (meters)	335	300	265
Total reservoir capacity (hm^3)	13,300	8,550	5,220
Reservoir active storage (hm^3)	10,300	6,450	3,930
Investigated installed capacities (MW)	2800 3200 3600	2400 2800 3200	2000 2400 2400
Surface area at FSL	170 km^2	114 km^2	68 km^2
FSL - Full Supply Levels; msl – meters above sea level; hm^3 - cubic hectometre; MW – megawatt			

4.11 ENVIRONMENTAL AND SOCIAL IMPACTS OF FSL 1220, 1255 AND 1290

4.11.1 The 2014 assessment was for the three dam height options, i.e., FSL 1220, FSL 1290 and FSL 1255. These dam height options differ by their reservoir size and installed capacity, although from geological, seismic and climate change perspectives there is no notable difference between the alternatives.

ENERGY PRODUCTION

4.11.2 The average annual energy production for each alternative:

- FSL 1220 - 10.1 TWh
- FSL 1255 - 12.4 TWh
- FSL 1290 - 14.4TWh

4.11.3 The FSL 1290 option results in an additional two (2) TWh/yr. of electricity production compared to the FSL 1255 alternative.

RESERVOIR SEDIMENTATION

4.11.4 The largest reservoir would retain the most sediment and provide the extended life to both Rogun and Nurek HPPs.

4.11.5 As discussed in the TEAS, the annual sediment input to the reservoir could be between 62 and 100 hm^3. Considering a 62 hm^3/yr. sediment inflow, the life expectancy would be 80, 120 and 200 years for FSL1220, 1255 and 1290 respectively. While with 100 hm^3/yr. sediment inflow, the life expectancy would be 45,75 and 115 years respectively for the three dam heights**.**

4.11.6 From an economic perspective, the FSL 1290 option provides the longest life span, most efficient energy production, and longest regional energy export potential.

FLOOD RISK

4.11.7 According to the TEAS, the existing Vakhsh cascade is not capable of handling a Probable Maximum Flood (PMF) The FSL 1220 alternative for Rogun would not be able to protect the downstream cascade in case of a PMF and substantial investment to the existing cascade would need to be made for this purpose. However, both the FSL 1290 and the FSL 1255 alternatives allow safe PMF evacuation for the entire cascade.

4.11.8 The construction of the Project will improve flood routing capacity for the area downstream of the Vakhsh cascade. This positive effect could be increased by appropriate flood management. The inclusion of Rogun HPP in the cascade would also reduce risks of floods of lower magnitude, but with a higher probability of occurrence. Under the intended operating mode, the flood routing capacity of floods of an occurrence probability of 1/10 or 1/100 would be the same for FSL 1220 and FSL 1255 since the winter drawdown of the Project would be 4.4 km^3 in both cases. However, the FSL 1290 option will offer a greater flood retention potential including preventive drawdown.

RESETTLEMENT

4.11.9 The reservoir size will have a direct effect on the magnitude of the socio-economic impact including the loss of additional agricultural land and resettlement.

4.11.10 The increase in reservoir size has a considerable effect on resettlement[1] and loss of agricultural land:

- FSL 1220: a resettlement of 13,000 PAPs or 1,825 households; loss of 971 Ha of land used for agriculture.
- FSL 1255: a resettlement of 18,000 PAPs or 2,433 households; loss of 1,409 Ha of agricultural land; and
- FSL 1290: a resettlement of 42,000 PAPs or 6,065 households; loss of 3,337 Ha of agricultural land.

4.11.11 As the FSL rises, the number of PAPs increases and has a considerable effect on resettlement. It is noted under the WB ESS5, it recommends 'avoiding resettlement, or when unavoidable, exploring all options including project design alternatives to minimize displacement of people'. As outlined in the TEAS (2014) studies, resettlement is unavoidable for all dam alternatives, with the technical studies showing both FSL 1255 and 1290 dams being feasible, with the recommended alternative for FSL 1290.

4.11.12 With the recommended FSL 1290, the total installed capacity exhibited the highest benefits from a least cost planning and economic perspective, ultimately a full production FSL 1290 met the winter energy needs of Tajikistan and allowed export sales of summer electricity to neighbouring countries. In addition, to sufficient reservoir volume to enable the required level of PMF attenuation and additional facilities for augmenting the flood-handling capacity of the cascade. With a longer operating lifetime for the dam of 115 years, over 75 years for FSL 1255.

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[1] For the definition of the resettlement, all villages below the respective FSL of the reservoir and a few villages above FSL which are expected to be affected by flood levels and accessibility have been considered.

4.11.13 While it is recognised that a higher rate of resettled PAPs was required for FSL 1290, those resettled would receive compensation and either the same or larger sized plots at their new locations, in addition to free transport of all construction materials at their existing home to the new site. New settlements would have improved public facilities, such as health centres, schools, water, and power. All affected households would have a choice of different livelihood restoration options, from agriculture, industrial or employment at Rogun HPP. Ultimately, communities for resettlement would have greater economic opportunities and prospects, with improved living standards.

RESETTLEMENT SITE SELECTION

4.11.14 According to Resolution No.47, The State Committee on Land Management and Geodesy is responsible for identifying suitable land for resettlement sites. The land is requested via the Hukumats and must be approved by the Jamoats and local community before resettlement can proceed.

4.11.15 Before the land acquisition for the development of resettlement sites can begin, the site must be approved as safe and suitable by government ministries and agencies with appropriate competencies (e.g., the Committee for Environmental Protection confirms that the site is not vulnerable to, and will not cause, significant environmental risks). Once all necessary approvals have been granted, relocation to the area can begin.

4.11.16 Site selection is aligned with central government planning for social and economic development.

4.11.17 Sites are selected in areas where the additional population will not cause strain on local resources, earthquake risk is low, and where there is sufficient agricultural and pastureland of sufficient quality to accommodate new arrivals. All new and existing residents have the right to unrestricted use of common pasture lands. In Tursunzoda, additional common pastureland for host communities was also provided to accommodate pre-existing population growth.

4.11.18 Five new resettlement sites have been identified in Nurobod region, besides those already in use. All new sites consist of agricultural fields and pastureland. According to the planning documents these new sites will accommodate around 2,600 land plots (320 hectares).

4.11.19 These new resettlement sites are at an early stage of selection and evaluation by multiple government ministries to identify the exact size and location. Once agreed the Committee of Environmental Protection will undertake an assessment of environmental and social risks of developing the site.

EFFECTS ON RIPARIAN ENVIRONMENT

4.11.20 The Project will allow storage of water and transfer flow from the high flow season (summer, vegetation period) to the low flow season (winter, non-vegetation period) for maximizing winter energy output.

4.11.21 As described previously, the Government of Tajikistan intend to fill the Rogun reservoir using part of the share allocated to Tajikistan under current agreements and practices. Between 2005 and 2011, Tajikistan was not using its full share for irrigation from the Amu Darya (particularly from the Vakhsh River), with an average of 1.2 BCM of its share unused. This unused share is considered sufficient to fill the reservoir without reducing current irrigation in Tajikistan.

4.11.22 The TEAS study concludes that the different proposed Rogun dam alternatives will not impact the seasonal flow pattern downstream of Nurek and the operation of the Project will strictly comply with existing agreements and practices on allocation of water shares and at FSL 1255 and FSL 1290 will even have a large unused live storage capacity.

4.11.23 This will create an opportunity to cooperate with the entire Amu Darya basin, creating greater storage capacity that will allow for increased availability of water to riparian countries during dry years.

4.11.24 Three main operational patterns were identified in 2014 for the determining the Minimum Environmental Flow required for the Project (Pöyry 2014):

- Operation pattern 1: consists in applying the same water allocation and water use patterns currently in use. This would be achieved by operating Rogun dam with the same principles that are currently applied to Nurek, and by operating Nurek as a run-of-river dam for hydropower purposes only.
- Operation pattern 2: aimed at optimizing winter energy production, which would lead to an additional shift of flows from the high flow season to the low flow season. This would have consequences on water availability during the summer months and for irrigation.
- Operation pattern 3: aims at maximizing the water allocation for all the users in the entire basin, especially during the dry years. This requires a framework to be developed and implemented for the Project under different scenarios of water use.

4.11.25 The outcomes of the 2014 evaluation recommended the continued application of Operation pattern 1, which would result in minimal changes in the flow regime downstream of Nurek dam. However, adverse climatic conditions could lead to deviations from the envisaged operation pattern (Pöyry 2014).

4.11.26 Subsequent studies for this ESIA have focussed on updating the MEF study with the most recent information and consistent with the Good Practice Handbook for Environmental Flows for Hydropower Projects to determine the resolution for the EFlow assessment (World Bank, 2018).

BIOLOGICAL ENVIRONMENT

4.11.27 The higher the FSL, the larger the area submerged, and accordingly the effect on vegetation and fauna is greater. The submergence has impact biodiversity of floodplain habitat and limited extents of woodland habitat, both of which are considered likely to be Natural Habitat[2] (as per ESS6). Estimates of habitat loss for the Project within the Area of Influence (AoI) are provided in **Table 4-3**.

Table 4-3 - Habitat types within the Project Area of Influence at 1290m asl

Habitat type	Area (ha)	Relative coverage within AoI (%)
Pasture	15650	55.6
Agriculture	5850	20.8
River/floodplain	4220	15

[2] Natural habitats 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 ecological functions and species composition (ESS6).

Settlements	2150	7.6
Woodland	283	1
TOTAL	28153	100

4.11.28 Following updated studies in 2023, an offset strategy will be required to deliver no net loss for small areas of floodplain and juniper woodland habitats. Estimates for habitat loss for juniper woodland for each project alternative are presented within **Table 4-4**.

Table 4-4 – Juniper Woodland habitat loss for FSL 1220m, 1255m and 1290m

	FSL 1220	FSL 1255	FSL 1290
Total loss (ha)	43.8	92.6	153
Relative loss (in terms of the study area/EAAA) - %	15.5	32.7	54
Relative loss compared to 1290m - %	28.8	60.5	100

EAAA = ecologically appropriate area of analysis as per PS6 etc.

4.11.29 Beyond this, and as also reported within the 2014 ESIA, the adverse impact on flora and fauna is predicted to be of minor significance (at worst), with minor positive effects also identified. Similarly, and as reported within the 2014 ESIA, aquatic biodiversity is limited in terms of conservation importance, and no significant impacts have been identified following studies in 2023.

4.11.30 Considering the comparison on environmental and social aspects presented above, the FSL 1290 alternative with an installed capacity of 3.600 MW provides additional downstream flood protection to the cascade and is better on most of the criteria except resettlement and loss of land. Therefore, FSL 1290 has been considered as preferred option.

4.12 COST OF PROJECT ALTERNATIVES

4.12.1 The TEAS analysed the Least Cost option for meeting the domestic power demand between 2014 and 2050. The assessment considered a regional power market modelling approach to quantify Total System Costs (TSC) in the interconnected Central Asian Power System and to determine the economic return of the Project. A scenario with the Project and two scenarios without the Project were considered. The TSC for Tajikistan was defined as the sum of annualised capital expenditure repayments, non-fuel operating and maintenance costs, fuel costs and flood protection benefits, less the net financial benefits from net exports.

4.12.2 The TSC savings provided by the Project compared to no Project range from approximately 1 to 1.5 billion USD, depending on the project configuration. Since Tajikistan has negligible known indigenous gas resources, the “No large storage hydro, with imported gas” scenario results in an overall increase in the TSC, hence the savings from the Project are comparatively greater.

4.12.3 The TEAS analysis established that the benefits of the Project exceed those of other feasible HPPs and thermal plants. Regardless of which design option is chosen, the Project will significantly enhance security of supply in Tajikistan throughout the entire forecasted period, contributing an average of approximately 30% of electricity needed to meet demand between 2020 and 2050.

4.12.4 According to the reports submitted in 2014 by Coyne et Bellier, Pöyry, Engineering and Dam Safety Panel of Experts Environmental and Social Panel of Experts for the Project, the economic and least cost planning results show a clear preference for the FSL 1290 dam option. This option was further tested for scenarios considering gas imports to Tajikistan, schedule delays, hydrologic variation, sales price variation, and delay in sales of exports from the Project. At a 10% discount rate the highest dam option proved particularly robust to a wide range of scenario sensitivities. As an example, given the challenge of cost forecasting for large hydro projects, the FSL 1290 project provides a positive economic return (10% discount rate) even for project cost overruns of 31%, in addition to the inherent 11% contingency allowance.

5 IMPACT ASSESSMENT METHODOLOGY

5.1 INTRODUCTION

5.1.1. This chapter outlines the approach to the ESIA. It describes:

- The approach to defining the existing and future baseline.
- The approach to defining the scope of the Project and the Area of Influence (AoI).
- The approach to consideration of impact mitigation measures.
- The assessment of the significance of effects, through consideration of the magnitude of impacts and the sensitivity of the receiving social and biophysical environments and values including Transboundary effects.
- The approach to the consideration of major risks and hazards.
- The approach to the consideration of cumulative effects.
- An overview of the approach to ESIA consultation.

5.1.2. The ESIA process is a systematic approach to predict and evaluate the likely significant effects that a Project could have on aspects of the physical, biological, social/socio-economic and cultural environment. It facilitates the identification of management measures that the Project needs to take to avoid, reduce, mitigate, offset, or compensate for adverse effects and enhance positive effects where practicable.

5.1.3. The broad ESIA process incorporates the following key steps:

- Establishment of the legal, regulatory, and administrative framework for the project.
- Development of a Project Description and identification and assessment of Alternatives.
- Stakeholder Engagement to ensure their interests are taken into consideration and responded to.
- Identification of physical, biological, socio-economic, and cultural conditions that currently exist and would be expected to prevail in the absence of the Project (i.e., the baseline environment).
- An impact assessment to assess the way the Project will affect the physical, biological, cultural, or human environment (otherwise known as Receptors), in particular the Valued Components (VC) of those receptors, to produce significant effects. The key steps in the assessment include:
    - Impact prediction: to determine what could potentially happen to VCs because of the Project and its associated activities.
    - Impact evaluation: to evaluate the significance of the predicted impacts by considering their characteristics, magnitude and likelihood of occurrence, and the sensitivity, and the value and/or importance of the affected VCs.
    - VC Sensitivity Evaluation using a ‘source-pathway-receptor’ model.
    - Evaluation of Significance: Magnitude and receptor sensitivity are looked at in combination to identify whether an impact will, or will not result in a significant effect, and if so its degree of significance (defined in terms of Positive, or Negligible, Minor, Moderate or Major Adverse).
    - Mitigation and enhancement: to identify appropriate and justified measures to avoid or mitigate significant adverse effects and enhance positive effects.

- Residual evaluation: to evaluate the significance of effects even with the implementation of the mitigation and enhancement measures.

- A high-level assessment of Major Hazards and risks of relevant major accidents and/or disasters resulting from natural or manmade hazards (including operational failure). The assessment of likely significant adverse effects takes into consideration the vulnerability of the Project to Major Events and the Project's potential to cause Major Events; and
- Cumulative Impact Assessment to identify and assess the contribution by the Project to cumulative impacts in the Project's AoI.

5.2 CURRENT AND FUTURE BASELINE

5.2.1. In general, the baseline is the social and environmental characteristics and conditions of the area likely to be affected that are present at the time of the assessment. Environmental and social baseline conditions, including those which are predicted, are assessed either using existing available data (i.e., secondary data) or through additional surveys, studies, or modelling (i.e., primary data).

5.2.2. The baseline, together with the extensive and ongoing consultation for the project, has been used to identify the VCs for each topic that may be directly or indirectly affected by the activities of the Project during construction and operation. Together, the VCs and their setting comprise the baseline for each topic.

5.2.3. Baseline conditions, their AoI and associated VCs are summarized in **Volume I, Chapter 7: Environmental and Social Baseline** and described in more detail in the Technical Annexes in **Volume II.**

CURRENT BASELINE

5.2.4. The Project site (construction areas) has been subject to construction of the hydropower dam over numerous decades. As such, the historic baseline is no longer reflective of the current Project conditions in these areas and therefore is no longer relevant for the purposes of this ESIA. In addition, resettlement and alteration of parts of the inundation zone has also occurred both historically, as well as in response to current construction.

5.2.5. The baseline for this ESIA is therefore considered to be the current conditions in existence at the site. Where practicable, historic information, including the baseline from previous ESIA reports and other technical documents has been used to develop the understanding of the historical development and context for the site against which the current conditions can be understood. In addition, this information has been supplemented by primary baseline surveys conducted in 2023.

5.2.6. The dates of site visits for primary data collection and the list of data sources are provided in the relevant Technical Annexes found in **Volume II**.

FUTURE BASELINE

5.2.7. Baseline conditions typically relate to characteristics and conditions at the time of the assessment, however, for developments with long construction periods, or which significantly alter the existing environmental and social conditions, a future baseline scenario may be used to assess operational effects.

5.2.8. Future baseline conditions are those which may be reasonably predicted to be the case at a specific point in the future of the project. The prediction of future baseline conditions can, in certain instances, provide for an improved understanding of a project's impacts, throughout the various stages of its implementation.

5.2.9. The Project has the potential to significantly alter the existing environment once completed and inundation of the flooding zone has reached its maximum level in 2032, about 10 years from the present time. Therefore, the prediction of future baseline conditions is relevant in this context to better understand the potential effects during operation.

5.2.10. Future baseline conditions may be established for individual environmental topic assessments as relevant. The current conditions are used to assess activities during the most recent stage of construction (2019 to 2023) and for inundation of the flooding zone (up to 2036). Where relevant, the stages of dam construction and their effects at each stage have also been considered.

5.2.11. Future baseline conditions will prevail for full operation of the Project once inundation is completed and the Project is in full operation, from 2036. Where future baseline conditions are applicable to a topic these are described in the relevant technical annex in **Volume II.**

5.3 DEFINING THE SCOPE AND AREA OF INFLUENCE

TEMPORAL SCOPE

5.3.1. The ESIA addresses effects that are anticipated to arise during the construction and operation. These effects can broadly be summarized as follows:

- Any effects during the construction period that may arise as a result of Project construction activities such as demolition, excavation, temporary use of land (e.g., for site compounds), construction of new buildings, changes in traffic movements and temporary closures or diversions to roads.
- Any effects during the construction period that arise due to other activities, including resettlement of households, construction of infrastructure in new locations, demolition of resettled villages, enhancement/restoration of livelihoods.
- Any effects during the operational period that may arise from operational activities such as changes in downstream water releases, seasonal changes in reservoir levels, emissions, materials use, waste generation, energy use, and vehicle movements to and from the Site.

5.3.2. Given the extended design life of the Project (115 years) and likelihood of continued maintenance to extend the lifetime of the project in the future, decommissioning is not considered in this ESIA. Where appropriate, the effects of decommissioning will be subject to an assessment of likely significant environmental and social effects under the Environmental and Social regulations and laws in place at that time.

5.3.3. The baseline year for the assessment of construction impacts is defined as the commencement of construction during Phase 2 (2019 to 2023) up to the period when construction is complete in 2029 and the reservoir is filled in 2036.

5.3.4. Operational impacts will be assessed for the full operation and inundation of the Project expected by 2036, unless stated otherwise with respect to a particular environmental and social topic within the corresponding chapters of this ESIA.

SPATIAL SCOPE

5.3.5. The Project footprint is defined in **Volume I, Chapter 3**. In general, the maximum extent of the Project footprint / height / depth / length of structures, and inundation zone including an area surrounding these have been used to define maximum operating parameters (spatial Area of Influence), to allow for a conservative worst-case scenario analysis of effects.

5.3.6. Transboundary effects have been identified for those receptors which may be affected by operational flows from the Vakhsh River, and under a cascade dam failure.

5.3.7. If the design were to evolve such that the Project location, physical or operational characteristics change significantly beyond that specified in **Volume I, Chapter 3** and therefore the spatial scope of the ESIA changes, then supplementary environmental and social assessment documentation may be required. This would be required to evaluate the design change and demonstrate that there has been no change to the potentially significant environmental and social effects associated with the Project. The supplementary assessment documentation would also identify any further mitigation that may be required however this is not expected at this time.

5.3.8. The spatial scope of the study area for the ESIA will vary, according to the specific assessment requirements for each ESIA topic. The study areas for each topic are outlined in full in the appropriate Technical Annex in Volume II and summarized in **Volume I, Chapter 7** of this ESIA.

5.4 APPROACH TO MITIGATION

5.4.1. The ESIA will identify and evaluate measures that would avoid, reduce, or offset the significant adverse effects of the Project. The preferred hierarchy of mitigation is as follows:

- Avoidance of the effect.
- Minimize the effect.
- Mitigate the effect.
- Offset and/or compensate the effect.

5.4.2. Where the design of the Project has not resolved potentially significant effects, control and mitigation measures will be identified and outlined in corresponding topic chapters and annexes. These measures will relate to actions required to meet the applicable project standards and Good International Industry Practice (GIIP).

5.4.3. As part of the design and implementation of Stage 1 of the construction, many management measures have already been incorporated into the Project (e.g., design factors for climate change).

5.4.4. Following the assessment of effects on VCs, additional mitigation will be outlined to minimize adverse effects or enhance beneficial effects.

5.4.5. The additional mitigation measures reported within the topic chapters will be identified and included in the ESMP.

5.5 ASSESSMENT METHODOLOGY

5.5.1. To establish the scope of the Project features and activities, with particular reference to the aspects which may impact the VCs, a Project Description has been developed in sufficient detail to:

- Describe, at a level that can be understood, the features and activities proposed by Project.

- Facilitate a comprehensive identification of the potential interactions between Project activities and VCs, and the impacts and likely significant effects that could result from those interactions.

5.5.2. The Analysis of Alternatives enables Environmental and Social risks to be considered in the early stages of project planning as well as the later stages of design and implementation and describes the basis of selection of preferred alternatives at all stages of the Project. The objectives of Project alternative analysis are:

- To describe the basis of selection of preferred alternatives including location, technology, and design; and
- To provide the information of the analysis required in confirming its conclusions and methods to compare Project alternatives.

Because the Project was designed decades ago and construction is well underway, there is no longer opportunity for considering alternative locations or major changes in design. To the extent possible, the 2014 TEAS and ESIA evaluated various alternatives, and that evaluation is largely retained in this updated ESIA.

5.5.3. A summary of the Project facilities' design characteristics, planned Project activities and consideration of Project Alternatives, are provided in **Volume I, Chapter 3** and **Volume I, Chapter 4** respectively.

5.6 IMPACT ASSESSMENT

5.6.1. Prediction of impacts is a systematic exercise to determine what could potentially happen due to the interaction of the Project and its activities with the physical, biological, cultural, and human environments.

5.6.2. The diverse range of impacts considered in the impact assessment process results in a wide range of prediction methods being used, including quantitative, semi-quantitative and qualitative techniques.

5.6.3. It is important to note that the impact prediction should consider any management measures already included as part of the Project design and construction implementation.

IMPACT EVALUATION

5.6.4. Once the prediction of potential impacts is complete, each impact (identified as Impact Factors) is described in terms of its relevant characteristics. The purpose of the assessment is to identify and evaluate the magnitude of potential impacts on identified VCs (refer to **Table 5-1**).

Table 5-1 Impact Evaluation

Characteristic	Definition	Designation
Type	The type of change (or impact) may be positive, neutral or negative.	Positive; or Negative
Extent	Spatial extent (e.g., habitat impacted) or population extent (e.g., proportion of the population/community affected).	Local Regional National

Characteristic	Definition	Designation
		Transboundary
Duration	Period over which an impact will interact with a receptor.	Short-term Medium-term Long-term Permanent
Frequency	How often the impact will occur.	Infrequent Periodic Constant
Likelihood	What is the chance of the predicted impact occurring during the project lifetime.	Certain Likely Unlikely
Reversibility	Restoration of the pre-impact status of a receptor.	Reversible Irreversible

5.6.5. Once the impact is evaluated based on its characteristics, each potential impact is assigned a "magnitude". Magnitude describes the intensity of the change that is predicted to occur on the VC because of the potential impact. The definitions for these magnitude designations are defined as:

- Beneficial.
- Very Small adverse.
- Small adverse.
- Medium adverse.
- Large adverse.

5.6.6. An assessment of the overall magnitude of an impact is provided by considering all the dimensions of the impact described. In the case of a potential positive effect, no magnitude designation (aside from "beneficial") is assigned. It is considered sufficient for the purpose of the ESIA to indicate that the Project is expected to result in a potential positive effect, without characterizing the exact degree of positive change likely to occur.

DETERMINING VALUED COMPONENTS AND THEIR SENSITIVITY

5.6.7. Once the magnitude of an impact is determined, it is necessary to understand the significance of the impact. A 'source-pathway-receptor' is used to determine the VC's sensitivity:

- Source - the origin of a potential impact for a certain magnitude (i.e., an activity such as earthworks and a resultant effect, such as contaminated run-off from the earthworks).
- Pathway - how the effect of the activity could impact a receptor (e.g., for the example above, changes to the water quality in the receiving waters).

- VC (receptor) - the element of the receiving environment that is impacted (this could either be a component of the physical, ecological, or human environment such as water quality, e.g., for the above example, species living on or in the water body).

5.6.8. The VC sensitivity is based on two components:

- Value attributed to the VC by stakeholders or applicable regulations/policies.
- Degree to which a VC is resilient to a change.

5.6.9. The value considers whether, for example, the VC/receptor is rare, unique, has protected or threatened status, has importance at a local, regional, national, or international scale and, in the case of biological VCs, whether the species has a key role in ecosystem function.

5.6.10. The ability of a VC to adapt to change, tolerate, and/or recover from potential impacts is key to assessing its sensitivity to the impact under consideration. The overall VC sensitivity is determined by considering a combination of value, adaptability, tolerance, and recoverability. This is achieved through applying known research and information on the status and sensitivity of the feature under consideration coupled with professional judgement and experience.

5.6.11. VC Sensitivity is categorized as:

- Low Sensitivity – for example, common species; found in abundance; not a large population/mass affected; can recover from the impact.
- Medium Sensitivity – for example, common species; affected in large numbers/mass/area and takes a long time to recover.
- High Sensitivity – for example, where the VC is Internationally / nationally important, peculiar to the area affected, large population is impacted, and does not have capacity to recover.

EVALUATION OF SIGNIFICANCE

5.6.12. The significance of the effect is predicted as presented in the matrix provided in **Table 5-2**. For the purpose of this ESIA, major and moderate impacts are deemed to be significant, while minor impacts are not considered significant.

5.6.13. The evaluation of impacts presented in the ESIA is based on professional judgement and experience, informed by legal standards, national and regional government policy, current industry good practice and the views of stakeholders. Where specific standards are either not available or provide insufficient information on their own to allow grading of significance, the evaluation of significance has considered the magnitude of the impact and the quality, importance, or sensitivity of the affected VC.

5.6.14. Magnitude and receptor quality/importance/sensitivity are looked at in combination to evaluate whether an impact is, or is not, significant and if so its degree of significance (defined in terms of Positive, Negligible, Minor, Moderate or Major). Impacts classed as negligible include those that are slight or transitory, and those that are within the range of natural environmental and social change.

5.6.15. Where the assessment identifies that an aspect of the development is likely to give rise to significant effects, additional mitigation measures are identified to avoid, prevent, or reduce impacts to acceptable levels.

5.6.16. Following initial assessment, if the effect does not require additional mitigation (or none is possible) the residual impact will remain the same. Where mitigation measures are identified, impacts are re-assessed, and all residual impacts clearly described.

Table 5-2 Impact Significance Matrix

Impact Magnitude	VC / Receptor Sensitivity		
	Low	**Medium**	**High**
Beneficial	Positive	Positive	Positive
Very Small	Negligible	Negligible	Minor
Small	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
Large	Moderate	Major	Major

5.7 CUMULATIVE IMPACT ASSESSMENT

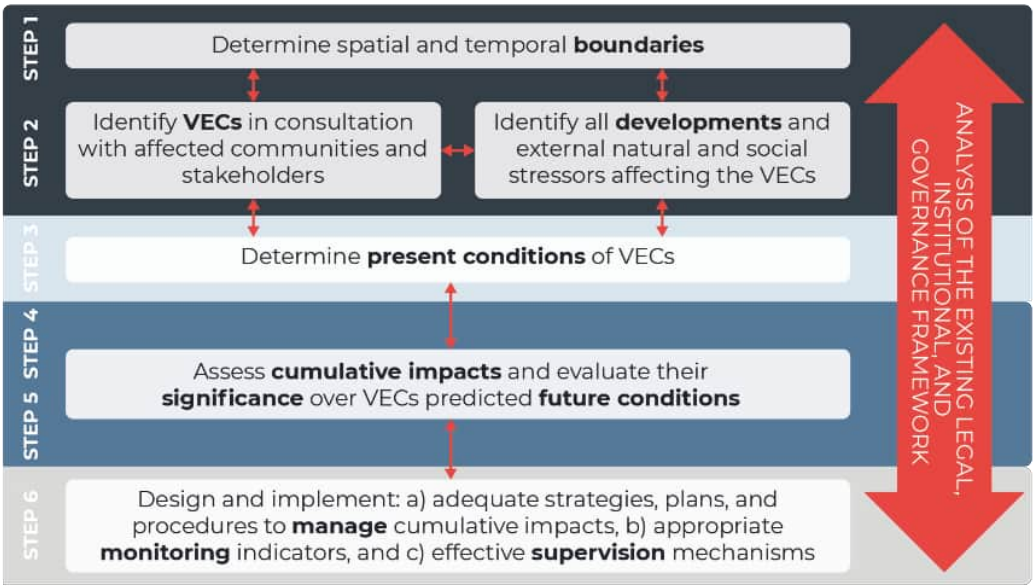
5.7.1. Cumulative impacts are those that arise due to an impact from the Project interacting with an impact from another non-Project activity to create an additional or more significant impact. A Cumulative Impact Assessment (CIA) is an assessment of these impacts.

5.7.2. Environmental and social impacts arising from existing, planned, and foreseeable future developments within the Project AoI might individually be insignificant, but when combined, could amount to a significant cumulative effect. Direct and indirect effects of the Project have been defined in Volume I, Chapter 8 and Volume II.

5.7.3. The assessment of cumulative impacts is an integral part of the ESIA process to ensure that multiple effects on people, heritage and environmental receptors arising from the Project combined with impacts from other projects/activities have been identified and addressed.

5.7.4. The methodology to complete the CIA in this ESIA is consistent with the IFC Rapid Cumulative Impact Assessment (RCIA) method as presented in Figure 5-1.

Figure 5-1 IFC's Six Step Approach to RCIA (IFC, 2013)



5.8 TRANSBOUNDARY IMPACT ASSESSMENT

5.8.1. The objective of the transboundary assessment is to identify and assess potential risks and impacts that occur in airsheds, watersheds, landscapes, habitat types, and/or migratory species that cross international boundaries.

5.8.2. In the context of the Project, the transboundary risks and impacts are driven by the requirement to manage the hydrological regime to avoid impacts on downstream countries and users.

5.8.3. The assessment considers the characteristics of the Project, location of Project and geographical area, environmental importance of AoI, potential impacts, extent, magnitude, probability, duration and frequency to establish a view on whether a transboundary impact is expected.

5.8.4. Transboundary impacts are described in **Volume 1 – Chapter 8** of this ESIA.

5.9 STAKEHOLDER ENGAGEMENT

5.9.1. Stakeholder engagement is the act of communicating with stakeholders to ensure their interests are taken into consideration and responded to and forms an integral part of the impact assessment process. It provides an opportunity to share information with stakeholders, to receive information from stakeholders, and to identify stakeholder concerns.

5.9.2. These concerns are fed into the assessment process, so that they can be systematically considered and mitigated or managed. Engaging stakeholders early provides the opportunity to recognize and then avoid or otherwise address potential issues early and prevent them from becoming bigger issues that can impact the success of a project.

5.9.3. Good relations between a project and its surrounding communities and relevant stakeholders are an essential condition in acquiring what is known as the "social license to operate."

5.9.4. Stakeholder engagement may be achieved by:

- Providing relevant information to stakeholders in a timely manner.

- Receiving relevant information from stakeholders in a timely manner.
- Facilitating two-way discussions to identify and address stakeholder issues.
- Feeding stakeholder issues and priorities into program decision-making processes and demonstrating how stakeholder concerns have been addressed, including changes in Project decision making;
- Maintaining a mechanism for grievances to be raised and resolved in a timely manner.
- Involving affected stakeholders in monitoring the implementation of mitigation measures or other environmental and social programs; and
- Reporting and follow-through to the stakeholders.

5.9.5. In achieving an effective stakeholder engagement, the Project has committed to an ongoing consultation and engagement process throughout all phases of the development. The process focuses on a broad range of activities, including information sharing, consultation to negotiation and partnership building and is captured in an existing Stakeholder Engagement Plan (SEP). The SEP is a live document, and as such it will continue to evolve as engagement is conducted.

5.9.6. **Volume I, Chapter 06** provides a summary of the stakeholder engagement activities and plan for the Project.

6 STAKEHOLDER ENGAGEMENT

6.1 INTRODUCTION

6.1.1. Stakeholder engagement is critical in the Environmental and Social Impact Assessment (ESIA) process, acting as an essential channel for meaningful involvement and collaboration among stakeholder groups.

6.1.2. Stakeholder engagement within the ESIA process fosters inclusive and participatory decision-making, ensuring that stakeholders' perspectives are considered and integrated into Project planning and implementation. By engaging stakeholders, the ESIA aims to identify any issues and concerns related to the Project's likely significant environmental and social effects and identify opportunities for sustainable development.

6.1.3. This chapter presents a summary of relevant engagement from the **Stakeholder Engagement Plan (SEP)** prepared as part of the ESIA and includes an overview of the stakeholder analysis, engagement and consultation activities undertaken to date, and the key issues raised around the Rogun HPP Project.

6.1.4. This chapter also presents the planned engagement program which will be implemented throughout the Project lifecycle including during the disclosure phase and construction and operational phases. As with the other environmental and social management plans (ESMPs) included within the ESIA, it will be the duty of the PMG as the recipient of the loan to implement and update the accompanying SEP in conjunction with other key implementing agencies of the Project, including DFZ and Rogun JSC.

6.2 PRINCIPLES OF STAKEHOLDER ENGAGEMENT

6.2.1. The stakeholder engagement process for the Project aims to establish effective communication channels and collaborative relationships with a diverse range of stakeholders. The process is iterative and aims to ensure transparency, inclusivity, and responsiveness throughout the Project's lifecycle, while respecting the unique needs and perspectives of each stakeholder group.

6.2.2. This approach is guided by several principles, including facilitating meaningful participation, promoting socio-economic development, and safeguarding the environment and the well-being of affected communities.

6.2.3. The stakeholder engagement strategy recognizes the importance of engaging transboundary governments, national bodies, contractors, workers, affected communities, and other relevant stakeholders, to ensure their active involvement and to address their concerns and aspirations. By incorporating these principles, the ESIA process endeavors to foster sustainable development and create a positive experience for all stakeholders involved.

6.3 METHODOLOGY

6.3.1. To ensure effective stakeholder engagement, the Project is dedicated to an ongoing process of consultation and engagement across all development phases. This ESIA incorporates a comprehensive approach to stakeholder engagement, including the development of the SEP to ensure effective communication and collaboration with all affected parties.

6.3.2. This process encompasses various activities such as information sharing, consultation, negotiation, and partnership building. The SEP is a dynamic document outlining the strategies, methods, and timelines for engaging stakeholders throughout the assessment process. This aims to identify and understand the diverse perspectives, concerns, and interests of stakeholders, allowing for their meaningful participation in decision-making.

6.4 REGULATORY CONTEXT

6.4.1. Tajikistan has a regulatory framework in place that governs stakeholder consultation and disclosure requirements for large-scale infrastructure development Projects. The Project's compliance with the relevant legislation is crucial to ensuring transparency, accountability, and meaningful stakeholder engagement throughout the ESIA process. Key laws and regulations are outlined in **Volume 1: Chapter 2** of this ESIA.

6.4.2. In addition to the national requirements described above, the Project is also being developed in accordance with several international standards and guidelines. These are described in **Volume 1: Chapter 2** of this ESIA.

6.5 STAKEHOLDER ENGAGEMENT PROCESS

6.5.1. Stakeholder engagement has been an ongoing process as part of the World Bank's Technical Assistance (TA) program which aims to support the Government of Tajikistan in improving the financial, commercial, environmental, and social frameworks of the Rogun HPP Project. The TA commenced with the completion of an ESIA and Techno-Economic Assessment Study (TEAS) between 2011-2014, through which extensive consultations were undertaken relating to the ongoing resettlement of affected communities.

6.5.2. More recently as part of the TA a SEP was produced in June 2022 for the Project's financing framework which will be deployed in conjunction with the 2023 SEP as part of this updated ESIA.

6.5.3. The SEP of the TA focused largely on institutional stakeholders, including potential financiers and government bodies, and throughout 2021 and 2022 in preparation of the report representatives of the PMG engaged with several national authorities and international finance institutions to discuss the economic feasibility of the Project.

6.5.4. The SEP for the Project is intended to define in greater detail, the environmental and social (E&S) risks and impacts on all parties that may be affected by the Project and will design and lay-out the commitments of the PMG relating to stakeholder engagement, consultation, and disclosure for the entire Project, including throughout construction, operation, and resettlement activities.

6.6 STAKEHOLDER IDENTIFICATION AND ANALYSIS

6.6.1. The identification of stakeholders plays a pivotal role in facilitating meaningful engagement throughout the Project. This process involves a systematic approach to identify individuals, groups, organizations, and communities that could be impacted by or hold an interest in the Project.

6.6.2. Through a thorough review of Project plans, objectives, and potential impacts, stakeholders have been categorized based on direct and indirect effects, considering both environmental and social aspects. A systematic approach has been used to map the stakeholders based on the Project Social

Area of Influence (AoI), identifying stakeholders by area of impact. Project stakeholders have been categorized into two main groups[1]:

- **Project's Affected Parties** – Individuals and groups, including local communities, who may be affected by the Project due to actual impacts or potential risks to their physical environment, health, safety, cultural practices, well-being, or livelihoods.
- **Other Interested Parties** – Persons, groups, or organizations with an interest in the Project, which may arise from the location of the Project, its characteristics, impacts, or issues of public interest.

6.6.3. The list of key stakeholders identified and their interests in the Project is presented in Table 6-1 below.

Vulnerable Groups

6.6.4. Project-specific vulnerable groups have been identified based on the household survey data, focus group discussions and secondary data sources. The following groups have been identified as vulnerable in relation to the Project:

- **Elderly** – Households with members aged over 60 living in the resettlement areas that require additional care. The household survey found that 7.8% of households have a member that is over the age of 60. The health of some of them could be negatively affected due to relocation and the caring burden on families could increase.
- **Persons with disabilities and chronic illness** – The household survey found that 20% of households have members with disabilities or suffer from chronic illnesses. These PAPs who may need to relocate and may find the move difficult or may become increasing vulnerable to Project impacts in terms of their health due to their sensitive physical and wellbeing status.
- **Women-headed households** - Widowed women with no provision of social security, or women headed households if they are categorized as 'Poor.' The proportion of female-headed households within the Project affected area is 17.8% and additionally several men have migrated abroad in search of jobs leaving women as sole care givers for children and elderly family members.
- **People living below the poverty line** – Households whose yearly income is below the national average income levels or minimum wage, are reliant on social assistance/social aid or have insufficient money for food. The household survey revealed that 40 % of the sample population earn less than yearly minimum wage (600 TJS monthly). One third of the households indicated that they are struggling to buy food due to insufficient family income.
- **Children** – Children in households of resettlement and displacement are particularly vulnerable and may find the move difficult, which has the potential to affect their physical and mental well-being.

[1] World Bank Environment and Social Framework (2017). Available at: https://thedocs.worldbank.org/en/doc/837721522762050108-0290022018/original/ESFFramework.pdf

- **Relocated households** – An estimated 46,000 PAPs are being physically displaced as a result of the dam and reservoir. Resettled persons are subject to both economic and physical vulnerability.

6.6.5. If other groups, such as ethnic minorities, are identified as potential affected stakeholders throughout the various stages of the Project, the SEP will be updated to reflect this. See the SEP for the full list of vulnerable groups.

Indigenous Peoples

6.6.6. There is no universally accepted definition of 'Indigenous Peoples.' However, according to the World Bank ESS7, the term 'Indigenous Peoples' is used in a generic sense to refer exclusively to a distinct social and cultural group possessing the following characteristics in varying degrees[2]:

- Self-identification as members of a distinct indigenous social and cultural group and recognition of this identity by others.
- Collective attachment to geographically distinct habitats, ancestral territories, or areas of seasonal use or occupation, as well as to the natural resources in these areas.
- Customary cultural, economic, social, or political institutions that are distinct or separate from those of the mainstream society or culture.
- A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.

6.6.7. At this stage of the Project, based on the World Bank definition, no Indigenous Peoples have been identified as potentially affected stakeholders in relation to the Project.

[2] World Bank Environmental and Social Framework (2017). Available at: https://thedocs.worldbank.org/en/doc/837721522762050108-0290022018/original/ESFFramework.pdf

Table 6-1 Stakeholder Groups and Interest within the Project

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
National Stakeholders	Project's Affected Parties	Project Management Group (PMG)	PMG for Energy Facilities Construction under the President of the Republic of Tajikistan is the implementing entity for Rogun HPP Project.	Regular meetings with all stakeholders, including government officials, to discuss Project progress and address concerns. Conducting open forums and workshops to provide updates on the ESIA process and gather feedback.
	Project's Affected Parties	Committee for Environment Protection Under the Government of Tajikistan	The committee's major duty is the implementation of public policy in the field of environmental protection, protection of forestry, securing protected natural areas, hydrometeorology, and rational resource use. The committee has a function of control over environmental protection practice, use of natural resources and monitoring compliance with environmental requirements.	Formal consultations and workshops to discuss the Project's potential impacts and proposed mitigation measures. Providing written reports and documentation to relevant ministries to keep them informed. Official letters and emails to the relevant National Government Authorities as required.
	Other Interested Parties	Ministry of Finance	The Ministry oversees handling all international financial matters, spending, financial services policy, organizing funding for various programs; addressing domestic policy and delivering strategies to ensure domestic economic growth.	
	Other Interested Parties	Ministry of Energy and Water Resources	The Ministry is in charge of developing and implementing policies in the field of energy and water resources.	
	Other Interested Parties	Ministry of Economic Development and Trade	Ministry develops public policy in the field of social-economic sector, implements public policy, norms, and regulations in the field of analysis and development of	

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
			strategies of social-economic development of the country.	
	Other Interested Parties	Ministry of Labor, Migration and Employment of Population of the Republic of Tajikistan	Responsible for labor standards and market. Interested in creating jobs and monitoring compliance with the provisions of the labor code.	
	Project's Affected Parties	State Enterprise of Directorate for Flooding Zone of Rogun HPP (DFZ)	Responsible for developing and implementing the resettlement and livelihood restoration program.	
	Project's Affected Parties	Local Authorities	Local authorities of host communities require additional resources and facilities to support the influx of resettled households.	Face-to-face meetings to explain the Project's objectives, potential impacts, and benefits for their communities. Encouraging community members' participation in discussions and decision-making.
	Project's Affected Parties	Public Security (Military guards)	Provision of security for the Rogun HPP construction sites.	Specialized meetings on security aspects.
International Organizations	Other Interested Parties	Interstate Commission for Water Coordination (ICWC)	Collective body of Central Asian States to coordinate water allocations and improve the principles of common water resources management and measures.	Joint meetings and consultations. Addressing cross-border environmental concerns.
	Other Interested Parties	International Labour Organization (ILO)	Can provide insights into labor practices and issues in Tajikistan. Promote labor rights, encourage decent employment opportunities, enhance social protection, and strengthen dialogue on work-related issues e.g.,	Official letters and emails. Press conferences and roundtables.

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
			children's rights, forced labor etc. Ensure compliance with ILO conventions and guidelines.	
Riparian Countries	Project's Affected Parties	Government of Uzbekistan	Potential beneficiaries of power and water management improvements. Concerns over dam safety and continued availability of water flows for commercial agriculture.	Transboundary roundtable meetings and press conferences on Project updates. Consultations with Riparian countries. Joint impact assessments and planning.
	Project's Affected Parties	Government of Kazakhstan	Potential beneficiaries of power. Concerns over water availability. Highly interdependent with regard to water and energy resources.	
	Project's Affected Parties	Government of Afghanistan	Potential beneficiaries of power. Part of the Amu Darya River basin.	
	Other Interested Parties	Government of Kyrgyzstan	Part of the Amu Darya River basin and highly interdependent with regard to water and energy resources. However, limited potential effects due to upstream position.	
	Project's Affected Parties	Government of Turkmenistan	Share the river basin of Rogun HPP. Highly dependent for irrigation on flows from the upstream countries.	
	Project's Affected Parties	Transboundary Project-Affected Persons (PAPs)	Concerns over dam safety, water management and reservoir operation, implementation and risks, environmental and social impacts.	

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
Contractor Management	Project's Affected Parties	Rogun JSC	Manages all contractors and subcontractors. Rogun JSC report monthly to the PMG on technical progress, however, they are also in day-to-day communication with PMG.	Periodic meetings on Project developments and Worker Grievance Procedure.
Rogun HPP Contractors and subcontractors	Project's Affected Parties	JSC "Sokhtmoni Asosi" JSC "Tojikhydroelektromontazh" (TGEM) JSC "Tojikhydromontazh" (NGM) LLC "Mirshah Construction" LLC "Elitstroy" LLC "Yoqubjon 2016" LLC "Inventor" LLC "Nursoz" LLC "Samand Construction" LLC "Nekzod" LLC "Jom-co"	Directly affected by decisions regarding financing, continued construction, changes in contract terms. Technical understanding of the range or issues associated with Rogun HPP, including financial issues.	Bulletin updates (via email, SMS & notice boards) on Project developments and Worker Grievance Procedure. Training on social and environmental responsibilities. Worker feedback mechanisms.

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
		LLC “Binokor”		
		LLC “Farrab”		
		LLC “Development of mountain areas”		
		LLC “Sahili-Nur”		
		JSC “ZTM (EMZ)” Norak		
		LLC “Repair and protection of concrete”		
		LLC “Nur-81”		
		LLC “Nurafzo 2010”		
		LLC “Hydromontage of Central Asia”		
		FC “EKK No. 3”		
		JSC “TojikSGEM”		
		LLC “Farkhunda-2014”		
		LLC “Expert-Sanoat”	Directly affected by decisions regarding financing, continued construction, and changes in contract terms.	
		LLC “Khurshed-2000”		

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
		LLC “Hingob”	Technical understanding of the range or issues associated with Rogun HPP, including financial issues.	
		LLC “Bunyodi Rogun”		
		LLC “Hydrospecproject”		
		LLC “Orui Ahmad”		
		JSC “TADES”		
		LLC “Usmon-2007”		
		LLC “Rogun-Sokhtmon”		
		LLC “Orion Sokhtmon”		
		LLC “SKIF”		
		LLC “Intersokhtmon”		
		Trevi company (Trevi)-Webuild		
		LLC “Energostroy-LTD”		
		FJSP “Tunel Saddi Ariana”		
		JSC “Hydroproject Institute”		

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
		LLC "Westtransstroy"		
		Webuild (SALINI)		
		JSP FSHM "Somoniyan"		
		Tractebel-Elektroconsult		
		JSC "Tojik Kon"		
		LLC "Vahsh-Sokhtmon"		
		Afry Design Company (AFRY)		
		FJSP "Khokrud"		
		FJSP "Tono Energy Engineering Company"		
Construction Workforce	Project's Affected Parties	Construction workers on site	Directly affected by decisions regarding financing, continued construction, changes in contract terms. Technical understanding of the range or issues associated with Rogun HPP, including financial issues. Risks associated with construction and operational phase of the Rogun HPP, including work accidents (use of explosives), occupational diseases (skin irritation, noise, etc.), contamination of soil, water, and health due to hazardous and non-hazardous waste.	Bulletin updates (via email, SMS & notice boards) on Project developments and Worker Grievance Procedure. Training on social and environmental responsibilities. Worker feedback mechanisms.

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
Impacted Community Members	Project's Affected Parties	Mayor of Rogun Town	Represent affected people and pool of potential employees. Facilitator for local development opportunities.	Consultation meetings and workshops. Information dissemination in local government channels. Official letters and emails.
		Hukumats and Jamoats of all affected villages: ▪ Mujikharf; ▪ Khakimi; ▪ Qal'ai Surkh; ▪ Mehrobod; ▪ Nusratullo Maksum; ▪ Khumdon; ▪ Safedchashma; ▪ 10 Years of Independence; ▪ Jura Rahmonov; ▪ Buston; ▪ Obi Mehnat; ▪ Sicharogh; ▪ Navobod village; ▪ Boqi Rahimzoda; and	Support for Project implementation at the local level, including allocation and withdrawal of land use rights. Protect the rights of inhabitants in the Project area. Represent local communities and PAPs. Receive and address any feedback and grievances from communities.	Face-to-face consultation meetings and workshops. Information dissemination in local government channels.

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
		▪ I. Halimov.		
		Population of Rogun Town	Livelihood impacts (loss of land, assets, infrastructure etc). Directly affected by the construction of civil works (noise, dust air quality), presence of work camps and influx of workers. May be affected by the long-term operations of the Vakhsh cascade principally by changes to water availability downstream of the dam(s). May be indirectly affected by economic development triggered by Rogun HPP. Receive the direct benefit of assured electricity supply after the Project is completed. Employment opportunities. Pressure on community services.	Regular face to face meetings and focus groups with individuals and communities to ensure that local communities concerns are understood. Bulletin updates about potential disruptions, health and safety risks and construction activities prior to any planned activities or changes.
		Resettled Communities	Physical and economic displacement due to being resettled. Livelihood Impacts (loss of land, assets, infrastructure etc).	Regular face to face meetings and focus groups with individuals and communities to ensure that local communities concerns are understood.
		Host Communities within New (Relocation) Sites	Potential effects associated with the influx of resettled households on host communities. Concerns over increased pressure on local infrastructure and public facilities due to influx of resettled communities.	Regular face to face meetings and focus groups with individuals and communities to ensure that local communities concerns are understood.

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
		Other Local Communities Living within the Project Area of Influence	Labor and service provision opportunities. Benefit from stable electricity supply. Positive and negative impacts associated with the development of the region. Livelihood impacts associated with rise in water levels e.g., recreational fishing. Potential impacts due to construction of associated facilities e.g., road closures.	Community consultations and town hall meetings. Project leaflets.
		Local Businesses	Economically interested business entities (conclusion of contracts, economic damage due to competition, etc.). Benefit from stable electricity supply.	Community consultations and town hall meetings addressing potential impacts on local enterprises. Project leaflets.
		Children and Young People	Risks associated with child labor, community resettlement and the relocation of schools. Young people may require additional assistance in finding a job in their new location.	Liaise with local universities on potential graduate employment opportunities and capacity building, where suitable attend careers fairs and face to face meetings.
		Women-Headed Households	Women-headed households may be more adversely impacted by the need to resettle and build their new houses, for example due to reduced ability to source labor from within the household if there are no or few adult males present. Women may have reduced input into decision making if consultations are not designed and scheduled to be convenient for both men and women in terms of timing and location. Women also have higher rates of economic inactivity and lower levels of higher	Women-only focus groups and consultations. Female focal points within each district to encourage women to raise any potential concerns.

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
			education relative to men, and more likely to generate income from informal activities. The influx of Project workers also increases risks of Gender-based violence.	
		Persons with disabilities (incl. long-term chronic illness)	Engagement can be challenging as persons with disabilities may be 'invisible' due to social taboos. Their physical and/or psychological conditions may require specific engagement methods.	Accessible engagement methods, such as providing written materials in accessible formats. Focus group discussions with visual aids and resources. Short radio programmes, video materials or documentary broadcasts on TV.
		Elderly People	Accessibility issues in relation to engagement. Particularly vulnerable to resettlement as may have cultural ties and/or connections to the land.	
Institutional Funding and Technical Assistance	Other Interested Parties	World Bank	Interested in the successful development of the Project and the achievement of development goals. Ensure applicable international EHS standards and safeguards are applied and maintained throughout all stages of the Project.	Periodic meetings to discuss updates on Project development.
International Finance Institutions and Donors	Other Interested Parties	European Union	Potential financial support and funding of the Rogun HPP and supervision of compliance with applicable international EHS standards.	Bi-annual virtual meetings, emails, and occasional face to face meetings to discuss updates on Project development.
		European Investment Bank		
		Asian Infrastructure Investment Bank		
		Asian Development Bank		
		USAID and US Embassy		

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
		Islamic Development Bank		
		Eurasian Development Bank		
		Kuwait Fund for Arab Economic Development		
		Saudi Fund for Development		
		UK Foreign, Commonwealth and Development Office		
		European Bank for Reconstruction and Development		
		Kreditanstalt für Wiederaufbau		
Other relevant parties	Other Interested Parties	International NGOs (e.g., Human Rights Watch) and National NGOs (e.g., Peshsaf)	Monitor Project performance in areas of their respective concerns. Represent the interests of different interested parties. Concerns over ensuring the protection of biodiversity, human rights, labor rights etc.	Liaise face to face with NGOs on social issues such as health, safety, security, local livelihoods, gender-based violence and harassment. Sharing draft ESIA reports for feedback.

Type	Stakeholder Category	Name	Role / Influence on Project	Method of Engagement
		Subject Matter Experts (e.g., Academics and Journalists)	Scientific understanding of the potential concerns regarding environmental and social impacts associated with the Project. Potential educational/outreach opportunities to increase awareness and acceptance of the Project.	Regular press releases to disclose Project information. Post regular updates on Project website.
		Mass Media	Intermediaries for informing the general public about planned activities and information disclosure concerning Project developments.	
		International Hydropower Association (Industry Peers, Competitors, and Associations)	IHA champions best sustainable practices within the hydropower sector through advocacy, research, and policy initiatives. IHA members include the world's leading hydropower developers, operators, and manufacturers. Additionally, the IHA developed its own sustainability standards in 2021. Therefore, the IHA sustainability standards can be a helpful reference for the Rogun HPP.	Roundtables and press conferences on Project updates. Sharing draft ESIA reports for feedback.

6.7 STAKEHOLDER ENGAGEMENT CONDUCTED TO DATE

HISTORICAL ENGAGEMENT

6.7.1. The Rogun HPP was first conceptualized in the 1970s. Construction activities on the Rogun HPP commenced in 1982 but halted in 1992 due to collapse of Soviet Union and civil war in Tajikistan. Due to subsequent damages to the Project resulting from both a flooding event and an earthquake, construction of the dam, and associated resettlement activities, only recommenced in 2008.

6.7.2. Between 2008-2011, the Resettlement Unit managed the resettlement program of the Project and led a series of community consultations as part of the process. However, during this period prior to the formation of the DFZ in 2011, there are limited stakeholder engagement records available. Nonetheless, it is clear the Project was well-known to people throughout Tajikistan due to its strategic importance and scale.

PREVIOUS ENGAGEMENT UNDERTAKEN BY DFZ

6.7.3. Since its official formation in 2011, DFZ have undertaken a series of consultation meetings with communities affected by resettlement between 2011 and 2023. No consultations were conducted during 2020 due to COVID-19 related restrictions. DFZ chair had arranged the community consultations by coordinating with the local authorities and Jamoat Heads prior to the upcoming sessions. The Jamoat Heads informed each household within the settlement about the date, time, and objectives of the meeting, which are held in large community spaces such as mosques, tea houses or schools to ensure maximum participation from local residents. This process is also supported by the DFZ representatives based in each district who also notify people of upcoming consultations.

6.7.4. During the consultation sessions, a summary of the key discussion points, questions and concerns are recorded in note form (minutes are not typed or recorded). However, these notes have not been recorded and stored systematically by DFZ. Notes of 59 of these consultation sessions with communities affected by resettlement between 2011 and 2023 were obtained. Overall, the key risks highlighted by communities are primarily regarding the resettlement process. This includes:

- Concerns over availability and timing of public infrastructure (e.g., schools, roads, mosques, cemeteries, libraries, sports fields) and utilities (e.g., electricity, drinking water, irrigation water) in new settlements.
- Compensation amounts, adjustments (e.g., in line with changing item costs and inflation), and payment schedule.
- Amount of agricultural land being provided in resettlement locations for themselves and family members.
- Livelihood restoration requests, such as building of bakeries and workshops for sewing.
- Low incomes of certain impacted households and registration for social support services.

6.7.5. The consultations carried out by DFZ have only been with communities impacted by resettlement, and primarily those being or having been resettled. To date, they have carried out limited consultation with host communities, communities to be located in the buffer zone of the reservoir, and downstream communities.

DFZ ENGAGEMENT UNDERTAKEN AS PART OF THE 2014 ESIA

6.7.6. Under the World Bank's previous technical assistance and the 2014 ESIA and TEAS, a resettlement framework and associated action plans were developed to guide the resettlement of communities. Under this framework, two resettlement action plans (RAPs) were developed, RAP 1 and 2018-2025 RAP 2 which have been used to guide resettlement activities.

6.7.7. A program of stakeholder engagement was undertaken during RAP 1 resettlement, which was initiated by DFZ and the local Jamoats and was also undertaken by the ESIA team. This included consultation with Project affected persons (PAPs) during RAP 1 to consider their views and to provide them with a choice of prepared resettlement sites. The active participation of Project-Affected Persons (PAPs) was essential for resettlement site selection, community infrastructure and amenities planning and construction, and crop and tree value assessments.

6.7.8. Decisions made during the planning and implementation of RAP 1 were required to be communicated to the community through multiple channels, including village leaders' notice boards, regular meetings, focus group discussions, and broadcast and printed media. Village-level discussions, led by the village leader, were to be conducted at least monthly.

ENGAGEMENT UNDERTAKEN BY THE WORLD BANK 2021-2022

6.7.9. Throughout the period of 2021 and 2022, representatives from the World Bank and Rogun have engaged with various stakeholders regarding the Technical Assistance for the Project. These engagements include:

- National Authorities: Meetings were held between September and November 2021 with key officials such as the President of Tajikistan, Prime Minister, Deputy Prime Ministers, Minister of Finance, Minister of Energy and Water Resources, Director of Rogun JSC, Director of Rogun PMG, and technical staff. These discussions primarily focused on technical studies and financing for the dam; and
- International Finance Institutions: Technical discussions involving the Project have taken place with institutions such as the European Union, European Investment Bank, Asia Infrastructure Investment Bank, Asian Development Bank, USAID and US Embassy, Islamic Development Bank, Islamic Corporation for the Development of the Private Sector, Eurasian Development Bank, Kuwait Fund for Arab Economic Development, Saudi Fund for Development, UK Foreign, Commonwealth and Development Office, European Bank for Reconstruction and Development, and Kreditanstalt für Wiederaufbau (KfW, German development bank).

6.7.10. During the consultations, the National Authorities were interested to find out from international Lenders their willingness to cooperate and provided information as needed in the interest of complying with national laws.

6.7.11. The prospective International Finance Institutions were interested in the development and status of the Project. The ESIA Consultant presented a summary of its inception report which described initial findings relating to environmental and social performance of the construction contractors, and also the resettlement program. The International Finance Institutions emphasized that the

Project would have to meet their respective environmental and social standards to qualify for financing. The ESIA Consultant and Environmental and Social Panel of Experts (ESPOE) both emphasized that, although some improvements were needed, there was no reason the Project could not comply with World Bank and other international standards.

6.7.12. There have been a series of meetings with national authorities and international Lenders during the TA program:

TRANSBOUNDARY CONSULTATION (2007-2014)

6.7.13. Between 2007 and 2014, the World Bank facilitated and hosted a structured consultation and information sharing program with riparian countries parallel to the 2014 ESIA and TEAS. This program involved correspondence between President Rahmon of Tajikistan and other Heads of States, in-country consultations on draft Terms of Reference (ToR) for the ESIA, and five comment and consultation sessions at key stages of the study process. Each session included the following:

- Documents were shared in advance via email and the World Bank website.
- A 4–6-week comment period to allow stakeholders to provide input through a designated email address.
- During this period, the World Bank organized consultation meetings for riparian governments, civil society organizations, diplomats, and the development community. Sessions 1-3 and 5 were held in Almaty, while the 4th session was in Dushanbe. All six riparian countries participated via video and audio conferencing.

6.7.14. The purpose of the engagement program was to facilitate an opportunity for riparian governments, civil society representatives, and diplomatic representatives to review the ToR for the ESIA alongside interim findings from the draft assessment studies. Additionally, the engagement programme aimed to:

- Ensure the credibility and high quality of draft assessments following international review.
- Encourage dialogue between the riparian governments.
- Respond to riparian governments requests for support from international financial communities.

6.7.15. Table 6-2 below provides a high-level summary of the key issues raised during the fifth and final information sharing session hosted between 16th-29th July 2014 hosted at the regional World Bank offices in Almaty, Kazakhstan. A detailed summary of issues raised and responses that were provided to stakeholders is highlighted within the SEP and the full table of stakeholder comments can be found as part of the 2014 ESIA disclosure package.

Table 6-2 Summary of Topics Raised in the Fifth Riparian Information-Sharing and Consultation Session (July 2014)

Topic	Issues Raised	Parties who raised the issues	Response Provided
Seismicity and dam safety	▪ Earthquake risk and dam failure. ▪ Use of 3D modelling assessments.	Kyrgyzstan Uzbekistan	▪ Confirmation of 3D modelling. ▪ Maximum Credible Earthquake has been assessed in line with international best practice and dam designed accordingly.
Sediment and mudflow	▪ Watershed management and reducing sediment flow.	Afghanistan	▪ Conclusion that watershed management is not viable in the Vakhsh basin to materially reduce such a large sediment inflow.
Geology	▪ Landslides onto roads. ▪ Lack of information on impacts to erosion.	Uzbekistan	▪ Impact of landslides studied extensively, and safety discussed in detail in previous consultations. ▪ Geology was studied in sufficient detail for an assessment study.
Probable Maximum Flood (PMF)	▪ The need for modifying the Vakhsh Cascade to accommodate PMF. ▪ Cost of potential modifications if required.	Uzbekistan	▪ No additional flood augmenting facilities would be required for several decades until the Rogun reservoir is sedimented to an extent it cannot attenuate PMF sufficiently.
Economic Factors	▪ Economic analysis lacking consideration of social impacts. ▪ Dam size and Project alternatives. ▪ Replacement of Rogun with the re-establishment of the Central Asian Transmission Grid. ▪ Share of water allocated downstream. ▪ Firm energy output.	Uzbekistan Kyrgyzstan Tajikistan	▪ Rogun HPP not expected to have downstream impacts based on operational modelling. ▪ Rogun HPP was chosen over alternatives due to the large volume of sediment transported by the river and short lifespan of smaller dams. Rogun would prolong the life of the Nurek dam. ▪ Rogun has selected an interregional model to prepare a least cost generation plan for the region and to ensure benefits of power exchange between countries could be assessed. ▪ The Government of Tajikistan's commitments to i) use only the Tajik allocation of water, as fixed by the ICWC in accordance with the existing agreements and ii) to maintain summer water transfer at the same

Topic	Issues Raised	Parties who raised the issues	Response Provided
			level as is currently being transferred at Nurek. ▪ Firm output defined as minimum energy available 95% of the time.
Hydrology	▪ Impact of climate change to inflow. ▪ Age of hydrological data used for modelling.	Tajikistan Uzbekistan Kyrgyzstan	▪ Assessment of likely scenario results for flood peak volumes linked to glacier retreat and discharge cited. ▪ Age of data used presented.
Flow regime (filling and operations)	▪ Tajikistan's share of water per annum for reservoir filling. ▪ Summer water shortages and winter flooding downstream. ▪ Downstream impacts on flora and fauna.	Tajikistan Turkmenistan	▪ Confirmation of the Government of Tajikistan's intention to fully utilize its allocation. ▪ Confirmation of intention to maintain summer water transfer at the same level as currently at Nurek.
Risks	▪ Uncategorized remaining risks. ▪ Requirements for a guarantor in the case of serious damage. ▪ Correctly accounting for triggered seismicity.	Uzbekistan	▪ Risks were categorized at the time and can be appropriately reduced as mitigation measures implemented. ▪ Confirmation that adequate measures would be taken in design, construction, and operation to international best practice. ▪ Reservoir triggered seismicity (RTS) studied in detail and confirmation that an earthquake generated by the Rogun reservoir would be much lower than the Maximum Credible Earthquake (MCE) the Project is designed for.

ENGAGEMENT UNDERTAKEN IN 2022-2023

6.7.16. As part of the TA Project and in development of the SEP, there have been a number of engagement sessions and consultations with international and national stakeholder groups. A summary of the key engagement sessions and consultations are summarized in Table 6-3.

Table 6-3 Engagement with National and International Stakeholders 2022-2023

Stakeholders Engaged / Date	Role / Responsibilities	Relevance to Project	Topics Discussed / Issues Raised
Deputy Mayor Of Rogun and Members of The Cabinet at The Mayor's Office / 11/03/2023	Play a leading role in managing and monitoring local community grievances.	Identification and representation of general environmental and social concerns held by the community.	▪ Members from the local community can go to the mayor's office on Saturdays to file grievances in person or via a project mailbox. ▪ There is also a public list of contact details of representatives from the different departments that people can call to raise concerns. ▪ The Mayor's Office keeps a book of grievances, which records the grievant's name and the location and nature of the grievance. ▪ However, it was noted that many community grievances are related to general municipal services such as waste collection and health care facilities rather than any issues related to the Rogun HPP.
Rogun JSC 11/03/2023	Responsible for the management of all contractors and subcontractors.	Identification of general labor management concerns and worker grievances.	▪ Discussions on local employment opportunities and initiatives provided by the Project including a regularly updated job vacancy list, employment fairs 2-3 times per month. ▪ Issues can be raised to Rogun JSC using the complaints box and HR manager's contact email address. ▪ Issues hiring women due to Tajik legislation despite women coming forward for job advertisements.

Stakeholders Engaged / Date	Role / Responsibilities	Relevance to Project	Topics Discussed / Issues Raised
Representatives of Women's NGOs Active in Tajikistan / 09/03/2023	Various roles promoting women's rights, well-being, and empowerment	Identification of gender risks and opportunities, local partners for the implementation of the Gender Action Plan (GAP)	▪ Various women's NGOs are active in Tajikistan, but their activities in the Rogun HPP area are limited and restricted. ▪ Service providers and shelters. ▪ Women's economic empowerment and livelihood restoration must ensure practical skills training. ▪ Impact of labor migration on women.
UN Women / 09/03/2023	Works with governments and civil society to improve gender equality.	Identification of gender risks and opportunities, local partners for implementing the GAP.	▪ Various women's NGOs are active in Tajikistan, but their activities in the Rogun HPP area are limited/restricted. ▪ Service providers and shelters. ▪ Women's economic empowerment and livelihood restoration. ▪ Vulnerable categories of women (disabled women, ethnic minorities, women in very conservative communities). ▪ Gender training, objectives and sensitization for PMG and community. ▪ Impact of Covid-19. ▪ Use of technology. ▪ Women's water-use forums.
Committee of Women and Family Affairs (CoWFA) / 09/03/2023	State body responsible for women and family matters.	Identification of gender risks and opportunities Operates existing Grievance Redress Mechanism (GRM) for women reporting violence.	▪ Activities of CoWFA - in general and Project specific. ▪ Presidential. Fund grant of 20,000 TJS for women to start businesses – business case and follow-up required. ▪ Afghan women in Tajikistan.

Stakeholders Engaged / Date	Role / Responsibilities	Relevance to Project	Topics Discussed / Issues Raised
State Committee of Land and Geodesy / 16/05/2023	State body responsible for Land management and GIS mapping.		Understanding affected land types and the role of the committee in resettlement planning.
State Investment Committee/Bureau of Technical Inventory / 16/05/2023	Facilitates and overseas investment activities within Tajikistan, state body responsible for investment planning and Bureau responsible for asset and real estate valuation.		Discussion on asset valuation practices of the Committee in Rogun HPP, which forms the basis of compensation of PAPs for their affected fixed assets.
Ministry of Labor, Migration and Employment / 19/05/2023	Providing employment and livelihood support for resettled individuals and households, providing employment services for unemployed.		Discussion on implementation of livelihood support program that the MLMEP is leading in resettled communities and understanding future plans.
Committee for Environmental Protection under the Government of the Republic of Tajikistan / 01/08/2023	Supervision over environment protection and environmental planning and compliance.		Committee have an environmental protection department in Rogun to monitor compliance with environmental requirements. Discussed potential offset locations, however, this has not yet been decided. Committee confirmed that they monitor and oversee the vegetation relocation process, which is carried out by the Forestry Agency.

6.7.17. Additionally, there were meetings with a number of resettled and host communities have been affected by the Project resettlement program. A summary of the engagements is provided in **Table 6-4** below:

Table 6-4 - Engagement with Resettled Communities and Settlements

Date	District	City/Village	Stakeholder Attendees	Topics/Observations
11/28/2022	Dushanbe	Dushanbe City	▪ Deputy Director of the Directorate of the Rogun HPP Flooding Zone (DFZ): Mr. Rustam Saidzoda and DFZ.	▪ Stage 1 RAP and RAP 2 implementation, progress, and notes. ▪ Compensation process and GRM; and ▪ Define site-visit route/plan.
11/28/2022	Tursunzoda	Toichi	▪ Deputy Director of the: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Tursunzoda City – Mr. Ehsonzoda Musulmon. ▪ Head of Labor, Migration and Employment of the Population Department in Tursunzoda City: - Mr. Odinazoda Ahliddin. ▪ Head of Jura Rahmon Jamoat – Mr. Tursunov Rahmatullo. ▪ The Head of women In Toychi village -Ms. Gulchehra. ▪ PAP heads of households (HH), represented by men and women of young and adult ages.	▪ The majority of household representatives were in those villages affected by RAP 1. ▪ Previously conducted public consultations and training on resettlement rules and principles were addressed. ▪ Women's roles, resettlement, and impact on the economic aspect of women's lives were discussed. ▪ Other aspects of GRM efficiency and correctness were discussed. ▪ The issues of house construction and potential problems. ▪ Negative and positive impacts of the resettlement.
11/28/2022	Tursunzoda	Namuna	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and the DFZ representatives; PAP heads of HH, represented by men.	▪ These settlers fall in the scope of RAP 2. ▪ A small proportion is already resettled, and the rest are to be resettled. Infrastructure and livelihood, agriculture land plots,

Date	District	City/Village	Stakeholder Attendees	Topics/Observations
				compensation and construction issues were discussed. ▪ Loss of main income source and related mitigation measures. ▪ Other aspects of GRM efficiency and correctness were discussed; and ▪ Women's occupation and the required support for its development in new places were discussed.
11/29/2022	Fayzobod	Buston	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Fayzobod district – Mr. Karimzoda Junaidullo. ▪ Head of Labor, Migration and Employment of Population Department in Rogun City – Mr. Odinazoda Ahliddin. ▪ Head of Buston Jamoat – Mr. Ahtam Vosiev. ▪ The Head of women in Buston village -Ms.Shamsiya Rahmonova. ▪ Men in Buston village represent the HH heads of the resettled HH.	▪ These settlers fall in the scope of RAP 2. ▪ A small proportion is already resettled, and the rest are to be resettled. Infrastructure and livelihood, agriculture land plots, compensation and construction issues were discussed. ▪ Loss of main income source and related mitigation measures. ▪ Other aspects of GRM efficiency and correctness were discussed. Women's occupation and the required support for its development in new places were discussed.
11/29/2022	Rogun	Yoligarmova	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Roghun City – Mr. Sharafzoda Bahrom.	▪ Households affected by RAP 1. ▪ Previously conducted public consultations and public awareness of resettlement rules and principles were addressed.

Date	District	City/Village	Stakeholder Attendees	Topics/Observations
			▪ Head of Labor and Migration department – Mr. Nuraliev Faridun. ▪ The heads of Resettled HH are represented by adult men and women, including one disabled person in Yoligarmova Village.	▪ The HH members were questioned if they were satisfied with compensations and overall resettlement procedures and measures. ▪ Women's roles, resettlement, and impact on the economic aspects of women's life were discussed. ▪ Other aspects of GRM efficiency and correctness were discussed. ▪ The issues of house construction and potential problems were addressed. Negative and positive impacts of the resettlement. ▪ The opinion of the Head of the household, who had a physical disability, was shared, and discussed. ▪ Violence against women and its reasons.
11/30/2022	Roghun	Lughur	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Roghun City – Mr. Sharafzoda Bahrom. ▪ Head of Labor, Migration and Employment of Population Department in Rogun City: - Mr. Nuraliev Faridun. ▪ The heads of Resettled HH are represented by adult men in Lughur village.	▪ Land plots allocation, and whether it has covered all. HH satisfaction with compensations. ▪ Discussions if the compensations include reimbursement for economic impact. ▪ Conducted public consultations regarding the RAP and public awareness about the Project. ▪ GRM and gender issues.

Date	District	City/Village	Stakeholder Attendees	Topics/Observations
12/30/2022	Nurobod	Aligalaboni Bolo	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Nurobod District. ▪ Head of Labor, Migration and Employment of Population Department in Nurobod District: - Mr. Eshunov Zabihullo. ▪ The heads of Resettled HH are represented by adult men of the affected village.	▪ Land plots allocation, and whether it has covered all. ▪ HH satisfaction with compensations. ▪ Discussions if the compensations include reimbursement for economic impact. ▪ Conducted public consultations regarding the RAP and public awareness about the Project. ▪ GRM and gender issues. ▪ Conversation with sheep keepers and other HHs who have created small businesses.
12/30/2022	Nurobod	Qumoq	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Nurobod District. ▪ Head of Labor, Migration and Employment of the Population Department in Nurobod District: - Mr. Eshunov Zabihullo. ▪ The heads of Resettled HH are represented by adult men of the affected village.	▪ Public awareness and satisfaction about\with Project implementation. HH were questioned if they were consulted previously about the Project etc. ▪ Land allocation questions were asked. Income and livelihood restoration issues were addressed.
11/30/2022	Nurobod	Hakimi	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Nurobod District.	▪ Meeting with women-representative and addressing the overall and women-specific questions. ▪ Land plots procedure and if HH had options for choice.

Date	District	City/Village	Stakeholder Attendees	Topics/Observations
			▪ Head of Labor, Migration and Employment of the Population Department in Nurobod District: - Mr. Eshunov Zabihullo. ▪ The heads of Resettled HH are represented by adult men of the affected village.	▪ Overview of the geography and infrastructure of the village.
11/30/2022	Nurobod	Chanor	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Nurobod District. ▪ Head of Labor, Migration and Employment of the Population Department in Nurobod District – Mr. Eshunov Zabihullo. ▪ The heads of Resettled HH are represented by adult men of the affected village.	▪ Small area of land left by its habitant as a result of resettlement. ▪ Review of remaining infrastructure and potential issues. ▪ Cemetery relocation review on the site.
12/30/2022	Nurobod	Mehrobod	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Deputy Chairman of Nurobod District. ▪ Head of Mehrobod jamoat: Mr. Rustam Haqnazarov. ▪ Head of Labor, Migration and Employment of the Population Department in Nurobod – Mr. Eshunov Zabihullo.	▪ Simple observations were made while passing by the site.

Date	District	City/Village	Stakeholder Attendees	Topics/Observations
			▪ The heads of Resettled HH are represented by adult men of the affected village.	
12/30/2022	Nurobod	Darband	▪ Deputy Director of the DFZ: Mr. Rustam Saidzoda and DFZ representatives. ▪ The Head of Nurobod District, Darband City: Mr. Jabirzoda D.P. ▪ The Deputy Chairman of Nurobod District. ▪ Head of Mehrobod jamoat: Mr. Rustam Haqnazarov. ▪ Head of Labor, Migration and Employment of the Population Department in Nurobod District, Mr. Eshunov Zabihullo. ▪ The heads of Resettled HH are represented by adult men of the affected village.	▪ The town is constructed specially for resettlement. Revision of infrastructure, secondary schools, medical centers etc. ▪ Meeting with the Head of the Nurobod District regarding infrastructure development and opportunities for migrants in new Darband town.

STAKEHOLDER ENGAGEMENT JULY/AUGUST 2023

6.7.18. When the household socio-economic surveys were being undertaken in July and August 2023, key environmental and social aspects of the project were explained to PAPs while the household data was being collected. The resettlement surveys included focus group discussions which are summarized in the **Resettlement Policy Framework** (RPF).

6.7.19. Between 30th July and 5th August 2023, additional engagement sessions were held with resettled communities, host communities, to be resettled communities and other potentially affected communities within the Project region to obtain their concerns and views about the Project. A summary of the key issues and takeaways from the consultation sessions is presented in Table 6-5 below.

Table 6-5 Engagement with Resettled, Host and Other Affected Communities, August 2023

No.	Date	Village	Jamoat	Meeting Location	Summary	Key Risks
1	02/08/2023	Rogun City	Rogun City	Meeting Hall of the local government office	Given the location of the discussion and official environment, participants didn't feel completely comfortable to openly involve in the discussion. Conditions in Rogun City have significantly improved since the recommencement of construction, namely in water supply and electricity supply. Some rent out their housing to workers and have benefited from the Project financially. They are aware of Rogun HPP from TV, newspaper ("Rogun's Light") and official meetings. If they have any issues, attendees stated they can go to the Mayor or Rogun JSC offices to submit a complaint. Some of participants work(ed) at the HPP site and are satisfied with the working/living conditions there. All workers have uniforms and necessary protection equipment. Many local women work there in different positions (mainly nurses, cleaners, and HR staff). Community doesn't have any problems with the workers – they rarely come to the town, only when	Hospital is available in Rogun, but there is a problem with qualified doctors. After the meeting, WSP team was approached by participants with the issue of doctors and teachers. There are significant expectations amongst the community regarding positives to be provided by Rogun HPP in the Project, particularly regarding local economic growth through tourism. Engagement through the current, ongoing channels are preferred – meetings and information through the local Jamoat and Mahalas, TV and internet.

No.	Date	Village	Jamoat	Meeting Location	Summary	Key Risks
					they need to send money or buy something from the local shops. Construction traffic also uses a separate road to pedestrian traffic to access the site. Attendees stated they are not disturbed by explosions on site, but they do hear them faintly and the explosion schedule is provided in the mayor's office. Employment fayres are held in Rogun, and employment is easily available. Attendees also stated that those villages being resettled by the Project contain low-income households and people's living conditions have improved.	
2	02/08/2023	Obi Garm	Obi Garm, Rogun District	Local school	Participants get information about Rogun HPP from different sources: TV, social media (Facebook), newspaper. Also, some of the villagers (10-15%) work at the construction site and share information about the construction process. People working there are satisfied with the working conditions; transportation is provided to those who work daily. Among participants were those who used to work at construction site both during the Soviet times and now. According to them, previously all specialists came from other USSR countries: Russia, Belarus, Ukraine, etc. and locals were mainly hired as laborers. Now locals have all the knowledge and qualifications to occupy higher, specialist positions. Men have been going for fishing to the small local river. Among the species available in the local river, participants mentioned trout and marinka.	People mentioned an issue with drinking water pipes that need to be replaced. But it is more a local problem, mostly related to lack of management and finance, rather than an impact of Rogun HPP. Meetings are usually conducted in Jamoat, people are used to such meetings and prefer this way of communication.

No.	Date	Village	Jamoat	Meeting Location	Summary	Key Risks
					Every three months, the Employment Department of Rogun government organizes job fairs during which various organizations operating in the area, including Rogun HPP, provides job opportunities to unemployed people. Attendees were happy the Project is being constructed as they have benefitted from the improved roads in the local area and employment.	
3	03/08/2023	Layron	Hakimi (Nurobod District)	Mosque garden	164 households in the village. Source of information about Rogun HPP: TV, newspaper, local people (aprox.5%) working on HPP construction site. Some other people work for Chinese company who are constructing the Obigarm-Nurobod road in the district. Estimated completion time for the road construction is 2024. So far there haven't been any issues with the workers – they have camps where they live and go outside to visit the shops buying food. There were communities from this Jamoat being moved to Faizabad, Dangara, Tursunzoda and Rudaki districts, participants have some relatives among the resettles and the latter are happy with the new conditions. Previous meetings were held in the village (in the mosque) and in Jamoat. The location usually is selected based on the topic of discussion – if it is something that all community needs to engage in, then meetings are conducted in the village. In other cases, heads of Mahalas gather at the Jamoat and	People mentioned issues with dust due to road construction. Attendees mentioned that before the temperature during the summertime hardly reached 24-25C, now it is up to 34-35C. Previously they had up to 1meter of snow during the winter, now it is much less. There have been no previous meetings on Rogun HPP in the village. Engagement through the current, ongoing channels are preferred – meetings and information through the local Jamoat and Mahalas, TV and internet.

No.	Date	Village	Jamoat	Meeting Location	Summary	Key Risks
					then hold meetings in their mosques to inform everyone what was discussed. Participants of our meeting were from various villages and as they said, they will inform their communities about this discussion. For future communications they prefer to do it through Jamoats. Community goes for fishing to the local river Kaskunob (trout, marinka, milkfish). It is a mixed of spring and glacier water.	
4	03/08/2023	Mujikharf	Mujikharf (Nurobod District)	In front of mosque	Source of information: meetings, TV, people who work there. “Energy independence is one of the strategic goals of the country. And once this goal is achieved, we can move towards the next strategic goal – industrialization of the country”. Among participants were people who worked at the HPP site during the Soviet time and according to them the construction machinery is much better and advanced now than it was before. Attendees stated they have increased the number of fruit trees in the local area to sell more produce to Rogun HPP and the road Project.	Attendees stated that during the Soviet time, households being resettled did not receive compensation for their trees and gardens, but now they do. There have been several previous meetings between the village and the road Project management, including the Chinese contractors, however no previous engagement on Rogun HPP.
5	03/08/2023	Yakhch	Izzatullo Halimov (Nurobod District)	Jamoat building	Source of information: meetings, TV, newspaper, radio. Some villages in Jamoat have been resettled to Faizabad, Tursunzoda. Participants mentioned that resettlers got very good living conditions. Members of some villages in the Jamoat have been resettled already (3 villages fully, and 2 villages	There have been multiple previous meetings on Rogun HPP in the village, sharing the resettlement plan and implementing the process. Engagement through the current, ongoing channels are preferred – meetings and information through the

No.	Date	Village	Jamoat	Meeting Location	Summary	Key Risks
					partially) and have stated that living conditions have improved significantly. Options were provided to all households being resettled and rights to compensation are well-known and understood. District representatives also visit them to check on their living conditions.	local Jamoat and Mahalas, TV and internet.
6	03/08/2023	Khumdon	Khumdon (Nurobod District)	Community Hall	Among participants were those resettled from Mehrobod Jamoat (former Komsomolobod). They are satisfied with all conditions they have been offered in the new place. Two women (both are heads of HH) mentioned that they were offered several options for resettlement and selected Khumbon because it is close to Rasht where a Pedagogical Institute based. After moving, both entered the Institute and graduated from it and found jobs in Darband. Prior to resettlement, meetings were held with the host community to get their consent. The host community has not raised any objections as according to them new infrastructure and improved facilities became available to all of them where they could get a job. Moreover, when resettlers build their houses, they hire laborers from the host community.	When people first moved to this area, water supply was not provided suitably, and the local school was not big enough – however these were quickly provided. There have been multiple previous meetings on Rogun HPP in the village for resettled persons, sharing the resettlement plan and implementing the process. Engagement through the current, ongoing channels are preferred – meetings and information through the local Jamoat and Mahalas, TV and internet.
7	04/08/2023	Navdonak	Qalai Surkh (Rasht District)	Community Hall	280 households live in the village. People get information from different sources: older people from meeting, TV, radio, newspaper; youth from Internet. Local population works at the HPP site, mainly as drivers. Information about the vacancies, in addition	There have not been previous meetings on Rogun HPP in the village as they have not been impacted by resettlement. Engagement through the current, ongoing channels are preferred – meetings and information through the

No.	Date	Village	Jamoat	Meeting Location	Summary	Key Risks
					to the mentioned sources, is provided by the employment department as well. Meetings on resettlement were conducted several times in the village, people know which villages and where will be resettled. Community believes that with construction of Rogun HPP all the issues with electricity will be resolved. Currently people use the water coming from mountains. Villages located near the riverbank build a channel on the upstream of the river and use that water for irrigation. Information they prefer to receive either through TV or face-to-face meetings.	local Jamoat and Mahalas, TV and internet.
8	04/08/2023	Qalai Surkh	Qalai Surkh (Rasht District)	Community Hall	85 households, 600 ppl live in the village. Mainly engaged in farming (gardening), beekeeping and livestock production both for own consumption and for sale and even for export to Russia. The village had a pump station which barely worked for the last three years and was mainly maintained by the community. This year the pump broke and needs to be replaced. Water management department cannot help due to lack of finance. The level of labor migration to Russia is very high in the village: 80% among youth and 30-40% in the entirely community. In Russia people mainly work in private sector and construction. Those who are married and those who work in construction come back every six months.	There have not been previous meetings on Rogun HPP in the village as they have not been impacted by resettlement. Engagement through the current, ongoing channels are preferred – meetings and information through the local Jamoat and Mahalas, TV and internet. People would like to know more about the construction process, size of reservoir, etc.

No.	Date	Village	Jamoat	Meeting Location	Summary	Key Risks
					Source of information: older people from meeting, TV, radio, newspaper; youth from Internet. Local population works at the HPP site, mainly as drivers.	

6.8 SUMMARY OF KEY ISSUES RAISED

6.8.1. The stakeholder engagement process to date has yielded valuable information regarding RAP implementation, GRM implementation, resettlement impacts including on vulnerable groups, and land allocation and compensation for affected. The following key issues and themes identified across the process so far are listed and summarized below:

- Level of engagement with communities not affected by the resettlement program.
- Impacts of the resettlement program.
- Land allocation and compensation.
- Infrastructure, utilities, and services.

Engagement with Communities not Affected by the Resettlement Program

6.8.2. Engagement to date conducted by DFZ has primarily focused on communities directly impacted by the resettlement programme. However there has been limited engagement undertaken with other potentially affected communities, including within the buffer zone.

Impacts of the Resettlement Program

6.8.3. Challenges associated with the construction of houses in relocation settlements have been highlighted by resettled persons during consultation meetings. This includes poor quality roads, the availability and transportation of construction materials (such as sand and gravel) and accessibility issues. DFZ addressed these issues with specific resettled communities by providing machinery for communities to use, including an excavator for transporting sand and gravel, ensuring suitable transportation provisions, and enhancing access roads (including providing iron sheets for channel crossings). The Project GRM will ensure that all Project-related issues will be resolved in a timely manner.

6.8.4. A small number of women affected by resettlement, who are the heads of their household, were concerned over the provision of support to construct their new homes. However, with the support of Jamoats, additional assistance is provided to women-headed households. Ongoing engagement with vulnerable groups will be facilitated by DFZ to ensure minimum impact on these groups.

Land Allocation and Compensation

6.8.5. During consultation meetings, PAPs questioned the land plot allocation process and economic impact reimbursement. Concerns have been raised regarding compensation amounts, adjustments (e.g., in line with changing item costs and inflation), and the payment schedule. Concerns over the amount of agricultural land being provided in resettlement locations for resettled persons and their family members have also been highlighted in engagement meetings. DFZ and its resettlement consultants have been engaging with resettled communities to provide up-to-date information on the Project, land acquisition process and RAP studies and identify compensation and resettlement assistance requirements (please see RAP 2).

Infrastructure, Utilities and Services

6.8.6. At some of the relocation sites, communities who were initially relocated under the first stages of RAP 1 experienced issues with water and electricity supply. However, these issues have since been addressed and no recent reports of insufficient utilities have been raised during recent engagement.

6.8.7. Some resettled communities raised concerns over the availability and construction progress of public infrastructure (e.g., schools, roads, mosques, cemeteries, libraries, sports fields) and utilities (e.g., electricity, drinking water, irrigation water) in the new relocation settlements. Follow up consultations and discussions with district authorities concerning infrastructure development have ensured that affected communities remain informed about that construction progress and utilities at relocation sites.

General Attitude Towards the Project

6.8.8. Overall, resettled communities, host communities and local stakeholders seemed positive about the Project. Residents and businesses are positive towards the benefits that the Project will bring, including stable electricity supply, particularly during winter months, improved road conditions and updated public infrastructure services.

Further information will be provided to potentially affected persons during continuous engagement and during the ESIA disclosure period. Following SEP implementation, the stakeholder engagement process will also continue throughout the construction and operation of the Project.

6.9 STAKEHOLDER ENGAGEMENT PROGRAMME

6.9.1. In addition to the previous stakeholder consultation and engagement undertaken for the Project (as summarized in Section 6.7), PMG and DFZ will disclose relevant information about the Project during the disclosure period, and then in an ongoing manner as the Project evolves.

6.9.2. The Project will have one DFZ assigned District Livelihood and Engagement Officer (DLEO) and one supporting Engagement Officer (one male and one female) for each affected district (Rasht, Rogun City, Nurobod, Faizobod, Tursunzoda, Dangara, and Rudaki) to ensure regular consultation and interaction with affected local communities. The appointment of female DLEOs on the Project will facilitate women in the local community directly approaching the DLEOs in relation to any concerns. PMG will appoint one Stakeholder Engagement Lead to manage regular consultation with all other stakeholder groups.

6.9.3. The Project will use different consultation approaches and methods for different stages of the Project activities and stakeholder groups. The stakeholder engagement activities that will be undertaken throughout the Project lifecycle are presented in Table 6-6 below (see **SEP** for further details on stakeholder engagement program).

Table 6-6 Stakeholder Engagement to be Undertaken

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
Project Implementation Phase					
Set up a Project disclosure website, hosted on the PMG website, with the following: ▪ Disclosure documents (available in Tajik, Russian & English); ▪ A mini video / webinar which is recorded in Tajik, Russian & English; ▪ A feedback form / form to submit questions; ▪ DFZ District Livelihood and Engagement Leads contact details; ▪ Information on the grievance mechanism; and ▪ Responses to frequently asked questions (to be updated throughout disclosure). This website will be advertised as follows: ▪ Notices provided to the District and Jamoat offices, and circulated to Mahallas; ▪ Notice boards in affected community centres, such as halls, schools, tea houses and mosques; ▪ SMS messaging, (which will contain links to the website, DFZ DLEOs contact details and advise as to how to obtain hard copies of disclosure documentation); ▪ Rogun HPP Twitter account and Rogun HPP Facebook account; ▪ Press conference; and ▪ TV, radio, and local newspaper adverts.	All	▪ Project Leaflets; ▪ ESIA (including ESMP); ▪ Non-technical Summary (NTS); ▪ SEP (this document); and ▪ RPF.	At time of ESIA disclosure	PMG Stakeholder Engagement Lead DFZ DLEOs	▪ PMG office; ▪ DFZ offices; ▪ PMG website: http://energyprojects.tj; ▪ Notice boards (with visual aids) in affected communities; and ▪ TV broadcasts / Radio / Newspaper.

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
DFZ to appoint 1 Senior Grievance Manager to oversee all community grievances. DFZ to allocate 1 DLEO and 1 supporting engagement officer (1 male and 1 female) for ongoing Project consultations and to manage community grievances relating to the Project, for each of the following districts: ▪ Nurobod; ▪ Rogun; ▪ Rasht; ▪ Faizobod; ▪ Tursunzoda; ▪ Dangara; and ▪ Rudaki. These individuals should have experience in dealing with stakeholder engagement and community grievances.	Affected Communities	▪ Project Leaflets; ▪ Posters; ▪ NTS; and ▪ SEP.	Upon approval of international financing	DFZ	▪ DFZ office.
Place hard copies of Project leaflets and documentation within all affected settlements (resettled communities, communities to be resettled, host communities, and other affected communities within the Project Area of Influence). Hard copies to be displayed on notice boards and made available in community hubs, including halls, mosques, and tea houses, affected municipality offices and local DFZ offices. To be distributed by the DLEOs in liaison with Jamoats. A minimum of 3 hard copies of the NTS, SEP & RPF will be retained at DFZ offices, and extra copies will be made available if affected people would like to take a copy with them.	Affected Communities	▪ Project Leaflets; ▪ NTS; ▪ RPF; and ▪ SEP.	At time of ESIA disclosure	DFZ DLEOs	▪ All affected communities within the Rasht, Rogun City, Nurobod, Faizobod, Tursunzoda, Dangara, and Rudaki districts.

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
Hold public consultation meetings for host communities, affected businesses and other affected communities within the Project area. These consultations will present: ▪ Project construction updates; ▪ Grievance mechanism; ▪ Temporary impacts (traffic, noise, vibration, dust etc); and ▪ Restrictions or diversions caused by Project-related activities. All consultations and meeting minutes should be recorded.	Affected Communities / Businesses	▪ Project Leaflets; ▪ ESIA (including the ESMP); ▪ NTS; ▪ SEP (this document); ▪ RPF; and ▪ Maps (showing potential locations of diversions and environmental constraints)	November-December 2023	DFZ DLEOs PMG Stakeholder Engagement Lead	▪ All affected communities within the Rasht, Rogun City, Nurobod, Faizobod, Tursunzoda, Dangara, and Rudaki districts; and ▪ DFZ office and website.
Hold public consultation meetings and a series of focus groups for resettled people in the following more significantly affected communities: ▪ Chorsada; ▪ Aligalaboni Poyon; ▪ Sicharogh; ▪ Talkhakchashma; ▪ Tagi Agba; ▪ Tagi Kamar; ▪ Mirogh; ▪ Chanor; ▪ Saripul Yak; ▪ Khakimi Bolo (Hakimii Bolo); ▪ Mujikharfi Mayda; ▪ Delvokhak; ▪ Dehai Shoh; ▪ Ayni; ▪ Dushokhazamin; ▪ Dakhana; ▪ Dakhani Gumush; ▪ Kh. Sherozi; ▪ Kavlokho; ▪ Magzori Sir;	Resettled Communities / to be Resettled Communities	▪ Project Leaflets; ▪ ESIA (including the ESMP); ▪ NTS; ▪ SEP (this document); and ▪ RPF.	November-December 2023, January-February 2024	DFZ DLEOs	▪ All resettled/ to be resettled communities in Nurobod, Rogun and Rasht.

Activity		Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
▪ Khakimi Miyona; ▪ Khakimi Poyon (Hakimii Poyon); ▪ Obiboriki Bolo; ▪ Roghuni Poyon; ▪ Aligalaboni Bolo; ▪ Bedikho (Bediho); ▪ Lughuri Poyon (Luguri Poyon); ▪ Saidon (Khodzhaalisho); ▪ Qal'ai surkh; ▪ Kaznok; ▪ Kachamandi; ▪ Buni Sufiyon; ▪ Sangi Maliki; ▪ Shulmak; ▪ Shule; ▪ Yashm; ▪ Shohindara; ▪ Pojei Bolo; ▪ Pojei Poyon; ▪ Navobod; ▪ Amirbek Village; ▪ Navdonek; ▪ Sari Kosh; ▪ Mujikharfi Kalon;	▪ Labi Jar; ▪ Yusti Poyon; ▪ Yusti Bolo; ▪ Yakhak; ▪ Iston; ▪ Ayni-Khojaayni; ▪ Miyondara; ▪ Sari Dzhu; ▪ Zoroni Kalon; ▪ Komosomolobod; ▪ Pandovchii Dekhi-Khochi; ▪ Pandovchii Sari Dasht; ▪ Zarda; ▪ Dehai Gulmon; ▪ Loyoba Village; ▪ Yakhch; ▪ Zoroni Mayda; ▪ Shahtuti Miyona; ▪ Shahtuti Poyon; ▪ Hasandara; ▪ Kofara; ▪ Sangdevor; ▪ Novako; ▪ Sangi Kar; and ▪ Yapoloki					

<table>
<tr><th colspan="2">Activity</th><th>Stakeholders</th><th>Information Materials</th><th>Timeframe / Frequency</th><th>Responsibility</th><th>Location</th></tr>
<tr><td colspan="2">The number of focus groups will be increased, if necessary, to ensure that all those interested in attending are able to participate.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Implement and undertake RAP, including:
▪ Appropriate distribution of the RAP and ESIA disclosure;
▪ Negotiation with landowners and users (formal and informal) to agree entitlements and compensation amounts, in line with the RAP;
▪ Continue consultation with PAPs to ensure effective compensation disbursement;
▪ Further consultation during legal challenges, if required;
▪ Consultation stipulated as part of the grievance mechanism;
▪ Consultation to inform update Project schedule and progress;
▪ Consultation with PAPs as part of effective RAP monitoring; and
▪ Final evaluation of RAP implementation (completion audit).</td><td>Affected Landowners and Formal / Informal Users</td><td>▪ RPF; and
▪ ESIA.</td><td>Throughout resettlement program (RAP 2 and subsequent RAPs)</td><td>DFZ
DFZ DLEOs</td><td>▪ DFZ offices;
▪ Affected municipality offices; and
▪ Affected Hukumat and Jamoat, Administrations.</td></tr>
<tr><td colspan="2">Develop and implement an online Grievance Mechanism form available to the public.</td><td>All</td><td>▪ Grievance Mechanism (and related forms)</td><td>At time of ESIA disclosure</td><td>PMG Stakeholder Engagement Lead</td><td>▪ PMG website.</td></tr>
<tr><td>Conduct consultations</td><td>Riparian Nations</td><td>▪ Project Leaflets;</td><td>In September, prior to disclosure period</td><td>At time of ESIA disclosure</td><td>PMG Stakeholder</td><td>▪ Virtual / in-person consultation.</td></tr>
</table>

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
with Riparian Nations, including one virtual scoping meeting prior to the ESIA disclosure period and one in-person consultation at the time of ESIA disclosure.	▪ ESIA; ▪ SEP; and ▪ Grievance Mechanism.	In November, at the time of ESIA disclosure		Engagement Lead	
Conduct roundtables and press conferences on Project updates, including: ▪ Project schedule; ▪ Project development / progress; ▪ Impact management; ▪ Grievance Mechanism; and ▪ Notification of forthcoming major events or commencement of specific Project activities. Electronic publications and press releases to be shared on the Project website.	Riparian Nations International NGOs	▪ Project Leaflets; ▪ ESIA; ▪ SEP; and ▪ Grievance Mechanism.	Throughout construction period biannually	PMG Stakeholder Engagement Lead	▪ Virtual / in-person conference; ▪ Radio / newspaper / TV; ▪ PMG website; and ▪ Rogun HPP / PMG social media (such as Twitter and Facebook).
Conduct public meetings, prepare press releases on Project updates, including: ▪ Project schedule; ▪ Project development / progress; ▪ Impact management;	▪ Local NGOs / Community-Based Organization; and	▪ Project Leaflets; ▪ ESIA; ▪ SEP; and ▪ Grievance Mechanism.	Throughout construction period biannually	PMG Stakeholder Engagement Lead	▪ Public venues; ▪ Notice boards in public venues (mosques, libraries, offices of

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
▪ Grievance Mechanism; and ▪ Notification of forthcoming major events or commencement of specific Project activities. Summary of hearings to be presented on short radio programs and broadcasted on TV. Dissemination of hard copies at designated public locations.	▪ Public.				local administrations and NGOs); ▪ Radio / newspaper / TV; ▪ PMG website; and ▪ Rogun HPP / PMG social media (such as Twitter and Facebook).
Submit official letters and emails to the relevant National Government Authorities as required. Facilitate bi-annual face-to-face meetings with National Government Authorities to discuss regulations, permitting and updates on Project development.	▪ Committee for Environment Protection Under the Government of Tajikistan; ▪ Ministry of Finance; ▪ Ministry of Health and Social Protection of Population; ▪ Ministry of Energy and Water Resources; ▪ Ministry of Economic	▪ ESIA (including the ESMP).	During Construction (as required)	PMG Contractors (where required)	▪ Committee for Environment Protection Under the Government of Tajikistan; ▪ Ministry of Finance; ▪ Ministry of Health and Social Protection of Population; ▪ Ministry of Energy and Water Resources; ▪ Ministry of Economic Development and Trade; ▪ Ministry of Labor, Migration and Employment of Population of the Republic of Tajikistan; and

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
	Development and Trade; ▪ Ministry of Labor, Migration and Employment of Population of the Republic of Tajikistan; and ▪ Ministry of Agriculture.				▪ Ministry of Agriculture.
Consult and collaborate with local emergency services.	Local Emergency Services	▪ EPF.	Throughout construction and operation	PMG Stakeholder Engagement Lead Rogun JSC	▪ Local Emergency Services (fire stations and police stations).
Conduct women-only focus groups and workshops to ensure that their views are taken into account and to share details of gender sensitive GRM. Seek specific feedback from women on their desires in terms of employment, skills and training and preferences around vocations.	▪ Women employed in Project structures; ▪ Women in host communities; ▪ Women who have/will be	▪ GAP.	During construction, approximately biannually	Female Gender Focal Points from Rogun JSC Female DLEOs	▪ All affected communities within the Rasht, Rogun City, Nurobod, Faizobod, Tursunzoda, Dangara, and Rudaki districts.

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
	resettled; and ▪ Women in rural areas of the wider Project area.				
Facilitate focus groups and workshops for affected vulnerable groups and facilitate ongoing consultation with vulnerable PAPs. Inform about Project benefits, grant opportunities and available support services.	Vulnerable Groups (including minorities, people living with disabilities and the elderly).	▪ Project Leaflets; ▪ ESIA (including the ESMP); ▪ NTS; ▪ SEP; ▪ RPF; and ▪ Visual aids.	During Construction Regularly, as needed	DFZ DLEOs	▪ DFZ office; ▪ Affected municipality offices; ▪ Affected Jamoat offices; and ▪ Easily accessible community spaces in affected communities within the Rasht, Rogun City, Nurobod, Faizobod, Tursunzoda, Dangara, and Rudaki districts.
Formally consult and coordinate with the Academy of Sciences of the Republic of Tajikistan (the A Donish Institute) to provide supervision regarding potential heritage assets.	Academy of Sciences of the Republic of Tajikistan (the A Donish Institute).	▪ ESIA (including the ESMP); and ▪ Construction Program.	During Construction (as required)	PMG Stakeholder Engagement Lead DFZ DLEOs Contractors (where required)	▪ PMG office; ▪ DFZ office; and ▪ A Donish Institute.

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
Benefit sharing consultation focus groups to discuss and record benefit sharing opportunities and challenges to implementing the Benefit Sharing Programme.	▪ Local communities and PAPs, ▪ Ministry of Finance; ▪ Ministry of Health and Social Protection of Population; ▪ Ministry of Labor, Migration and Employment of Population of the Republic of Tajikistan; ▪ National NGOs	▪ Benefit Sharing Programme; and ▪ SEP.	During construction (as required).	PMG Stakeholder Engagement Lead DFZ DLEOs	▪ Easily accessible community spaces in affected communities within the Rasht, Rogun City, Nurobod, Faizobod, Tursunzoda, Dangara, and Rudaki districts.
Provide employment advertisements and advertisements for local employment fayres on Rogun HPP and Ministry of Labor, Migration and Employment of Population of the Republic of Tajikistan websites, on municipality offices bulletin boards and consult with Jamoat Heads on the Project employment opportunities. Where possible, promote women involvement in the Project.	Local Communities PAPs Local businesses Contractors	▪ Employment Adverts; and ▪ Local Procurement and Employment Plan	Monthly throughout Construction	Rogun JSC Contractors DFZ DLEOs (to connect those seeking employment e.g. vulnerable groups with	▪ Contractor website; ▪ Municipality offices notice board; ▪ Employment fairs; ▪ Affected Jamoat community notice boards; and

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
Liaise with local universities on potential graduate employment opportunities and capacity building, where suitable attend careers fairs and face to face meetings.				hiring companies)	▪ Radio / newspaper / local TV.
Conduct regular meetings with Project employees and provide bulletin updates (via email, SMS & notice boards) on Project developments and Worker Grievance Procedure.	Project workers	▪ Project leaflets; and ▪ Staff Handbook.	During construction (monthly)	Rogun JSC Contractors	▪ Rogun JSC offices; ▪ Worker accommodation camp notice boards; ▪ On-site notice boards; ▪ Emails; and ▪ SMS messaging.
Post hotline number for reporting gender-based violence and harassment.	Local Communities Project workers	▪ Hotline Leaflet.	At time of ESIA disclosure	DFZ DLEOs Rogun JSC Contractors	▪ Worker accommodation notice boards; ▪ Construction site notice boards; and ▪ Affected Jamoat village notice boards.
Immediately Prior to Operation and During Operation					
Conduct round tables, prepare press releases for all stakeholders to sum up results of Project. Disclose information about the Project operation program, benefits, risks, health and safety signs. Information to be presented in Russian, Tajik and English for local, national, and international stakeholders.	All Stakeholders / Public	▪ Leaflets; ▪ Advertisements; ▪ Announcements; ▪ Link to online monitoring system for the	Six months prior to commissioning	PMG Stakeholder Engagement Lead	▪ Affected Jamoats; ▪ Affected Districts; ▪ Notice boards in public venues (mosques, libraries, offices of local administrations); ▪ Radio / newspaper / TV;

Activity	Stakeholders	Information Materials	Timeframe / Frequency	Responsibility	Location
		Vakhsh Cascade; and ▪ Maps.			▪ PMG website; and ▪ Rogun JSC / PMG social media (such as Twitter and Facebook).
Undertake regular community meetings with communities around the reservoir to monitor ongoing impacts of the Project, changes in quality of life and implementation of Project community development activities.	Communities surrounding the reservoir	▪ Community development plans; and ▪ ESMP.	Annually during operation	DFZ DLEOs	▪ Buffer zone communities.

6.10 BENEFIT SHARING CONSULTATION

6.10.1. The Project will implement a Benefit Sharing Programme to maximize the development impact of the dam for stakeholders living in the AoI. The programme will focus on community development and poverty alleviation, complementing the livelihood restoration activities planned as part of the RAPs. Consultation with communities that are directly and indirectly affected by the dam alongside broader members of civil society to discuss benefit sharing opportunities will be undertaken (see **SEP** for full details on consultation planned under the Benefit Sharing Programme).

6.11 CITIZEN ENGAGEMENT

6.11.1. Citizen engagement, as defined by the World Bank Group, involves two-way interaction between citizens and the government to identify methods for the inclusion of citizens and to assess priorities for intervention, design, and implementation of the Project and to improve its outcome[3]. Citizen engagement plays a critical role in advocating for the transparency and accountability of public institutions and the effectiveness of solutions implemented. Further details on citizen engagement as part of the Project are presented within the accompanying **SEP**.

6.12 GRIEVANCE REDRESS MECHANISM

6.12.1. Prior to the development of the current Stakeholder Engagement Plan, community grievances were primarily submitted to the local Mahalla and Head of Jamoat, or occasionally directly to a DFZ officer. Any grievances of community members in Rogun City are directed to the office of the Mayor of Rogun. No systematic recording of the grievances was undertaken, and no other grievance redress channel was in practice for other stakeholders, such as NGOs and neighbouring riparian countries.

6.12.2. The Project GRM builds on the existing communication methods and channels used by communities to raise grievance and will work using a two-tier resolution system. The grievance management procedure will be monitored continuously, with monthly progress reports submitted to management. The overall effectiveness of the grievance management procedure will be assessed on a six-monthly basis. Additionally, the grievance mechanism allows submission of anonymous and sexual exploitation and abuse/sexual harassment complaints by community members. The full details describing the implementation of the GRM can be found within the accompanying **SEP**.

6.13 MONITORING AND REPORTING

6.13.1. The planned engagement programme presented in Table 6-6 above is set out within the accompanying **SEP**, alongside the Project GRM and how this can be used by stakeholders. Additionally, the budget (approximately USD 368,000) required to carry out the engagement programme and detailed description of the key roles and responsibilities for implementation is set out within the SEP. The PMG Stakeholder Engagement Lead, Senior Grievance Manager (SGM)

[3] Strategic framework for mainstreaming citizen engagement in World Bank Group operations (2014): engaging with citizens for improved results: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/266371468124780089/strategic-framework-for-mainstreaming-citizen-engagement-in-world-bank-group-operations-engaging-with-citizens-for-improved-results

and DLEOs will review the SEP regularly to ensure that all the consultation activities are implemented and are in accordance with the planned schedule.

6.13.2. In terms of the monitoring and review of the stakeholder engagement programme, the PMG Stakeholder Engagement Lead will be responsible for producing progress updates on the SEP within quarterly reports submitted to the World Bank. The reports will include all stakeholder interactions and consultations, grievances and decisions, new stakeholders, partnership progress, and plans for the next period.

6.14 ROLES AND RESPONSIBILITIES

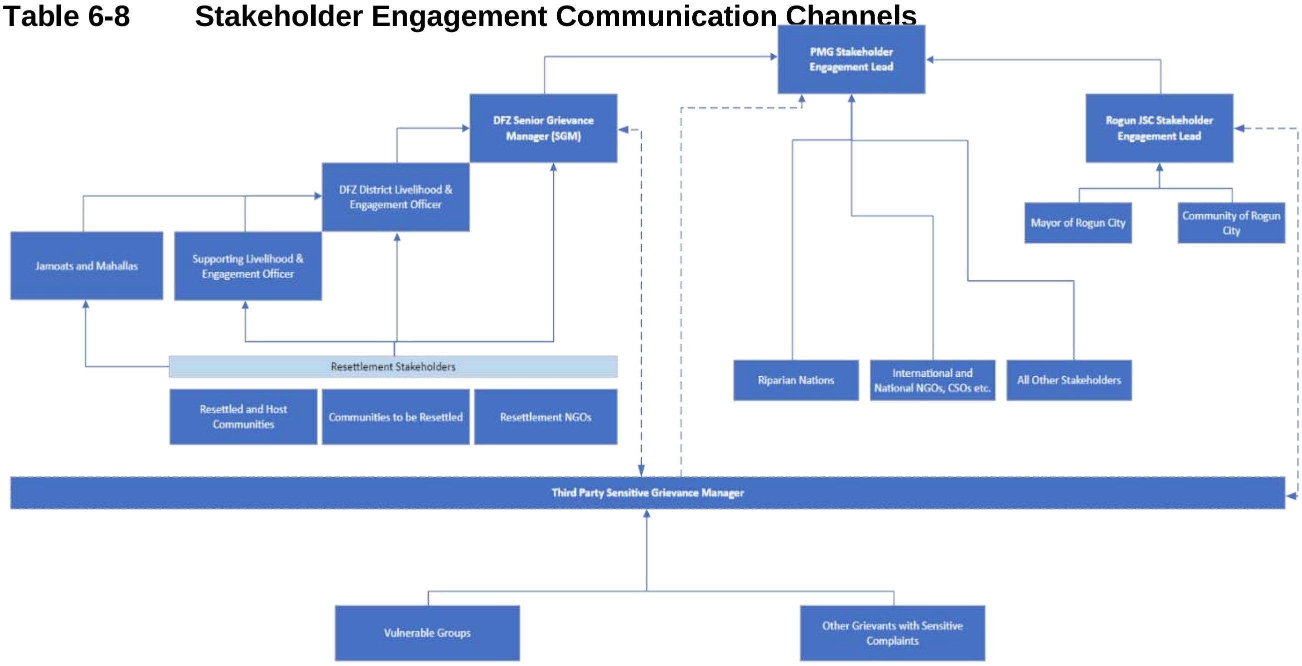
6.14.1. The key roles for implementing the engagement programme and their key responsibilities are presented in Table 6-7 below.

Table 6-7 Engagement Roles and Responsibilities

Role	Responsibility
DFZ District Livelihood & Engagement Officer (DLEO)	Responsible for all community-related stakeholder engagement activities and GRM implementation and management.
DFZ Senior Grievance Manager (SGM)	Manage and oversee community grievance procedure. Monthly reporting on community grievances to PMG Stakeholder Engagement Lead.
Grievance Committee	Resolve non-judicial disputes arising out of various matters related to the Project.
Rogun JSC Stakeholder Engagement Lead	Responsible for stakeholder engagement activities and GRM implementation and management related to workers and community members in Rogun City. Monthly reporting on Rogun-related grievances to PMG Stakeholder Engagement Lead.
PMG Stakeholder Engagement Lead	Responsible for all other stakeholder engagement activities and GRM implementation and management. Monthly reporting on all Project-related grievances to senior management.
Third-Party Sensitive GRM Officer	Manage and implement sensitive GRM. Monitor and report on SEA/SH risks and grievances and ongoing monitoring of the support and safety needs of survivors and any witnesses and/or Whistleblowers.

Further information on the specific engagement activities to be carried out by each unit above is contained within the SEP. In summary, the diagram below presents the channels through which stakeholder engagement will be carried out on this Project:

Table 6-8 Stakeholder Engagement Communication Channels



6.15 COMPLIANCE WITH NATIONAL LEGISLATION

6.15.1. Through the development and implementation of the SEP under the updated 2023 ESIA and SEP, stakeholder engagement is meeting national EIA requirements regarding disclosure, consultation, and access to information.

6.16 DISCLOSURE OF THE ESIA AND SUPPLEMENTARY DOCUMENTATION

6.16.1. PMG, supported by DFZ and Rogun JSC, will disclose relevant information about the Project during the disclosure period and then in an ongoing manner as the Project evolves. The ESIA and supplementary documentation will be disclosed with sufficient time for consultation and thereafter will remain in the public domain. The disclosed information will include:

- Draft ESIA (including the ESMP).
- Non-Technical Summary (NTS) of the ESIA.
- Environmental and Social Commitment Plan (ESCP).
- Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM).
- Resettlement Policy Framework (RPF).

6.16.2. Consultation and disclosure materials, including the relevant management plans, will be adapted depending on the point of interest of the different stakeholder groups. The draft ESIA report will be available for review and comment by stakeholders through a variety of mechanisms outlined in the SEP. During the disclosure period, consultation will be undertaken with those likely to be affected by the Project, as outlined in the SEP. Further information on the disclosure process is set out in the SEP.

6.17 POST DISCLOSURE OF THE ESIA AND SUPPLEMENTARY DOCUMENTATION

6.17.1. Following completion of the disclosure period, feedback gained throughout will inform the continued development of the Project through updating the ESIA and relevant mitigation measures and management plans. The disclosure documentation (such as the ESIA and SEP) will be updated to capture the feedback gained throughout the disclosure period. The full programme for disclosure activities is provided within the SEP document and the agenda for undertaking the programme will be shared with the Project Lenders for comment prior to its implementation in the first week of the disclosure period.

6.17.2. After the disclosure period, feedback from the engagement sessions presented within the SEP will be circulated by the PMG to relevant departments of the supporting and implementing agencies and the mitigation measures contained within the relevant management plans will be updated as appropriate.

7 ENVIRONMENTAL AND SOCIAL BASELINE

7.1 INTRODUCTION

7.1.1. This chapter provides a summary of the environmental and social baseline conditions, presented in a series of baseline summaries that provide a clear overview of each topic.

7.1.2. Further details supporting the baseline summaries are presented in **Volume II**: **Technical Annexes** of this ESIA. The following figures present the baseline summaries for the Project:

Table 7-1 - Baseline Summaries

Baseline Summary	Aspect
Figure 7-1	Air Quality
Figure 7-2	Noise
Figure 7-3	Soils and Geology
Figure 7-4	Water
Figure 7-5	Traffic and Transport
Figure 7-6	Waste
Figure 7-7	Biodiversity
Figure 7-8	Local Economy and Employment
Figure 7-10	Community Assets and Infrastructure
Figure 7-11	Community Health, Safety and Security
Figure 7-12	Human Rights, Vulnerabilities and Gender Issues
Figure 7-13	Land Acquisition and Resettlement
Figure 7-14	Cultural Heritage
Figure 7-15	Landscape & Visual
Figure 7-16	Meteorology & Climate
Figure 7-17	Area of Influence (AoI)

Current Baseline

Background air quality data for the Rogun area is not recorded by the Tajik Government. The collection of baseline data for the Project has been predominantly desk based. Desk based baseline datasets analyses include; Meteorology, Temperature, Windspeed and Direction, Wind Classes, Precipitation, and NASA Background Pollutant Concentrations.

In addition, a site visit for the purpose of auditing air emissions management practice, existing baseline data collection and additional sampling was completed by WSP between the 30th April and 6th May 2023.

Meteorology

Numerical Weather Prediction (NWP) meteorological data has been obtained for the location of the Project (38.681N, 69.774E) for the five years from 2019 to 2022 inclusive. NWP Meteorological Datasets are summarised below.

Summary of NWP Meteorological Datasets

Year	Temperature (°C)	Wind Speed (m/s)	Days with Wind Speed greater than 5.4 m/s	Dry Days	Days with Precipitation >0.25mm
2018	14.4	1.8	0	224	128
2019	14.4	1.8	0	207	136
2020	13.4	1.7	0	220	134
2021	14.6	1.8	0	237	109
2022	15.4	1.8	0	220	126

Temperature

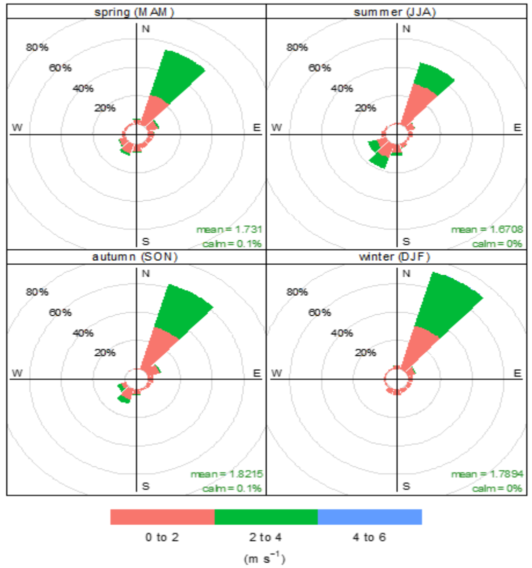
Within the 5-year NWP dataset, temperatures vary between an average maximum of 20.7°C and absolute maximum of 37.8°C, and an average minimum of 8.2°C and absolute minimum of -13.7°C.

Windspeed, Classes and Direction

Wind direction is characterised by a strong north-easterly element that is present within all five years in the NWP dataset obtained.

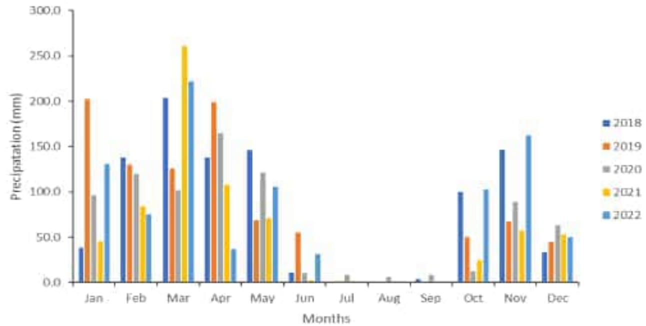
Wind speed in the area is characterised by only a small variation in average wind speed of approximately 1.3 m/s, with no occasions where wind speed might reach or exceed the speed of 5.4 m/s that characterises conditions leading to excessive surface wind erosion.

NWP Seasonal Wind Roses for 2022



Precipitation

No rainfall is experienced for up to 65% of the year and up to 136 days in the year where rainfall is in excess of 0.25mm that would allow for natural suppression of dust conditions.



NASA EarthData—Background PM 2.5 Concentrations Summary

Ground level PM2.5 annual average concentration	Within the AoI (20 km buffer)	World Health Organisation (WHO) guideline value
Maximum	25.7 µg/m³	5 µg/m³
Minimum	21.3 µg/m³	

PM2.5 concentrations are elevated in Tajikistan and the surrounding countries. This is possibly due to the mountainous habitats either being dusty and dry at lower altitudes or experiencing high concentrations of aerosols and humidity at higher altitudes or specific times of the year.

REFERENCES

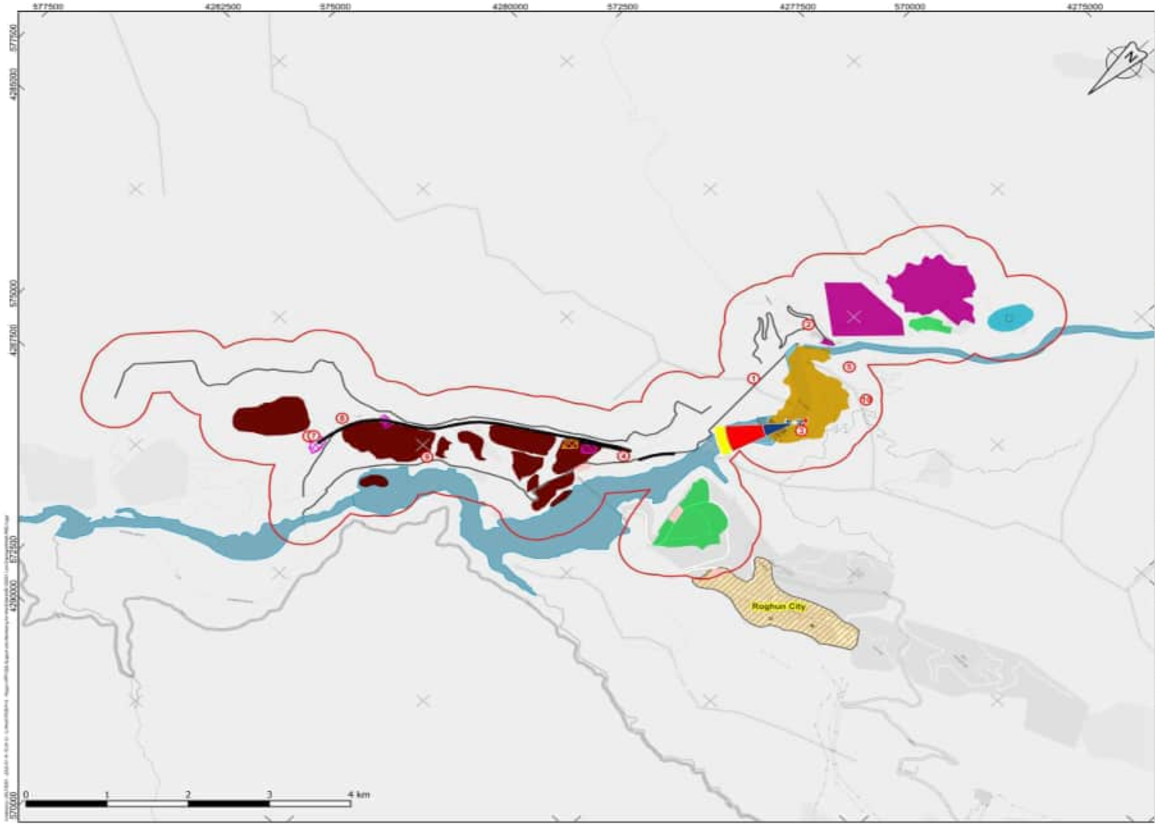
World Health Organization. (2021). WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Retrieved July 2023, from World Health Organization: https://www.who.int/publications/i/item/9789240034228

Carslaw , D., Davison , J., & Ropkins , K. (2012). openair --- an R package for air quality data analysis. Environmental Modelling & Software, 27-28, 52-61. Retrieved from https://davidcarslaw.github.io/openair/

NASA (2023), EarthData. Retrieved from https://www.earthdata.nasa.gov/search

During the site visit, spot particulate (PM10) measurements were taken using a hand-held light scattering laser photometer providing real-time aerosol mass concentrations at the following locations:

Baseline Air Quality Monitoring Locations



Baseline Air Quality Monitoring Results

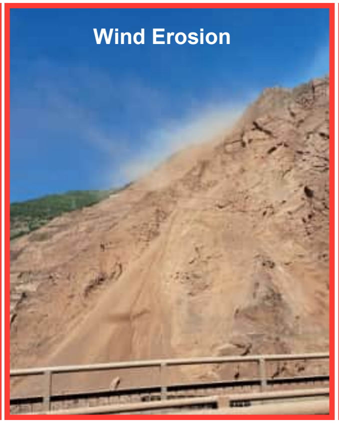
Sample Point	Location	Monitored PM_{10} Concentration (mg/m^3)	
		Average (15-min)	Peak
1	Underground works area, Pit 5	0.1	0.2
2	Above Ground DT1 Outlet Downstream	0.05	--
3	Downstream, Coffer Dam	0.03	--
4	On-Site Laboratory	0.01	--
5	Roadside, Near Reservoir	0.05	0.4
6	Adjacent Crushing Plant/Background	0.04	--
7	Adjacent Crushing Plant	0.06	--
8	Adjacent Conveyor Belt	0.08	0.2
9	Haulage Route	0.04	3.0
10	Underground Tunnel DT4	--	0.18
		--	0.15
Background (Workers Residence)	Within workers compound	0.08	--
Background	Hotel Grounds, Rogun	0.06	--

Observed Sources of Visible Air Pollution

Dust Suspension from Roads

Vehicle Dust Resuspension

Wind Erosion



Visible Construction Dust Plume

Introduction

A noise survey was undertaken at six key locations within the site on 2 and 3 May 2023. The purpose of the survey was to evaluate the existing sound climate at both the site and nearby identified noise sensitive receptors, as well as to determine any existing noise sources.

Baseline Noise Survey

The baseline noise conditions presented in this section correspond to current conditions. The original submission of the ESIA did not include baseline noise information data.

The sound measurements were made in accordance with ISO 1996. All noise measurements were carried out with a Class 1 sound level meter RION NL-52

Summary of Measured Noise Levels from the Project Site

Measurement Location	Average Sound Pressure Level (dBA)	Maximum Sound Pressure Level (dBA)
1 – Area 1 Campsite	60	75
2 - Haul Road	76	95
3 - DT4 Tunnel	86	99
4 – Cofferdam	81	103
5 – Conveyor 2m	81	84
5 – Conveyor 10m	77	80
6 – Crushing 30m	89	98
6 – Crushing 50m	85	94

Baseline – Current conditions

Area 1 Campsite

A short-term noise measurement was undertaken within Area 1 Campsite overlooking the haul road in the main site The noise measurement was also undertaken at approximately 3m from the façade of one of the accommodation buildings, shown adjacent.

Area 2 Haul Road

A short-term noise measurement was undertaken within short distance of the haul road in the main site. The noise measurement was undertaken at approximately 15m from the haul road during a normal period in the daytime, shown below.

Area 3 DT4 Tunnel

A short-term noise measurement was undertaken within short distance of the activities inside DT4. The noise measurement was undertaken at approximately 10m from the activities during a normal period in the daytime.

Area 4 Cofferdam

A short-term noise measurement was undertaken within short distance of the activities at the Cofferdam. The noise measurement was undertaken at approximately 40m from the activities during a normal period in the daytime, shown adjacent.

Area 5 Conveyor

A short-term noise measurement was undertaken within short distance of the conveyor. The noise measurements were undertaken at approximately 2m and 10m from the activities during a normal period in the daytime, shown below.

Area 6 Crushing Plant

The noise measurements were undertaken at approximately 30m and 50 from the activities during a normal period in the daytime. It is considered that, based on the site visit and meetings with the Contractors, this item would be one of the main noise sources on site during the construction phase. It is noted that this is one of two crushing plants of similar size.

Figure 7-3 Soils and Geology - Baseline Summary

Geology

The Rogun TEAS Study found that the main lithological groups identified at the dam site include:

- **The Upper Jurassic salt formation,** primarily composed of salt, subordinate gypsum and a thin red mudstone layer. In the Project area it is shaped as a wedge truncated by the Ionakhsh Fault, the thickness of which is assumed to increase by 15m for every 100m in depth.
- **The Lower Cretaceous continental sequence**, mainly composed of sandstone, siltstone and mudstone layers. The thickness of this sequence at the dam site is in the range of 1,100m.
- **The Marine sequence** - principally Upper Cretaceous - composed of sandstone, siltstone and shales, typified by the presence of limestone, marls and gypsum layers.

The following features have potential influence on the Rogun Dam design:

- **Evaporite Masses and Karst**

Some foothills of the Vakhsh Ridge on the left bank of the Vakhsh river, are formed by evaporite rock masses aligned on the Vakhsh Fault. They were also identified in the valley of Passimurakho, which is the extension along strike of the Vakhsh Fault lineament. It is thus possible that a salt diapir would underlie the interfluve between Passimurakho and Obi-Djushon valleys. These exhibit intensive karst dissolution features. These and the formation of sinkholes can be accompanied by superficial landslides. Such processes have previously led to sinking in the city of Rogun, causing damages to buildings

- **Seismic Scarps**

Evidence of Upper Quaternary and modern age earthquakes was found in the reservoir area. Seismic scarps are evident over a segment of at least 15km at the foot of the Vakhsh Ridge. A seismic scarp between the Tagikamar and Khodzhaalisho streams could be linked to an ancient rockslide, which could be reactivated as water levels rise above the 1,250 m elevation.

- **Slope stability**

Significant potential slides have been identified, corresponding to an evaluation of slope instability. The most important issue is related to the landslide mechanism triggered by the dissolution of salt at the toe of the slope. Such landslides would mostly occur in the left bank

Soils

Tajikistan's soil is typically poor in humus but rich in mineral nutrients. Sand, shingle, scree, bare rock and permanent snow and ice cover about two-thirds of the surface. The following soils have been identified within the Project site:

- Cambisols
- Leptosols
- Alluvial
- Podzols (unconfirmed)

Brown Soils Devoid of Macrostructure (likely Cambisols)

Possible Podzols

Leptosols—Very thin, rocky soils

Alluvial— Sandy soils

Figure 7-4 Water - Baseline Summary

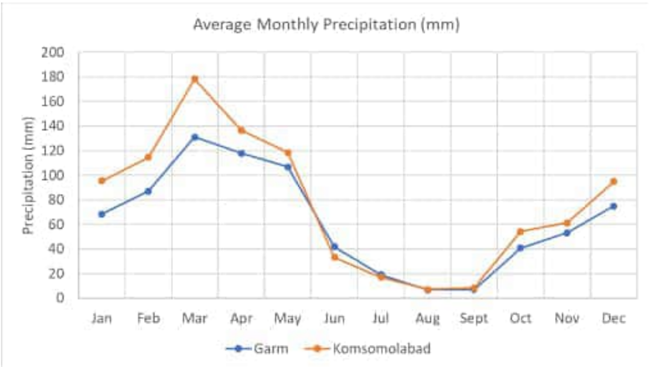
Climate & Temperature

The climate in the region is continental, which is characterised by a wide annual temperature range with hot summers and cool winters (Coyne et Bellier et al., 2014f). The coldest month is typically January, with minimum temperatures of -30°C and -32°C reported at Komsomolabad and Garm, respectively (Coyne et Bellier et al., 2014f). The hottest month is typically July.

Precipitation

The majority of the precipitation in the project area falls during the winter (primarily as snow) and in spring months, while precipitation is low in the summer months. (Coyne et Bellier et al., 2014f).

Most of the precipitation occurring between December and May. The highest average monthly values are observed in March and are approximately 130 mm and 180 mm for Garm and Komsomolabad, respectively. During the driest months (July to September), the average monthly precipitation is below 20 mm.

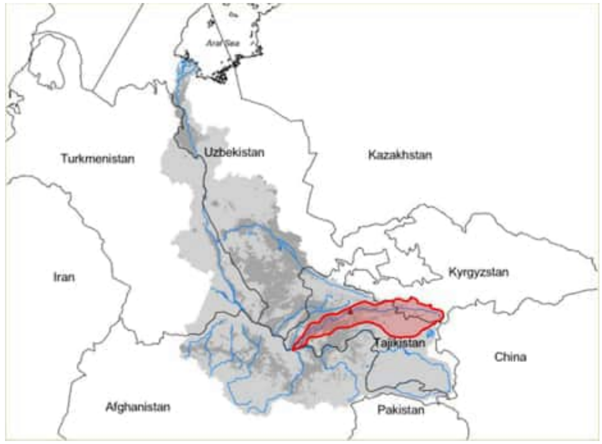


Average Monthly Precipitation – Garm and Komsomolabad

Evapotranspiration and Evaporation

Evapotranspiration for the project area is estimated to range between 750 and 1000 mm/year, while the evaporation from the reservoir is expected to be in the range of 800 to 1200 mm/year (Pöyry 2014).

- The Rogun dam site is located in the Amu Darya river basin which is the on the upper reaches of the Vakhsh river. The Amu Darya river basin is the largest in Central Asia Pöyry, (2014), extending, from its headwaters in the Parmir mountain range to where it discharges into the inland Aral Sea, covering area of approximately 543,739 km2 across, Kyrgyzstan, Tajikistan, Afghanistan, Turkmenistan and Uzbekistan.
- The headwaters of the Amu Darya river basin are in the high snow-capped Parmir and Tian Shan mountains. The Amu Darya river itself starts where the Vakhsh and Paynj rivers combine.
- Approximately 30% of the Vakhsh river catchment lies above 4,000 masl, within the snow and glacier cover zone,.
- Some of the flood plain in these lower reaches of the river basin are important nature reserves, such as the Amu Darya Nature Reserve, protecting the tugai habitat, unique to the floodplains in the desert areas of Central Asia. Pöyr, (2014).



The Amu Darya basin and Vakhsh subbasin (Pöyry (2014)

- The development of the Amu Darya and Aral Sea basins began in the 1960s In the Vakhsh river catchment agriculture and housing are concentrated in the valley bottoms where the terrain is less steep, making up only around 5 to 7% of the land use outside of the mountainous regions.
- Most of the land use is low productivity grazing pasture, making up between 75% to 35% of the land depending on altitude. Forest and scrub only make up around 3% of the land.

Figure 7-4 Water - Baseline Summary

Vakhsh River and main tributaries (Pöyry 2014)

Hydrogeology

Torgoev et al (2017) report that the Upper Cretaceous sediments in the area contain groundwater and are directly recharged by precipitation infiltration. It may be assumed it reflects natural conditions except in the vicinity of settlements where there is likely to be anthropogenic impacts from leaking tanks, septic systems, sewage pipes, spills and agricultural sources.

Hydrology (Surface Water Quality)

The Aral Sea is a large lake located between Uzbekistan and Kazakhstan which has two main tributaries, the Amu Darya River and the Syr Darya. The Aral Sea and has no outflow and the inflows have historically been balanced by evaporation (Pöyry 2014).

Especially during the 1960s, the Aral Sea basin has been widely impacted by large irrigation projects. The resulting increased abstractions from the two tributaries have heavily affected the water balance within it.

Geomorphology

Due to the intensity of erosion processes in its catchment, the Vakhsh river has a high sediment load. The concentration of suspended solids fluctuates during the year and reaches its maximum during the flood season Pöyry, (2014). In the mountainous reaches of the Vakhsh the steep unstable valley sides (Figure 20), and frequent earthquakes in the region, results in a high risk of land and rockslides.

From the gauged flows and estimated bed slope the stream power of the Vakhsh river in the vicinity of the Rogun dam can be estimated to be 31 kW for the annual average peak flow. Where the channel is constrained to around a 100 m width this gives a unit stream power of 0.31 kW/m. Where the valley bottom is wider and there is less constraint on the river channel, the riverbed can be over 1 km wide.

Constrained channel downstream of Rogun dam site (Esri mapping imagery)

Photo of a braided channel at a location upstream of Rogun dam site

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Torgoev, I., Havenith, H.B., Torgoev, A., Cerfontaine, P., and Ischuk, A., 2017. Geophysical investigation of the landslide-prone slope downstream from the Rogun Dam construction site (Tajikistan). Proceedings of the 4th World Landslide Forum, Slovenia.

Figure 7-5 Traffic and Transport - Baseline Summary

Road Section Around the Rogun Reservoir

- 1: Main road on the right bank in the lower part of the reservoir: a considerable part of the realignment of this international road started in the 1980s. Construction stopped shortly after the independence of Tajikistan (September 1991) and the constructed sections have deteriorated over the last 20 years.
- 2: Main bridge over the reservoir: the relocation of the international road also includes a major bridge with a span of 786 m;
- 3: Main road on the left bank in the upper part of the reservoir: only a small section of the international road needs to be replaced;
- 4: New access road on the right bank in the upper part of reservoir: an access road needs to be built because of the rugged terrain
- 5: New access road on the left bank in the lower part of the reservoir: an access road is required because of the reservoir.

Road Network

The main road from Dushanbe to Obi Garm (M41) branches shortly before reaching Obi Garm to access the Rogun HPP site. Shortly after Obi Garm, short stretches of this road will be submerged in Stage 1 of the reservoir filling while, at later stages of impoundment, longer distances including the only bridge suitable for heavy traffic crossing the river, will disappear. This road is an important international and national road and will be replaced and, where required, road and bridge access to villages lying at higher elevations which will not be relocated will be provided.

Two major new roads were planned for the area surrounding the reservoir. One along the left bank of the lower part of the reservoir, from the dam to the main bridge which will cross the reservoir, the other on the right bank, upper part of the reservoir, between the bridge and the village of Gharm, located approximately 50 km to the north-east.

Road Section Around the Rogun Reservoir

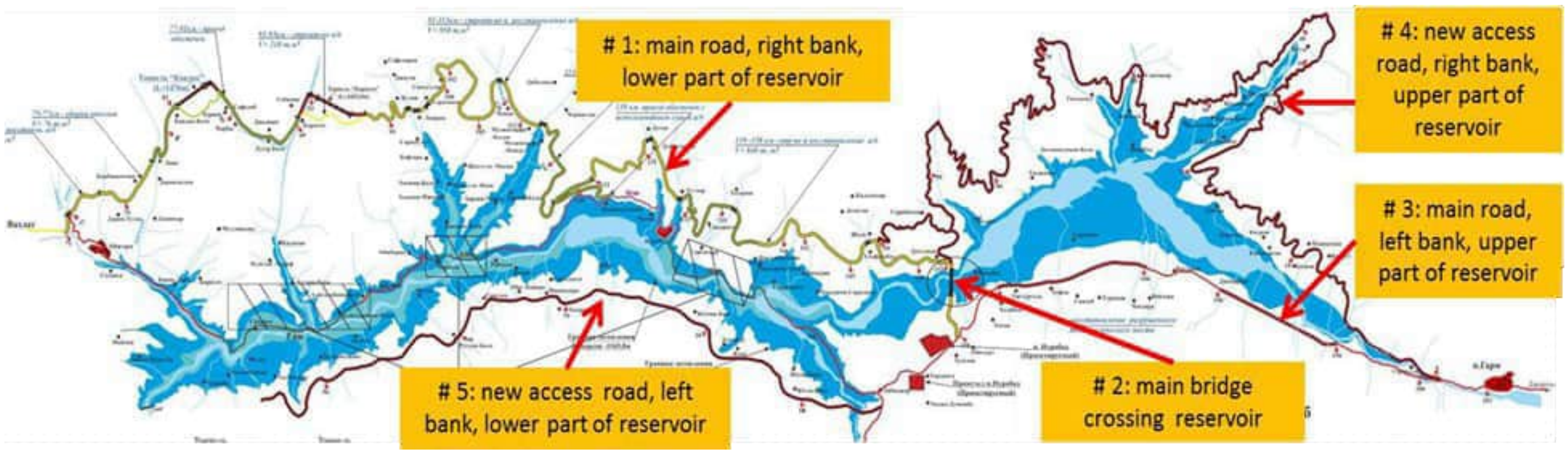


Figure 7-6 Waste - Baseline Summary

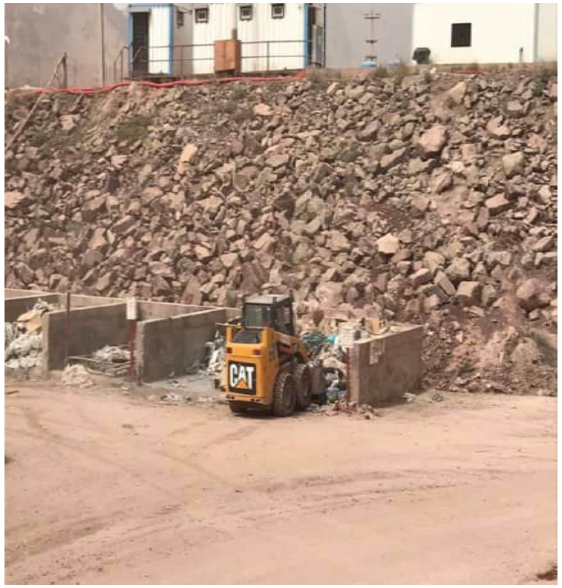
Existing Waste Management Infrastructure in Tajikistan

According to the United Nations Environment Programme (UNEP), adequate waste management is one of Tajikistan's biggest environmental challenges (UNEP, 2019).

- On average, the country generates nearly a kilogram of waste per person per day, creating almost 2 million tonnes of waste across the country every year.
- There are some 70 landfills in Tajikistan containing about 12 million tonnes of waste.
- Inadequate regulation and management in the country mean that hazardous chemicals pose a considerable threat to the environment and public health.

LOT 2—WeBuild

- Facilities managed by the contractor WeBuild include a tank farm, maintenance yard and garage, warehouses, crushed-ore storage, washing facility and Wastewater Treatment Works (WWTW).
- Hazardous waste is stored in the workshop service area. The storage area is constructed from concrete and is covered with corrugated roofing.



WeBuild General waste storage area

LOT 3—TGEM Contractor

- Types of waste produced by the contractor TGEM include domestic/general waste, packaging, hazardous and construction waste, sewage and batching plant wastewater.
- Domestic waste is stored in metal skips, which do not appear to be covered or equipped with lids to protect the contents from rain, wind and snow.
- Hazardous waste is stored in metal barrels fitted with lids, which in turn are kept inside larger containers.

WeBuild General waste storage area

TGEM Construction Waste Storage

WeBuild Hazardous Storage

TGEM Domestic Waste Storage

Lot 4 Construction – Sadd Ariana Co. Contractor

Types of waste produced by the Contractor Sadd Ariana Co. include domestic/general, packaging, hazardous and construction waste. Septic tanks are installed on site for the collection of sewage waste.

According to information provided, the majority of the domestic and packaging waste is collected by Rogun municipal services for disposal at the Rogun landfill site. Metal waste is recycled.

Waste Water

Two types of wastewater, namely domestic wastewater (sewage) and industrial wastewater (i.e. from construction processes), are being generated on site. The bulk of the industrial wastewater is generated through concrete batching works.

Both types wastewater require treatment prior to discharge in order to achieve compliance with applicable wastewater discharge limits.

WeBuild Accommodation Camp WWTP- sewage waste from the WeBuild accommodation camp (approximately 300 personnel) is held in a septic tank (capacity 6 m3 /day). The effluent passes through a screen at an inlet station and then undergoes chlorination treatment. Sewage sludge from the septic tank is removed twice a year by a waste contractor.

WeBuild Accommodation Camp WWTP

WeBuild Main Office - sewage waste from the office (approximately 250 people) is held in a septic tank (capacity 5m3/day). According to information provided by site, the liquid component is discharged to an area of open ground just outside the perimeter fence.

WeBuild Office septic tank

WeBuild WWTP holding tank

Construction Area 5 - according to information provided, this Area (with approximately 250 personnel) is equipped with a septic tank for collecting sewage waste. As with the set-up at the WeBuild Camp, effluent passes through a screen at an inlet station and then undergoes chlorination treatment. The liquid is pumped into the Rogun city reticulation system to Rogun municipal WWTP.

Rogun Permanent Camp – a portable facility (Fraccaroli & Balzan automatic double filtering treatment unit using quartzite and activated carbon) is in operation. At the time of compiling this report it had not been confirmed what types of wastewater this facility is used for and where the water is ultimately discharged to.

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Global Waste-to-Energy Research and Technology Council, Columbia University (2015) Current State of Waste Management in Tajikistan and Potential for a waste-to-energy plant in Khujand City.

Current Baseline

Tajikistan is situated within the temperate zone, although has a more pronounced continental climate, with marked intra-annual temperature fluctuations. The notable landscape diversity comprising three major mountain chains separated by valleys and plains results in hugely varied microclimate, soil and vegetative conditions. There are over 23,000 species of flora fauna found within Tajikistan with the majority of ecosystems falling in to one of seven broad mountain categories. At lower altitudes, the majority of ecosystems comprise modified habitats in which agriculture and urban areas are dominant. Currently one of the most significant ongoing threats to biodiversity within the country is the ongoing/increasing modification of habitats and ecosystems

The Project is located within a modified landscape, broadly classified as an agroecosystem of gardens, forest-plantations and personal plots on the Vakhsh River in the southern region. The habitats present are typical for valleys within mountainous areas of Tajikistan. The majority of the habitats present across the ZoI have been modified by humans as part of settlements and agriculture land use. Along with remnant natural/semi-natural habitats, this has resulted in a landscape that comprises the following habitat types:

Protected Areas

There are no protected areas located within the area that will be affected, however, there are four protected areas located within 50km of Project:

Protected Areas within 50 km of the Project

Protected Area	IUCN Management Category	Distance to Project
Kamarovsky	Nature Refuge (IV)	Located c. 10km downstream of the Project
Sarikhosor	Natural Park (IV)	Located c. 50km downstream of the Project
Nurek Species Management Area	Species Management Area (IV)	Located c. 50km downstream of the Project on both sides of the upper part of the Nurek Reservoir
Romit	Nature Refuge (IV)	Located c. 50km to the west of the Project.
Tigrovaya Balka Nature Reserve	National Nature Reserve Important Bird Area (IBA)	Located downstream of the Project on the lowermost part of the Vakhsh river basin

Republic of Tajikistan, Scheme of ecosystems

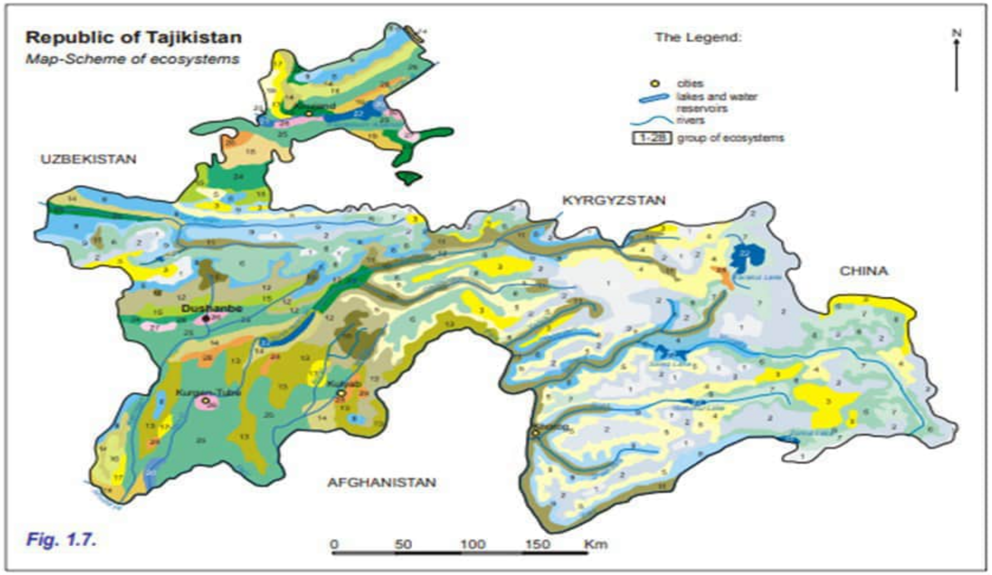


Fig. 1.7.

Fig. 1.7. **Legend to «Map-Scheme of ecosystems»**

Nival Glacier Ecosystems
- 1 Glaciers and snowfields
- 2 Rocks and taluses with rare vegetation

High Mountain Desert Ecosystems
- 3 Rare vegetation
- 4 Wormwood-teresken, steppe
- 5 Dwarf-shrub-steppe

High Mountain Meadow and Steppe Ecosystems
- 6 Forbs meadow steppe, thymes
- 7 Low-grass meadow, swamp

Mid-Mountain Conifer Forest Ecosystems
- 8 Various-shrub steppe and light forest
- 9 Forbs meadow-forest

Mid-Mountain Mesophyllic Forest Ecosystems
- 10 Broad-leaf forest
- 11 Flood-plain small-leaf forest
- 12 Light forest, foliage tree, mesophyllic shrub

Mid-Mountain Xerophytic Light Forest Ecosystems
- 13 High-grass, shrub, pistachio
- 14 Forbs wormwood, almond

Mid-Low-mountain Semisavanna (savannoide) Ecosystems
- 15 High-grass
- 16 Forbs and shrub
- 17 Low-grass semisavanna

Foothill Semidesert and Desert Ecosystems
- 18 Low-grass, saltwort-wormwood
- 19 Sand, semi-woody, shrub

Wetland Ecosystems
- 20 Tugai
- 21 Meadow, swamp
- 22 Wetland

Agroecosystems
- 23 Gardens, forest-plantations, personal plots
- 24 Rain-fed pastures
- 25 Irrigable pastures

Urban Ecosystems
- 26 Municipal
- 27 Industrial

Ruderal-degraded Ecosystems
- 28 Weed, ruderal

Reptiles

The desk study recorded 49 species of reptiles present in Tajikistan, of which 35 species are present in the Vakhsh River Valley. During the 2023 field surveys, 13 of these were recorded which included central Asian tortoise Testudo Horsefieldii, which is classified as vulnerable on the IUCN red list.

Notable reptile records

Species name	Habitat and distribution	Conservation
Asian tortoise Testudo horsfieldii	The closest record was to the north of Obigarm, approximately 2km outside of the AoI, but with suitable habitat identified across the AoI to support this species.	IUCN VU TRB VU
Orange-tailed skink Eumeces schneiderii	Two records were made during the 2023 field surveys, both outside the AoI. As with the tortoise, the orange-tailed skink occupies a wide variety of habitats. Considered to be fairly common across the study area.	TRB EN
Tartar sand boa Eryx tatricus	Two records were made during 2023 field surveys, within valleys to the east of the AoI. Suitable habitat exists across the AoI.	TRB EN
Blunt-nosed viper Vipera lebetina	Two records were made during 2023 field surveys, with one being immediately adjacent to the flooding zone, east of Komsomalabad. Suitable habitat exists across the AoI.	TRB EN

Flora

Tajikistan supports a hugely diverse floral assemblage, with over 9,700 species of plant recorded, over 1,100 are endemic. Given the legacy of human influence, the floral assemblage has been greatly reduced. There were 11 species within the TRB and increased to 18 following surveys in 2023; however, the majority of these were from outside the AoI. A wide ranger of plants have been recorded from across the 12 targeted areas totalling 63 species. The majority of species found in the AoI are common.

Mammals

The desk study estimated 50 species of mammal to be present in the valley of the Vakhsh River, which included four insectivore species, 13 bat species, one hare species, 20 rodent species, 13 carnivores, and six ungulates.

During the fields surveys 38 species were recorded within the valley of the Vakhsh River within the ZoI. The most important habitats across the ZoI for the mammals are the forests including forest ravines, broadleaved forests and juniper forests, floodplain and alpine habitats.

Birds

The desk study recorded habitats suitable to support 217 bird species in the Vakhsh River Valley of which 23 of these species are listed in the Red book of the Republic of Tajikistan. The Vakhsh River Valley is one of the largest stopping points in Eurasia for migratory birds as it lies within two global migration routes which are West Siberian region—central and east African, the Arabian Peninsula and countries of central Asia—India, Pakistan and Afghanistan. The field surveys recorded 158 bird species within the Vakhsh River Valley notable species included the Egyptian vulture, bearded vulture and saker falcon.

Fish

There was a total of 36 fish species identified to be present within the Vakhsh River Valley including the lakes of the Tigrovaya Balka Nature Reserve in the desk study.

1) Pasture habitat near Komsomalabad
2) Modified floodplain habitat at Chorsada
3) Floodplain habitat upstream of the Vakhsh/Obikhingou confluence

Figure 7-8 Local Economy and Employment

Current Baseline

In 2019, estimated 26.3% of the Tajikistan population was living below the poverty line, which continues a trend of steady improvement to the national poverty rate since 2013, when it was at 34.3%. Incomes, particularly in the Rasht Valley region, tend to depend on unstable factors such as agriculture, livestock and remittances.

Agriculture makes up 28.6% of GDP (2017) and provides 71.1% of employment in Tajikistan. accounts for 43% of the labour force (2016), with the most important agricultural product being cotton. It is estimated that 7.4% of the population is multidimensionally poor, while an additional 20.2% is vulnerable to multi-dimensional poverty.

Emigration out of Tajikistan is high, particularly amongst younger Tajiks, due to the limited availability of jobs and the higher incomes available abroad. In 2021, at least 40% of households had at least one migrant working abroad. As a result there is a often a reliance in households on remittances from Tajikistani migrant labourers working away in Russia and Kazakhstan.

Economic Indicators

Economic Indicator	2010	2022
GDP (USD, billions)	5.64	10.49
GDP per capita (USD)	740.3	1,054.2
GNI per capita (USD)	2,962	4,548 (2021)
GDP per capita, purchasing power parity (PPP) (USD)	2,840	5180 (2021)
GDP growth (annual %)	6.5	8
Net Official Development Assistance (ODA) received (USD, millions)	388	546.7 (2021)
Foreign direct investment, net inflows (% of GDP)	9.4 (2008)	1.7
Personal remittances, received (% of GDP)	35.8	50.9

Labor Indicators in Tajikistan

Labor Indicator	2010	2021
Unemployment (% of total labor force)	10.9	7.8 (2022)
Labor force participation rate (%, female) (age 15 and older)	29.2	30.2
Labor force participation rate (%, male) (age 15 and older)	54.8	50.5

Multi-dimensional poverty indicators

Multi-dimensional Poverty	2012	2017
Population in multi-dimensional poverty (%)	12.2	7.4
Population who are multi-dimensionally poor and deprived in nutrition (%)	10.5	6.2
Population who are multi-dimensionally poor and deprived in child mortality (%)	2.8	2.1
Population who are multi-dimensionally poor and deprived in years of schooling (%)	0.4	0.1
Population who are multi-dimensionally poor and deprived in school attendance (%)	6.3	4.5
Population who are multi-dimensionally poor and deprived in cooking fuel (%)	7.9	3.4
Population who are multi-dimensionally poor and deprived in sanitation (%)	1.3	0.3
Population who are multi-dimensionally poor and deprived in drinking water (%)	7.5	3.5
Population who are multi-dimensionally poor and deprived in electricity (%)	0.5	0.1
Population who are multi-dimensionally poor and deprived in housing (%)	10.3	5.6
Population who are multi-dimensionally poor and deprived in assets (%)	1.7	0.3

Current Baseline

Infrastructure

The main road from Dushanbe to Obi Garm (M41) branches shortly before reaching Obi Garm to access the Project. Shortly after Obi Garm, short stretches of this road will eventually be submerged by the reservoir.

This road is an important international and national road and will be replaced where required, with road and bridge access provided to those settlements which are not being relocated.

Electricity

While the majority of the population in Tajikistan has access to electricity, many experience blackout during winter due to the current power system being unable to meet demand.

Energy Infrastructure Indicators

Energy Indicator	Year varies	Year varies
Access to electricity (% of population)	98.8 (2010)	99.6 (2021)
Electric power consumption (kWh per capita)	2036.9 (2007)	1486.2 (2014)
Renewable energy consumption (% of total final energy consumption)	53.8 (2007)	38.6 (2019)

Healthcare

Tajikistan has a health system which provides health services to individuals who fulfil particular criteria.

Health spending in Tajikistan is the lowest in the WHO European Region, despite increased spending over the past few years. The country also has the lowest ratio of healthcare workers to population in the WHO European Region.

Life expectancy in Tajikistan has improved in recent years and is higher than the central Asia average, but lower than the WHO European Region average.

Water

Access to clean drinking water continues to be a problem in Tajikistan, particularly in rural areas.

Access, for the general population, to improved water sources has improved from over 75% in 2012 to over 84% in 2020, however Tajikistan has the lowest share of population (55%) with access to safely managed water supply sources.

Religion

Islam is the primary religion in Tajikistan, with approximately 98% of the population identifying as Muslim (95% Sunni and 3% Shia).

Jamoat Community Infrastructure

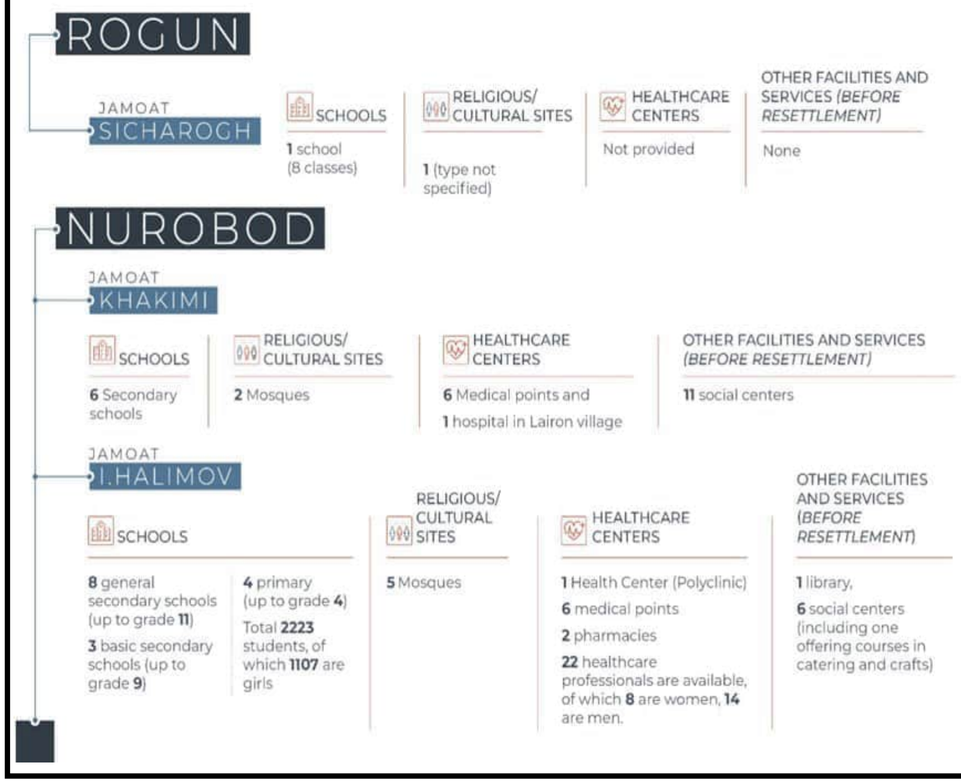


Figure 7-10 Community Assets & Infrastructure - Baseline Summary

JAMOAT KHUMDON

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
1 school in Labi Jar village	There are no official mosques. People pray in public centers	Not provided	None

JAMOAT MEHROBOD

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
4 secondary schools	**4** Mosques **2** Teahouses	**4** Medical Points	None

JAMOAT MUJIKHARF

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
15 secondary schools	**25** Mosques **13** Pilgrimage Sites	**5** Medical Points **1** Healthcare Center **1** Hospital	**3** Mills, **5** Sawmills, **2** Plant for door and window manufacture

JAMOAT SAFEDCHASHMA

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
8 secondary schools and preparatory schools	**7** - Mosques (two of them are official)	**1** Hospital **3** medical points	**1** Museum

RASHT

JAMOAT BOQI RAHIMZODA

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
4 Primary **4** basic secondary **7** secondary	**8** (unspecified)	**1** Outpatient clinic **8** Medical points	None

JAMOAT N MAKHSUM

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
10 secondary schools and preparatory schools	**Not provided**	**10** Medical Points	**32** shopping centers, youth center, sewing center Basic educational courses provided

JAMOAT OBI MEHNAT

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
2 Educational Institutions **1** primary school	**1** Mosque, **1** Mausoleum which is a place of pilgrimage	**1** Healthcare center **1** Hospital	**5** Beehives

JAMOAT QAL'AI SURKH

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
3 Secondary Schools	**4** Mosques **1** Teahouse	**3** Medical points	**3** Shops

JAMOAT NAVOBOD

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
2 Secondary Schools **3** Kindergartens	**4** (unspecified)	**1** Healthcare Center **2** Hospitals	**Courses:** Welding, Driving, Concrete Working

FAIZOBOD

JAMOAT BUSTON

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
4 General Secondary Educational Institutions **4** basic secondary schools **1** kindergarten	**4** (types not specified)	**2** Healthcare center **3** Medical Points	Job Fairs and Courses

TURSUNZODA

JAMOAT 10 SOLANGII ISTIKLOLIAT

SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
18 General Secondary Educational Institutions **7** secondary schools **6** basic secondary schools **5** primary schools **0** kindergartens	**15** Mosques	**3** Healthcare Centers **10** First-aid Posts	Computer Courses Provided

JAMOAT JURA RAHMONOV

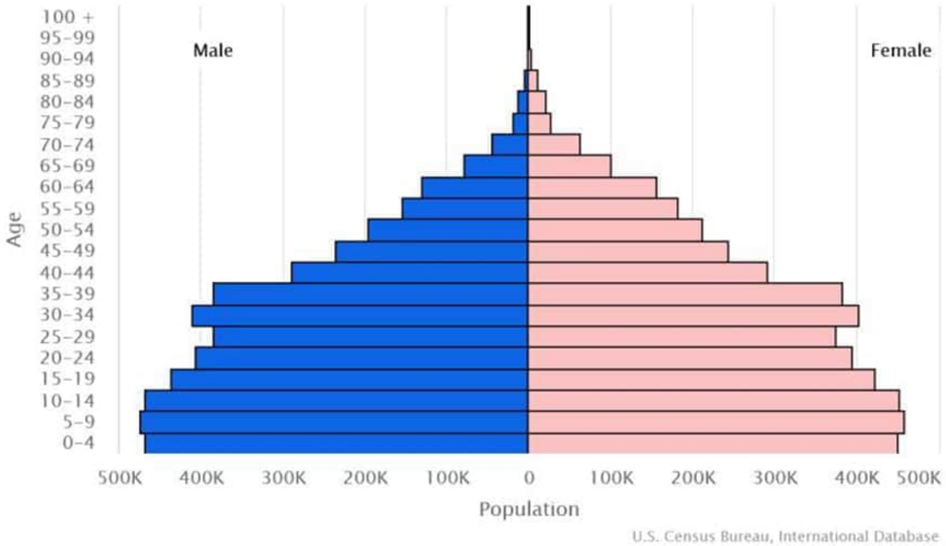
SCHOOLS	RELIGIOUS/ CULTURAL SITES	HEALTHCARE CENTERS	OTHER FACILITIES AND SERVICES *(BEFORE RESETTLEMENT)*
9 General Secondary Educational Institutions **4** Basic Secondary Schools **1** kindergarten	Not provided	**3** Healthcare Centers **10** first-aid Posts	None

Figure 7-11 Community Health, Safety and Security—Baseline Summary

Current Baseline

Tajikistan is a relatively young country, with nearly 50% of the population under the age of 25 years old.

Population Age Pyramid for Tajikistan



Family Planning in Tajikistan

Family planning services are limited in Tajikistan, and in 2017 it was estimated that 21% of women were using contraceptives. In 2017, the proportion of women of reproductive age (15-49 years) who were married or in a union and were using, or whose partner was using, a method of contraception was 29.3%. The estimated fertility rate in 2023 in Tajikistan is 2.42 children born per woman

Traffic Accidents in Tajikistan and Rasht

Traffic Accidents in Tajikistan have been decreasing from 1303 recorded incidents in 2017 to 1096 incidents in 2022. Locally, in the Rasht zone, both accident rates and fatality rates have remained steady over the same period. The fewest accidents occurred in 2021 (3), the fewest fatalities in 2019 (2). The most accidents occurred in 2022 (11) and the most deaths in 2020 (7).

Health in Tajikistan

Health Indicator	2010	2021
Life expectancy at birth (years, female)	73.2	73.7
Life expectancy at birth (years, male)	68.3	69.6
Fertility rate (births per woman)	3.5	3.2
HIV prevalence (% population ages 15-49 yrs old)	0.1	0.2
Incidence of tuberculosis (per 100,000 people)	128	88
Mortality rate, under 5 (per 1,000 live births)	43	31
Maternal mortality rate (per 100,000 live births)	32.0	17.0 (2020)
Mortality rate, adult, female (per 1,000 female adults)	144.8	107.4
Mortality rate, adult, male (per 1,000 male adults)	227.0	162.8
Prevalence of underweight, weight for age (% of children under 5)	14.9 (2005)	8.3 (2010)
Prevalence of stunting, height for age (% of children under 5)	29.5	15.3 (2020)
Immunization, measles (% of children ages 12-23 months)	94	97

Deaths from infectious and parasitic disease

According to WHO data, infectious disease was responsible for 578 deaths in 2017, the most recent year for which data is available. Of these, 278 deaths were from tuberculosis, and a further 149 were from diarrheal diseases. HIV/AIDS was responsible for 7 deaths.

WHO, 2023, WHO Mortality Database Tajikistan. Available at: https://platform.who.int/mortality/countries/country-details/MDB/tajikistan [Accessed 24.08.2023]

Figure 7-12 Inclusion, Vulnerabilities and Gender Issues - Baseline Summary

Poverty in Tajikistan

In the last decade, Tajikistan sustained economic growth and managed to reduce national poverty rates from 34.3% in 2013 to 22.5% in 2022 (World Bank, 2023, Tajikistan Economic Update).

According to the World Bank, the poverty rate fell to 13.4% under the international poverty line of US$ 3.65 (2017 PPP). Social protection and assistance systems are going through modernization to capture more vulnerable people in need. However, still the country faces challenges in ensuring the inclusion and protecting the rights of all members of society, whether along gender lines or issues faced by vulnerable populations.

Gender Issues

In Tajikistan, discrimination based on gender is illegal, and equal work for equal renumeration is mandated. However, family-related factors and social institutions mean that gender inequality remains high, particularly in the areas of tertiary education enrolment, labor pay, household decision making and control over assets.

- In 2021, women held 23.4% of the seats available in parliament, compared to 19.6% in 2008.
- Approximately 69% of working age females not in paid employment in 2016 and the proportion of females in the total number of employed declining.
- Domestic violence is prevalent in Tajikistan, and while the 2013 law on the prevention of violence in the family offers victims some protection, it does not criminalise domestic violence or marital rape.
- 30% of the wives left behind by their migrant husbands have been abandoned adding to the family’s financial burden on their shoulders along with traditional responsibilities of taking care of children and the elderly and dealing with domestic work.
- 23% of households in Tajikistan are headed by females and they tend to be smaller households. Rogun Household survey data indicates 17.8% of the respondents were female heads of households.
- Female headed households have a higher risk of poverty than those headed by males.

Vulnerable Households - Reported by Jamoats (by district)

District	Households with social protection	People with disabilities	Widows	Poor individuals	Elderly	Orphans	Military veterans
Rogun	38	---	24	103	42	---	---
Nurobod	1292	100	---	377 individuals 181 families	---	---	---
Rasht	1210	580	8	492	---	110	2
Faizobod	16	6	---	---	16	2	---
Tursunzoda	423	658	---	---	---	---	---

Identified Vulnerable Groups

Disabled people, e.g. those with physical or mental disabilities or chronic illnesses, who will require physical assistance if the village is to be relocated.

Female-headed households (as well as women acting as de facto HoH while the HoH is absent, e.g. for labor migration), who may require additional assistance in building their new houses.

Elderly people with no younger family members within their household, who may also require additional assistance in building their new houses.

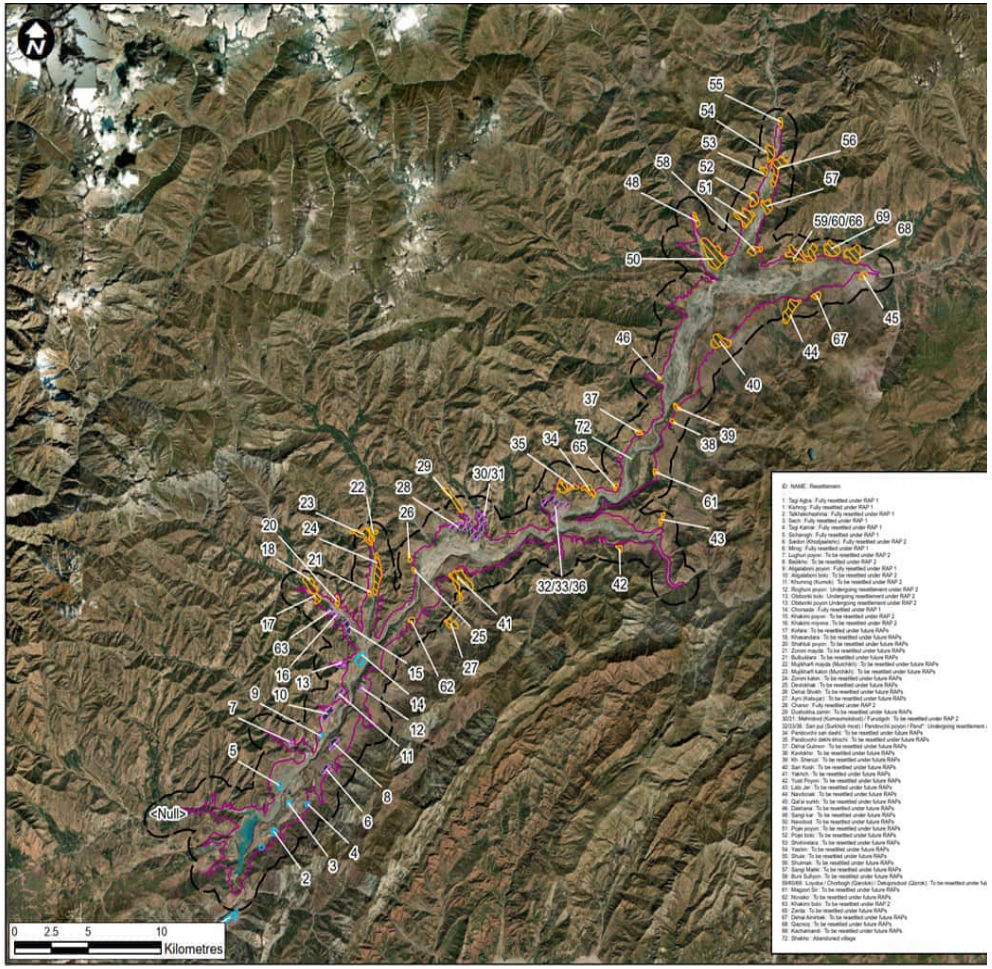
Young people (aged 24 or under) who may require additional assistance in finding a job in their new location

Figure 7-13 Land Acquisition & Resettlement - Baseline Summary

Project Resettlement Figures

Phase	Period	Resettlement Status	Total number of affected villages	Total number of affected households	Total number of affected persons
1	2014-2017 RAP 1	Resettlement completed	8	326	2,697
2	2017-2025 RAP 2	Resettlement completed	6	455	4,682
		Resettlement in progress	4	643	5,004
		Resettlement not started	6	507	3,594
	2025-2032 Future RAPs	Future resettlement	45	4,752	30,651
	Total affected		**69**	**6,683**	**46,628**

Map of Areas to be Resettled



Resettlement Action Plans (RAPs)

In 2014 the first Resettlement Action Plan (RAP1) was prepared which covered the Phase 1 resettlement of 2,697 people residing in eight villages in the Rogun City and Nurobod District. These villages were either situated within the construction footprint or were due to be flooded by early reservoir filling.

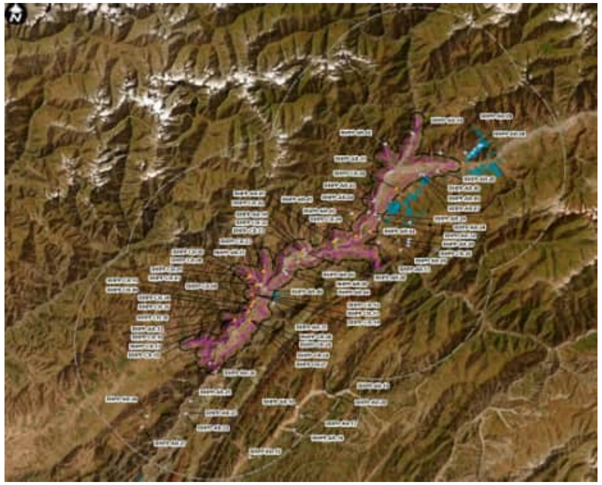
The second RAP (2017-2025, RAP2) covers the resettlement of 16 villages up to the year 2025, situated in Rogun City and Nurobod District. A total of 13,280 affected people is covered by RAP 2, some of whom have already been resettled, or are in the process of being resettled. Additional RAPs will be prepared to cover the remaining 45 villages, including 30,651 affected people, who are due to be resettled in the period from 2025 to 2032.

Future Resettlement Areas (after 2025)

Remaining 45 villages are planned to be resettled after 2025, with some still undergoing geotechnical studies to determine whether relocation will be required. These villages are located within 12 jamoats (Khakimi, Sicharogh, Mehrobod, I. Halimov, Mujikharf, Safedchashma, Boqi Rahimzoda, Khumdon, Shahraki Navobod, Obi Mehnat, N. Makhsum, Qal'ai Surkh).

Archaeological, Historic and Palaeontological Resources

Within a baseline study area buffered to the maximum inundation zone, identified tangible, material remains of past human occupation include prehistoric burials, fortified medieval sites, abandoned settlements, relict agricultural landscapes and stone, iron and pottery surface artefacts. Targeted baseline surveys completed in support of the Project, suggest the upper terraces of the Vakhsh River (above 1,200 *masl*) have the greatest archaeological potential.



Distribution of Cultural Heritage Baseline Resources

Palaeontological

Fossilized dinosaur footprints were identified during recent geological investigations. The multiple sets of footprints from different species were recorded on a steeply dipping sandstone slab . Based on the available geological data, these date to the Cretaceous period (~145 – 65 MYA).

Prehistoric

Evidence of Neolithic settlement (3rd—1st Millennium BCE) has been identified below 1,110 *masl*, with burial mounds tentatively dated to the Kushan Period (1st Century BCE – 4th Century CE). Other burials (likely Late Bronze Age) and associated ceramics have been recorded on the exposed river terraces (c. 1,400 *masl*).

Medieval

The remains of several fortresses and watchtowers (5th—17th Century CE), are visible as earthworks, strategically positioned on the upper terraces of the valley. The Karategin route of the Silk Road, linking China with Uzbekistan, passed along the Vakhsh River, primarily used throughout the 5th to 12th Centuries. Located along the route were trading settlements, small fortresses and outposts to deter raiders. The locations of nine fortresses recently recorded are also listed on Tajikistan's the National Register of monuments (2017).

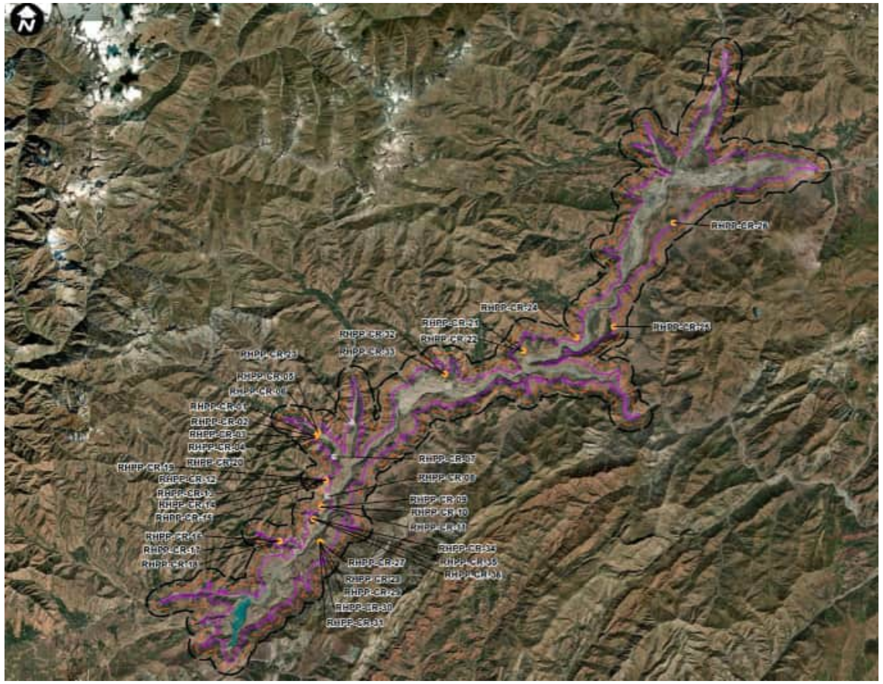
Historic

Several villages with historic ancient origins have been identified (in combination with the ethnographic studies) the oldest are believed to have been originally settled in the 16th Century. Historic tombs and cemeteries are readily identifiable, while built heritage resources include a 200-year old flour mill. Cemetery excavations have provided evidence of occupation dating to a transition period between the ancient Persian faith of Zoroastrianism and Islam, within single-chambered, stone-lined graves, orientated around the central shrine (*mazar*).

Kalai Bacha Fortress, Navdonak Village (Filominova, 2023)

Cultural and Sacred Resources

Tangible, physical features and natural objects embodying spiritual and cultural values have been identified within the study area, in participation with local communities. These include cemeteries, mosques, natural springs, cultural landscapes and other natural features of local cultural significance. Ancient trees, tombs and shrines (*mazars*), and central 'magical greeting' pillars within traditional houses were also noted as assets of local cultural value.



Distribution of known Cultural and Sacred Resources within the Area of Influence

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Intangible Cultural Heritage

Intangible cultural heritage comprises unique cultural activities and belief systems, including indigenous cultural knowledge and traditional lifestyles. The ethnographic consultation programme has observed a number of unique activities, distinct to the region, not commonly found elsewhere in Tajikistan, potentially developed in response to the remote setting and relative isolation of the mountainous village communities.

Traditional craft activities include wool carpet weaving, needlework and embroidery, the construction of clay hearths and musicians making their own instruments and playing traditional music.

The practice of traditional medicine was also observed, with plants and herbs gathered from the mountains.

Traditional ceremonial practices (associated with seasonal festivities, birth, circumcision, marriage and death) were noted and widespread.

Other cultural activities identified include the use of amulets to ward off evil spirits, traditional pottery production, beekeeping, preparation of foods associated with key ceremonial events and festivals.

A Local displaying his Collection of Handmade Musical Instruments (Ashurmadova, 2023)

Figure 7-15 Landscape and Visual - Baseline Summary

Landscape

The landscape of the Area of Influence (AoI) is mostly U-shaped valleys and narrow V-shaped river valleys marked with high mountains and steep slopes around river Vakhsh. The landforms observed in the AoI are mainly riverbeds, floodplains and river terraces.

Close to the Dam site the landscape is high hills on both the side devoid of any vegetation.

Forests are rare in the project area as most trees have been cut to get firewood. Shrubs and bushes are found on the slopes of the reservoir but these are also decreasing as coverage since most are cleared to make way for cultivation.

Landscape view close to Rogun Dam site

Visual

Visual amenity refers to the view, it's components and context which can have a great effect on the quality of peoples' lives. Visual amenity is defined as the 'pleasantness of the view' or outlook of an identified receptor or group of receptors. The project area is quite remote with limited highway infrastructure and steep terrain. Potential Project impacts are considered in relation to the following visual amenity valued component receptors.

Most of the villages that fall within FSL 1290 will be resettled by 2025. Similarly, 76 km of the existing M 41 will be under submergence and hence a new alignment has been identified between Obigam and Nurobad. This new replaced segment will be at a higher altitude.

It is important to note here that existing receptors will no longer be present to perceive the changes in the landscape.

Topography

The project area is located in the Pamir range around the Vakhsh river having an elevation that ranges between 1000 and 2000 metres.

Topographic Map of Tajikistan (project area is marked with red box)

Character Area 1: River and river floodplain: This area is characterised by the riparian landscape associated with the River Vaksh/ River Surkhob and its tributaries. The river Vakhsh cuts a V-shaped channel into the original U-shaped glacial valley, resulting in the river being framed by high mountains. The river is characterised by sand bars and braided channels in most of its reach.

Character Area 2: Residential settlements/small scale agricultural land on the lower slopes: These areas are characterised by wider flood plains, lower slopes or river terraces with village settlements associated with agricultural land, orchards to a varying degree, and is likely to be a characteristic of the wider landscape of the project area.

Figure 7-16 Meteorology & Climate - Baseline Summary

Current Baseline

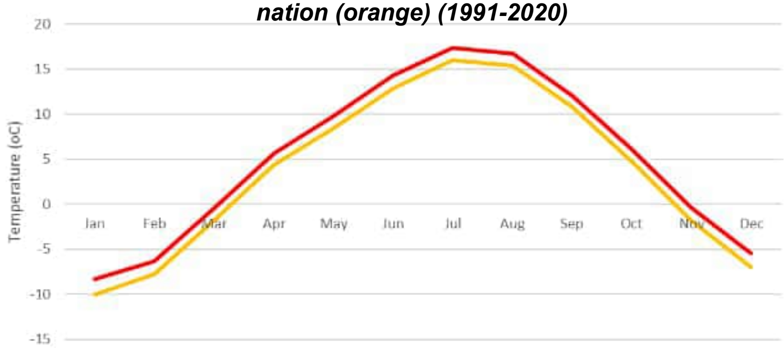
Information on the current meteorological data of Tajikistan has been obtained from the World Bank Climate Change Knowledge Portal. Tajikistan is located in the temperate continental climate zone and with moderate climate variables typical of Central Asia. Climate variability is linked with its geological sub-state, which includes coastal, plain areas and mountains. Baseline climate information for the Region of Republican Subordination is presented as representative of the climate of the Project. The Region is located across central and west Tajikistan, in which the Project is located.

Temperature

Average monthly temperatures in Region of Republican Subordination are slightly warmer in comparison to the rest of Tajikistan. The coldest month is January, with July and August being the warmest months. Temperature records spanning 1901-2021 show increases in annual temperatures consistent with climate projections (see below table) however, temperature has been approximately 0.7°C high than the average for 1961-1990. 2016 was the warmest year since 1900 in Tajikistan with an average temperature of 4.53°C .

Year	Average Annual Temperature (°C)
1901-1930	2.7°C
1931-1960	2.7°C
1961-1990	3.1°C
1991-2021	3.8°C

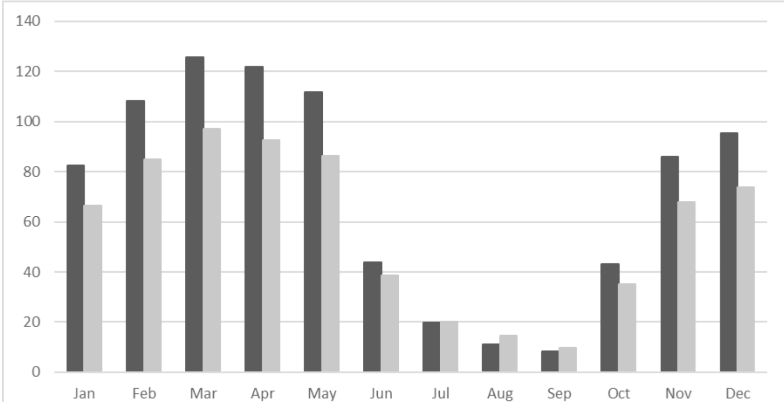
Average Monthly Temperature for Tajikistan (red) vs Region of Republican Subordination (orange) (1991-2020)



Precipitation

Average monthly precipitation in Region of Republican Subordination is generally higher in comparison to the rest of Tajikistan. The wettest month is March, with July, August and September being the driest months. Records indicate annual increases in precipitation with approximately 55mm higher than average for 1961-1990.

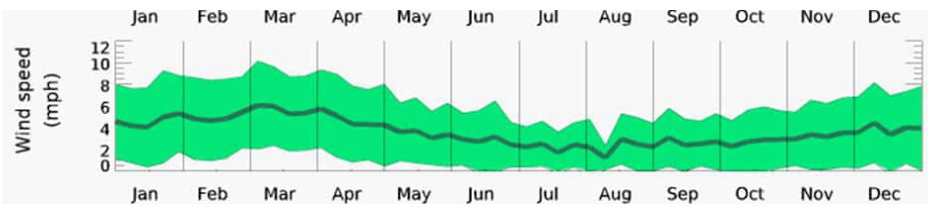
Average Monthly Precipitation for Tajikistan (black) vs Region of Republican Subordination (white) (1991-2020)



Wind

Meteoblue presents observed climate data for the Region of Republican Subordination obtained approximately 72km away from the Project.

Average Monthly Wind Speed (mph) for Tajikistan vs Region of Republican Subordination 2022



Sea Level

The Project is located approximately 1000km from the Arabian Sea at an elevation of approximately 1000m above sea level and so sea level rise is not considered relevant within this assessment.

Future Baseline (Climate Projections)

Climate projections have been derived from the World Bank Climate Change Knowledge Portal for the Project area. Projections have been presented for Region of Republican Subordination. Projections have been provided for SSP2-4.5 and SSP5-8.5, the latter has been used to provide 'worst case' scenario against which to assess the resilience of the Project. The projections have been assessed for the 2030s, 2050s and 2090s (20 year period)

Region of Republican Subordination - Projected Change in Season Temperature (°C) under SSP2 and SSP5

Year		SSP2	SSP5
2030s	Summer	+1.15°C	+1.24°C
	Winter	+1.01°C	+1.37°C
2050s	Summer	+1.87°C	+2.54°C
	Winter	+1.92°C	+2.54°C
2090s	Summer	+3.13°C	+6.10°C
	Winter	+2.99°C	+5.66°C

SSP2-4.5 shows an increase in temperature in the range of 1.15°C in 2030s summer to 3.13°C in 2090s summer. For SSP5-8.5 this shows an increase in temperature in the range of 1.24°C in 2030s summer to 6.10° C in 2090s summer.

Region of Republican Subordination - Projected Mean Maximum of Daily Max-Temperature (°C) under SSP2 and SSP5 for 2030s, 2050s & 2090s

Year		SSP2	SSP5
Baseline (1995-2014)	summer	34.2°C	
	winter	10.0°C	
2030s	summer	35.2°C	35.4°C
	winter	11.3°C	11.4°C
2050s	summer	36.1°C	36.6°C
	winter	12.1°C	12.6°C
2090s	summer	37.2°C	40.2°C
	winter	13.4°C	15.9°C

Periods of extreme temperature can increase the risk of fire outbreak, with high temperatures, low humidity and dry conditions conducive to fire weather. With extreme temperature events likely in the Project area, this poses a risk of fire to the Project.

Precipitation

Region of Republican Subordination - Projected Change in Annual Precipitation (mm) under SSP2 and SSP5 for 2030s, 2050s & 2090s (baseline period 1995-2014)

Year	SSP2	SSP5
2030s	+17.4mm	+4.3mm
2050s	+28.0mm	+26.8mm
2090s	+39.5mm	+61.2mm

An increase in annual precipitation is predicted in Region of Republican Subordination for all time periods and scenarios. This is due to winter precipitation increases far outweighing summer precipitation decreases. The projected change in annual precipitation for Region of Republican Subordination for the 2030s, 2050s and 2090s under SSP2-4.5 and SSP5-8.5 compared to the baseline of 1995-2014 for the 50th percentile is presented in Table 14-5. This shows an increase in annual precipitation in the range of 4.3mm to 61.2mm.

As the country's mountain glaciers melt at increasing rates, in the shorter term this could lead to excess waterflows and cause severe flooding and associated hazards such as landslides and mudslides. In the longer term, reduced glaciers are likely to reduce the regularity of waterflows and may result in the drying of some watersheds. Either hazards may result in severe loss and damage to the Project

Wind

There is low confidence in the accuracy of the results from existing models of future wind conditions under climate change. The site of the Project is identified as having a 'very low' storm hazard risk

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World Bank (2021a) Tajikistan Country Profile. Available at: https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

7.2 AIR QUALITY

7.2.1. A summary of baseline conditions for air quality is presented in Figure 7-1. Further supporting detail for the air quality baseline conditions can be found within **Volume II, Annex 01**.

7.2.2. The collection of air quality baseline data for the Project has been predominately desk-based with a WSP Site Visit for the collection of baseline data of particulate matter (PM)10 measurements.

Dust Suspension

7.2.3. The greatest observed source of visible air pollution on site was from the suspension of dust from the haulage routes. These routes were observed to be very active with several large haulage trucks observed during a 15-minute period. Roads were largely observed to be extremely dusty with no hard surfacing observed on-site. Photos of the observations on-site are presented in Figure 7-1.

7.2.4. Information received as part of the Request for Information (RFI) states that through the transport and access tunnels T-3, T 3a, T-4, T-2, T-9, T-18, T-22, TSA-1, etc. more than 400 vehicles and self-propelled plant, which are sources of air emissions, are moving per day. This includes trucks, sprinklers, fuel pumps (230 units), 115 cars and 55 other items of mobile plant.

Particulate Matter (PM)10

7.2.5. Background data for PM has been obtained from the NASA EarthData programme of data capture from various space missions run by a variety of national and international space agencies. Satellite-based estimates of surface PM2.5 have been obtained based on analysis of satellite data undertaken by van Donkelaar et al. The PM2.5 data within a 20 km buffer zone of the Project shows:

- Maximum ground level PM2.5 annual average concentration: 25.7 µg/m³; and
- Minimum ground level PM2.5 annual average concentration: 21.3 µg/m³.

7.2.6. The minimum PM2.5 concentration within the AoI 20 km buffer zone is above the WHO guideline value of 5 µg/m³ but within the range of values for the WHO interim targets designed to allow countries to work towards the Guideline Value. Compared to the national statistic for Tajikistan within the EarthData dataset, the maximum within the AoI is 47% of the maximum recorded within the national boundary and 117% of the average recorded across the country.

Meteorology

7.2.7. Numerical Weather Prediction (NWP) meteorological data has been obtained for the location of the Project (38.681N, 69.774E) for the period from 2019 to 2022 inclusive. Data using NWP methods has been obtained as no location specific measurements have been made available.

7.2.8. A summary of the Meteorological data is presented in Figure 7-16, and summarised below:

- Average wind speed of approximately 1.3 m/s, with no days exceeding 5.4 m/s. Wind direction is characterised by a strong north-easterly element that is present within all five years in the NWP dataset obtained.
- Temperatures vary between an average maximum of 20.7°C and absolute maximum of 37.8°C.
- Temperatures vary between an average minimum of 8.2°C and absolute minimum of -13.7°C.
- No rainfall is experienced for up to 65% of the year and up to 136 days in the year where rainfall is more than 0.25mm that would allow for natural suppression of dust conditions.

7.3 NOISE

7.3.1. A summary of baseline conditions for noise are presented in Figure 7-2. Further supporting detail for the noise baseline conditions can be found within **Volume II, Annex 02**.

Baseline Noise Survey

7.3.2. A baseline noise survey was undertaken in May 2023 to establish the noise climate within the Project site. The baseline noise conditions are representative of typical construction activities at a given time on site and they do not intend to represent the noise climate representative of the entire duration of the construction programme.

7.1.1. The sound measurements were made in accordance with ISO 1996. All noise measurements were carried out with a Class 1 sound level meter RION NL-52 Equipment Serial No.: 320638. A calibration check was performed before and after all measurements and no significant drift was observed. The survey equipment has laboratory calibration within 2 years for the sound level meter and within 1 year for the field calibrator. All measurements were made with a measurement microphone mounted at 1.2 to 1.5 metres above local ground level, in free-field conditions.

7.3.3. Noise survey measurements were taken at 6 locations across the construction site.

Table 7-2 – Summary of Measurement Noise Levels

Measurement Location	Distance from the measurement locations to the main activities (m)	Average Sound Pressure Level, dB $L_{Aeq,T}$	Maximum Sound Pressure Level, dB L_{Amax}
1 – Area 1 Campsite	400	60	75
2 - Haul Road	15	76	95
3 - DT4 Tunnel	10	86	99
4 – Cofferdam	40	81	103
5 – Conveyor 2m	2	81	84
5 – Conveyor 10m	10	77	80
6a – Crushing 30m	30	89	98
6b – Crushing 50m	50	85	94

7.4 SOILS & GEOLOGY

7.4.1. A summary of baseline conditions for Soils & Geology are presented in Figure 7-3. Further supporting detail for the Soils & Geology baseline conditions can be found within **Volume II, Annex 03**.

7.4.2. More than nine-tenths of Tajikistan is mountainous territory. Half thereof sits 3,000 m or more above sea level. The valleys are important for Tajikistan's human geography but make up less than one-tenth of the country's area. One of the largest of these valleys is the Vakhsh valley into which the Rogun Dam falls.

Geology

7.4.3. Tajikistan has a complex relief and geological structure. The rocks covering the country were formed from the Archean-Proterozoic to the Quaternary period and are mainly represented by rocks formed through volcanic activity and rocks of sedimentary origin. The geological structure of the country is divided into Karamazar (Northern Tajikistan), Central Tajikistan (Hissar – Alai), Pamir (with Darvaz), Tajik depression and Fergana depression. The Project is located in the Hissar-Alai region (ADB, 2019).

7.4.4. The Rogun Techno-Economic Assessment Study (Coyne et Bellier, 2014) found that the main lithological groups identified at the dam site include:

- The Upper Jurassic salt formation, primarily composed of salt, subordinate gypsum and a thin red mudstone layer. In the Project area it is shaped as a wedge truncated by the Ionakhsh Fault, the thickness of which is assumed to increase by 15m for every 100m in depth.
- The Lower Cretaceous continental sequence, mainly composed of sandstone, siltstone and mudstone layers. The thickness of this sequence at the dam site is in the range of 1,100m.
- The Marine sequence - principally Upper Cretaceous - composed of sandstone, siltstone and shales, typified by the presence of limestone, marls and gypsum layers.

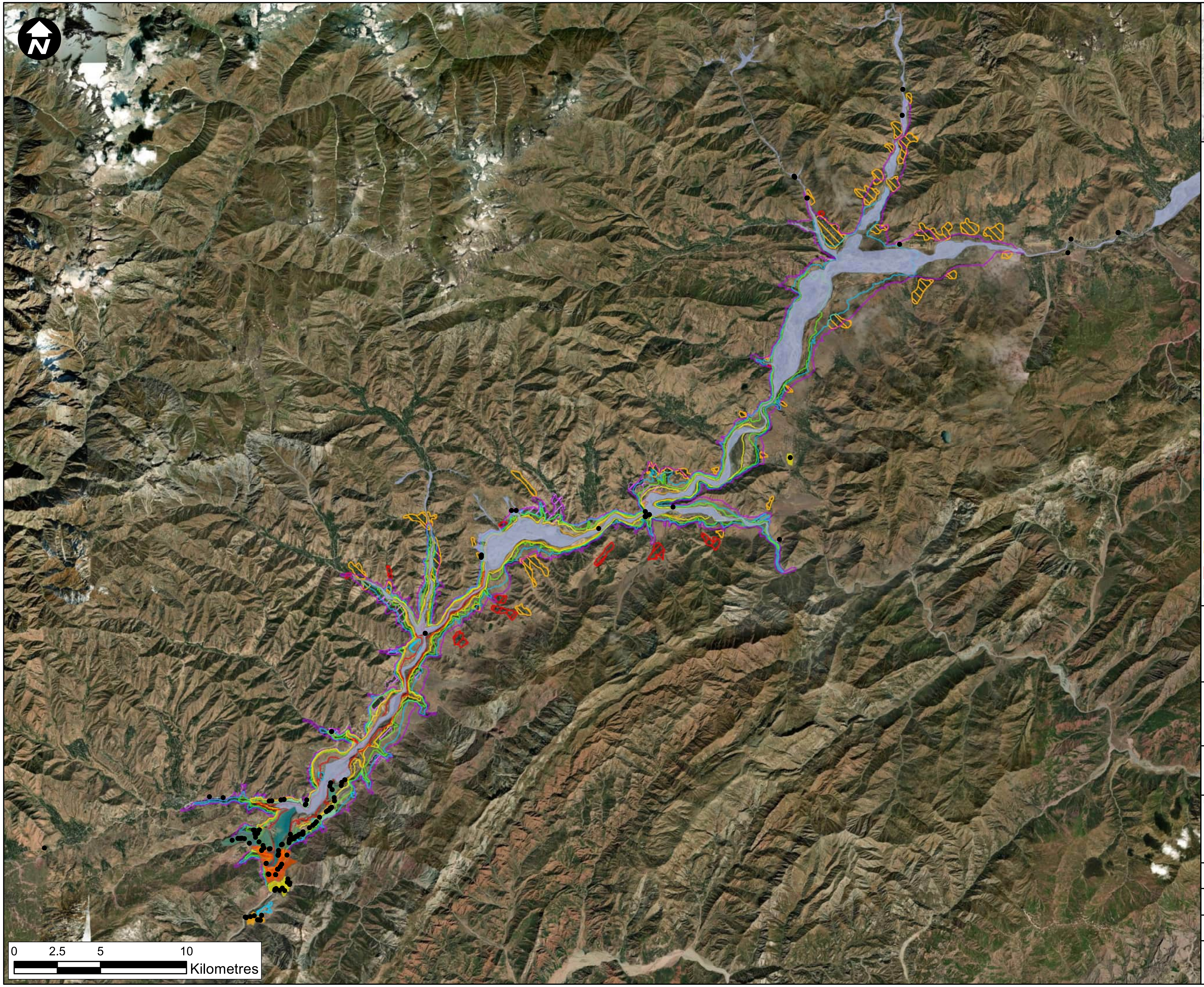
7.4.5. The site geology largely alternates between sandstone and siltstone. Sandstone weathers to produce soils with a sandy texture and siltstone weathers to produce soils with a silty texture. Sand- and silt-dominated soils tend to be largely devoid of macrostructure, as it is typically the clay fraction of a soil that provides structure.

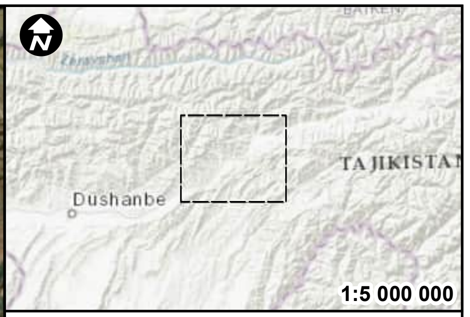
Soils

7.4.6. As most of Tajikistan is covered by mountainous terrain, with only 7% of the land area in valleys, the soils of the country are varied and unevenly distributed. The country's varied climatic conditions also result in a range of different types of soils. The parts located at lower altitudes have soils that are generally dark brown, and in the highlands are typically light brown (ADB, 2019).

7.4.7. A site visit in May 2023 was undertaken to aid the identification of the soils around the Project site using the Harmonised World Soil Database (HWSD). The following soil types were identified to be present around the Project site, with the distribution of these soils presented in Figure 7-3a.

- Cambisols
- Leptosols
- Fluvial Arenosols
- Ferralsols





Legend

- Soil Classification Points

Soil Types

- Arenosol Luvisol
- Cambisol
- Cambisol Anthrosol
- Ferralsol
- Ferralsol Anthrosol
- Leptosol
- Leptosol Anthrosol

Inundation Boundary

- 1110m
- 1165m
- 1185m
- 1220m
- 1255m
- 1290m

Resettlement_Areas

- Fully resettled under RAP 1
- To be resettled under RAP 2
- Abandoned village
- To be resettled under future RAPs
- Not to be resettled
- Unknown

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

PROJECT TITLE

Rogun HPP E&S Support and Monitoring for World Bank

DRAWING TITLE

Figure 7-3a
SOIL TYPES

DRAWING STATUS

FOR INFORMATION

DRAWN	CHECKED	APPROVED	AUTHORISED
TS	KK	NJ	AB

SCALE @ A3 SIZE	DATE	REVISION
1:200 000	2023/10/06	P00

DRAWING NUMBER

ROGUN-WSP-DR-MW-003

7.5 CONTAMINATED LAND

7.5.1. Further supporting detail for the Contaminated Land baseline conditions can be found within **Volume II, Annex 04**.

7.5.2. WSP attended site between Monday 4th and 8th Friday September 2023, during which time WSP were escorted around several key areas, including both areas identified as part of the 2014 ESIA works (ESIA Report (Final) Vol III Environmental and Social Management Plan, 2014), areas of potential concern identified during a review of existing information and areas identified at the time of the site walkover.

Fuel Storage

7.5.3. WSP visited six (6) tank farms (four (4) were active, two (2) were abandoned or inactive) and multiple single tank installations (both active, inactive and abandoned) during the site walkover. As a general comment, there was not consistency to the fuel storage standards being applied across the site, with difference organisations citing different standards that they had implemented, or that installation had complied with standards when installed but had not been updated since the time of installations (sometimes decades old).

Abandoned & Disused Tank Farms

7.5.4. WSP visited one (1) abandoned and one (1) disused tank farm

7.5.5. One tank farm was installed during the Soviet era and was reported not to have been active for at least four years. It is considered to be the responsibility of JSC Rogun. Access to inspect the tanks was limited to high level gantry situated above the level of the tanks. From the limited vantage point, no visual or olfactory evidence of contamination was noted during the September 2023 visit. .

Workshops & Construction Areas

7.5.6. WSP generally witnessed good practices within the workshops with respect to housekeeping and the storage of materials and oils. Incidental staining was noted in the majority of facilities where oil changes or hydraulic repairs were undertaken, none of which were identified at the time of the site walkover as a significant concern.

Sewage

7.5.7. A sewage treatment works is located in Construction Site 1, the works currently consists of three (3) settlement ponds with chloride manually dosed into one (1) of the ponds. At the time of the visit a new settlement pond was in the process of being excavated to the east of the 'sewage treatment works laboratory building'.

7.5.8. Across the wider site away from Construction Area 1 different contractors anecdotally utilised septic tanks to collect sewage. Further discussions within the contractors indicated the liquid drained straight to ground and the solids were collected / disposed of.

Washout Areas

7.5.9. The majority of the Contractors spoken to during the September 2023 site visit seemed to be unaware of the polluting nature of concrete wash waters i.e., high pH (11-12) due to calcium hydroxide (derived from the cement); high suspended solids; and other trace materials (originating from both cement and from additives).

7.5.10. Across the site, WSP witnessed a number of different setups and practices with respect to the 'washing out' of cement mixers, ranging from well considered wash down areas that drained into settlement pits with subsequent to water treatment to washout areas with no control, capture or treatment of the washout water. With the latter being the more common practice witnessed across the site.

7.5.11. A number of areas appeared to drain directly into the reservoir or river, with visible buildups of cement down gradient of the washdown areas. When discussed with the contractors / operators, they referred to surface water monitoring undertaken by another party and that if there was a significant environmental impacts Rogun HPP would have halted their practices.

Landfills & Waste Management

7.5.12. WSP visited three (3) 'dump' sites, two (2) of which are located within an area of future impoundment, and one (1) located in an elevated location downstream of the dam. WSP were unable to establish who controlled the 'dump' sites during the September 2023 site visit.

7.5.13. The 'dump' site located north of Construction Area 1 on the west bank, was apparently not in use, although some of the materials and waste appeared to have been deposited recently. Most of the materials / wastes deposited where aggregate or soils, however, there were frequent anthropogenic inclusions including general waste, tyres, oil drums and food waste.

Sub-Stations & Transformers

7.5.14. A number of transformers and sub-stations were noted around the construction site. WSP did not visit or inspect any of the transformers or equipment, however, based on the age of the Project it is likely Polychlorinated Biphenyls (PCBs) transformer oil was utilised historically onsite and may still be present within the some of the legacy equipment.

Asbestos

7.5.15. Possible Asbestos Containing Materials (ACMs) in the form of corrugated asbestos sheeting were noted on a handful of buildings within Construction Area 1.

7.5.16. Possible asbestos lagging was noted among the surficial debris and waste within the 'Cecharo' Demolition, however, due to the potential hazard, the area was not further inspected.

7.6 WATER

7.6.1. A summary of baseline conditions for Water are presented in Figure 7-4. Further supporting detail for the Water baseline conditions can be found within **Volume II, Annex 05**.

7.6.2. The Rogun dam site is located in the Amu Darya river basin, on the upper reaches of the Vakhsh river. The Amu Darya river basin extends across several countries, from its headwaters in the Parmir mountain range to where it discharges into the inland Aral Sea. With an area of approximately 543,739 km2 the river basin extends across, Kyrgyzstan, Tajikistan, Afghanistan, Turkmenistan and Uzbekistan making it the biggest river basin in central Asia and an international water resource.

Hydrogeology

7.6.3. The Upper Cretaceous and Jurassic sediments are metamorphosed and assumed to be dominated by secondary fracture porosity. Kolichko and Fil' (1981) report that the hydraulic conductivity of the bedrock varies depending on fracture intensity from close to zero to 30 L/s (it is assumed they are stating 30 L/s/m2 thus 3 x 10-2 m/s). Torgoev et al (2017) report that the Upper Cretaceous sediments in the area contain groundwater and are directly recharged by precipitation infiltration.

7.6.4. It is considered likely that the Quaternary deposits form local aquifers with hydraulic conductivities in the range of 3 x 10-2 m/s to 2 x 10-7 m/s (based on ranges of values for sand to gravel grade material published in Domenico and Swartz, 1998).

7.6.5. There is no information on water quality within the aquifers, though it may be assumed it reflects natural conditions except in the vicinity of settlements where there is likely to be anthropogenic impacts from leaking tanks, septic systems, sewage pipes, spills and agricultural sources.

7.6.6. It is assumed that groundwater generally flows from the upland areas and discharges in the valleys to provide baseflow to the river system. It is likely that in the valley alluvial deposits that groundwater levels are in continuity with river levels.

Hydrology

7.6.7. The Amu Darya River (of which the Vakhsh forms a sub-basin) is the largest river system in central Asia, with a total length of 2,415 km and a catchment area of 534,700 km^2 (Pöyry, 2014). Its headwaters are in the mountainous border region between Tajikistan and Afghanistan, and the river flows in a north-westerly direction towards the Aral Sea.

7.6.8. There is uncertainty regarding the total catchment area reported by different sources for the Amu Darya River. This is primarily because some rivers do not contribute permanently to the flows of the Amu Darya, discharge to desert areas, or have been permanently diverted (Pöyry 2014).

7.6.9. There are seven (7) hydrometric stations in the project area, gathering flow measurements using standardized instruments and methods of the Tajik Met Service. There is also several additional regional hydrometric stations located along the Amu Darya River basin, which are reported to record (daily) hydrological and water quality parameters.

Surface Water Quality

7.6.10. Monitoring has been undertaken since 1980 at the Nurabod hydrological station on the Vakhsh river, located within the future footprint of the Project (Pöyry, 2014).

7.6.11. Historical water quality analysis for the Nurabod station were performed locally in Nurabod until 1994. From 1994, six to eight water samples annually were sent to Dushanbe for analyses at the

National Agency for Hydrometeorology of the Republic of Tajikistan. The samples were not transported with temperature controls. Pöyry (2014) note that there are inconsistencies observed between data collected before and after a period of disruption in the monitoring between 1994 and 1997, particularly for oxygen-related parameters. Disruption to the monitoring additionally occurred in 1981.

7.6.12. Data on oxygen-related parameters are limited for the Vakhsh River, with Chemical Oxygen Demand (COD) at an average of 0.6 mg/L between 1998 and 2010. The average pH is circum-neutral at 7.6 between 1998 and 2010, which is within local and international water quality standards.

7.6.13. The average recorded temperature of the Vakhsh as reported by Pöyry (2014) is 7.6°C during the monitored period.

7.6.14. Concentrations of nitrate are below water quality standards with an average of 1.6 mg/L. Bicarbonate is at an average concentration of 105.4 mg/L during the monitoring period.

7.6.15. Average chloride concentrations during the monitoring period were 85.4 mg/L. Sulphate concentrations are noted by Pöyry (2014) to regularly exceed the Tajik surface water requirements (100 mg/L) with an average concentration of 169.6 mg/L

7.6.16. Water quality data from five (5) monitoring points were received from the National Agency for Hydrometeorology of the Republic of Tajikistan. The data represent annual average water qualities from 2013 until 2022 at five (5) sample locations. Details of the sample locations were not provided. Approximate locations based on river names include:

- Vakhsh River – Nurobod;
- Vakhsh River- Obigarm;
- Khingob River – before confluence;
- Surkhob River – before confluence; and
- Surkhob River – Garm.

7.1.2. In May 2023, a site visit was conducted by WSP staff alongside team members of the wider Rogun HPP Project. WSP attended workshops with Project representatives during the visit regarding water quality. As part of the Environmental Monitoring Plan implemented for the Rogun HPP, ten (10) locations were identified to be routinely sampled for water quality including:

- Three (3) locations sampled daily (upstream of the dam, downstream of the dam, and seepage); and
- Seven (7) locations sampled quarterly.

7.6.17. Single water quality measurements were recorded by WSP at ten (10) locations (some of which coincide with the WeBuild monitoring program) along the Vakhsh River during the May 2023 site visit.

7.6.18. In the samples measured by WSP, water temperature ranged between 10.6 to 17.1 °C. The highest temperatures were recorded in the two upstream tributaries which flow into the Vakhsh River (Darband (P7) and Obigarm (P9)). The pH ranged between 7.0 and 8.4, with the two tributaries again having the highest values measured.

7.6.19. Dissolved oxygen (RDO) ranged between 8.1 and 9.9 mg/L, with the two tributaries having the lowest values. Oxidation reduction potential (ORP) values ranged between 60.7 and 97.5 mV.

7.6.20. Conductivity ranged between 168.4 and 734.8 µS/cm; the two tributaries had the lowest conductivities whilst the two downstream locations (P1 and P4) had the highest.

7.6.21. Total dissolved solids (TDS) ranged between 132.4 and 606.4 mg/L; the two tributaries had the lowest conductivities whilst the two downstream locations had the highest. This may suggest the possibility that works related to the HPP construction are increasing these parameters in the downstream environment, although further water quality data across a longer time period would be required to make comprehensive conclusions.

Sediment

7.6.22. The Vakhsh River, with a drainage area of 30,390 km^2 at Rogun HPP, is characterised by a high sediment load, driven by intense erosion processes within the catchment. The solid runoff in the river is formed primarily from the wash away of silt within the river basin, in addition to smaller amounts from riverbed degradation.

7.6.23. Coyne et Bellier et al. (2014c) estimated annual sediment supplies to be in the order of 62 to 100 Mm3/year, or 87 to 140 million tonnes/year equivalent based on their review of data reported by HPI (2009) and Ministry of Water (2012). The higher value of 100 Mm3/year was considered by Coyne et Bellier et al. (2014c) to be a representative assumption of sediment solid runoff (as a conservative approach), given the range of uncertainties associated with sediment runoff could not be narrowed at the time of their study.

7.6.24. Pöyry (2014) report that the bed load volume is estimated to be 12% of the volume of suspended solids.

7.6.25. Density of suspended sediment load material was reported as 1.15 t/m^3 (HPI 2009), but this was considered low by Coyne et Bellier et al. (2014), which suggested a typical value of 1.4 t/m^3.

Geomorphology

Construction

7.6.26. The cofferdam for the dam construction is already in place and has formed an area of impounded water in which sediment has started to collect. As the dam's reservoir starts to fill the resulting lake will progressively inundate the upstream river channel and drown out any existing morphological features. At the full impoundment level of 1,290 m asl around 54 km of braided channel, up to 2 km in width, will become permanently inundated along with the associated habitat. The large change in water levels in the river valley will result in a change of water table level within the steep valley sides.

7.6.27. There is expected to be a limited change to the river channel between the dam location and the Nurek reservoir. Despite the movement of course bed load from upstream being blocked by the Rogun dam, the lower stream power associated with regulated flows will restrain the erosive power of the river in a reach that is already highly resistant to scour. This is evident in the channel reaches downstream of the Nurek dam where aerial imagery does not show any significant evidence of erosion.

7.6.28. There is also not expected to be any change to the river channel where it passes through the Tigrovaya Balka State National Reserve as the Nurek dam already blocks the majority of sediment from the headwaters of the Vakhsh river.

Operation (post 2036)

7.6.29. As much of the significant impacts changes to river morphology will have been realised during the filling of the reservoir, there will be limited additional incremental impact change during the fully operational phase. As the Rogun reservoir would be used for water regulation the water level is expected to vary by around 30 m during the year (Pöyry, 2014). This variation would result in a varying water table in the steep valley slopes, possibly increasing the risk of slope instability.

7.7 MINIMUM ENVIRONMENTAL FLOWS

7.7.1. A summary of baseline conditions for Minimum Environmental Flows are presented in Figure 7-5. Further supporting detail for the Minimum Environmental Flows baseline conditions can be found within **Volume II, Annex 06**.

Precipitation

7.7.2. Based on the data gathered from the three available weather stations, the annual weather pattern is consistent across the stations with maximum rainfall occurring in winter and spring (December to May) which primarily falls as snow, especially at higher altitudes with very little precipitation experienced in summer months with mean annual values of 8 – 16 mm recorded in July and 4 – 7 mm recorded in August. In the lower part of the catchment the precipitation ranges from 816 mm/a to 936 mm/a with this figure rising to 2 000 mm/a in the upper parts of the catchment.

Evapotranspiration and Evaporation

7.7.3. Evapotranspiration and Evaporation are monitored to understand the part of the water cycle where water turns into vapour and is "lost" into the environment. Evapotranspiration and Evaporation are a fundamental part to estimate the annual water availability and its distribution across the year.

7.7.4. Evapotranspiration for the Project area is estimated to range between 750 and 1000 mm/year, while the evaporation from the reservoir is expected to be in the range of 800 to 1200 mm/year (Poyry 2014).

Hydraulic habitats and Geomorphology

7.7.5. Changes in available habitat due to changes in hydrology (discharges) and the characteristics of the river channel impacts on the ecological responses. Within a river system, habitat availability and diversity are major attributes for the biota found within, and thus knowledge of the quality of habitats is important in an overall assessment of ecosystem health. Habitat assessment can be defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour et al., 1999). Both the quality and quantity of available habitat affect the structure and composition of resident biological communities (USEPA, 1998). Habitat quality and availability plays a critical role in the occurrence of aquatic biota.

7.7.6. Habitat diversity for freshwater biota within the Vakhsh River was limited and most river reaches were relatively homogeneous. In general, the river could be described under three main habitat types; including confined channels (gorges) with steep banks, open gorges with alluvial cobbles and boulders, and braided channels.

Sedimentation

7.7.7. During the June 2023 Biodiversity site visit, high levels of turbidity were observed within the Vakhsh River. These observations were similar to previous studies. Turbidity is the measurement of the cloudiness of water, which is as a result of suspended solids, which are insoluble materials such as debris or mud. The primary input of suspended solids into the river are as a result of the steepness of the catchment and the highly erodible nature of soils on the slopes.

7.7.8. High turbidity results in reduced light intensity (penetration) and visibility, impacting photosynthesis and fish behaviour. It further has the ability to smother and clog surfaces (habitats / spawning beds), as well as absorb nutrients and toxins (Brungs et al., 2013; Marr, 2014; Waters, 1995).

Hydrology

7.7.9. The Vakhsh River flow assessment has been conducted as part of the **Volume II, Annex 07**, and is summarised here. No direct flow measurements immediately downstream of Rogun were available. However, Nurek reservoir is located only a short distance downstream with no significant tributaries along this stretch of river, therefore data for Nurek reservoir inflows have been considered good approximations of discharges downstream of Rogun.

7.7.10. As a result, the data used in Coyne et Bellier *et al*. (2014) and the World Bank (2023) can be considered a good approximation to the flow conditions downstream of Rogun before the construction of the dam. The data sources available are:

- Rogun dam inflows for the period from 1932 to 2008 (Coyne et Bellier et al., 2014); and
- Nurek HPP inflows for the period from 2009 to 2019 (World Bank, 2023).

Base and Inflows

7.7.11. The construction of a dam for hydropower production purposes has three main effects on the surface water regime (Poyry 2014):

- **Change in the downstream flow regime**: the operation of hydropower turbines can shift considerably the discharges downstream of the dam between different seasons. Water is generally stored in the reservoir during the wet season, to be then released during the drier season. Poyry 2014 analyse how the increment in the number of cascading reservoirs in a river basin have made more evident the tendency to decrease the wet season flows and increment the dry season ones. Hydropeaking is another effect of turbine operations on the flow regime. To match the electricity demand, the hydroelectric facilities tend to discharge water at variable rates throughout the day, causing short-term changes in the downstream water flows and levels.
- **Change in the habitat:** due to the impoundment, the habitat changes from riverine to lacustrine, which might represent a threat for local aquatic ecosystems, where some species might not be able to adapt to the new environment, while others will thrive. Another consequence of the modification of the habitat can be a change in the water quality. The main drivers affecting the reservoir water quality are the pre-impoundment conditions of the area (i.e. the presence of biomass that will be submerged during the filling of the reservoir might deteriorate the water quality of the deeper layers), the use of the reservoir as disposal for municipal, agricultural and industrial waste water. These aspects become even more relevant when the reservoir is used as a water supply for local communities or is the habitat of endangered species.
- **Change of local water balance:** gains from direct precipitations, and losses from evaporation and infiltration.

Flood Risk

7.7.12. Flood events are natural events which have become part of the seasonal cycle for the aquatic and relevant terrestrial ecosystems in the relevant habitats. Flood events can have negative as well as positive effects on the biodiversity. Ecosystems have learned to adapt to the flooding scenarios and sometimes flood events changes habitat characteristics that assists in the life cycle of organism development. Peak flows are primarily influenced by the snowmelt during the summer months rather than precipitation. The estimated daily Probable Maximum Flood is 7 770 m3/s with an instantaneous peak PMF of 8 160 m3/s.

7.8 TRAFFIC AND TRANSPORT

7.8.1. A summary of baseline conditions for Traffic & Transport are presented in Figure 7-6. Further supporting detail for the baseline conditions can be found within **Volume II, Annex 07**.

External Traffic Flows

7.8.2. The Ministry of Transport has provided information on traffic flows summarising roads and highways data of Rogun City for January 2023, the road data pertaining to traffic flows is summarised in **Table 7-3**.

Table 7-3 - Summary of Ministry of Transport Data for Traffic Flows on Roads in Rogun City

Road/Road Section	Average Daily Traffic: Total Vehicles	Average Daily Traffic: Light Vehicles	Average Daily Traffic: Buses	Average Daily Traffic: Trucks
International roadway Vakhdat-Rasht-Lakhsh (from Vakhdat through Nurabad, Rasht and Lakhsh to the border with Kyrgyz Republic): Section 62 km to 87 km	3,738	2,820	78	840
Road of Chashmai Kullo village	670	500	-	170
Road of Maidoni Nav village	292	220	-	72
Road of Javoni village	580	420	-	160
Road of Chormaghz, Poru Farrukh and Ghofilobod villages	276	230	-	46
Road of Eshono Dehkonobod village	194	160	-	34
Road of Sangova village	142	120	-	22
Road of Sari Pulak Qandak village	1,110	800	-	310
Local road departure to Yoli Garmoba (entry from km 2+00 of the road of Javoni village)	101	75	-	26

Internal Traffic Flows

7.8.3. The following data has been provided by contractors on the Project site:

- The daily traffic flow inside the T3 tunnel is 852 units of vehicles, and the total amount of vehicle traffic per month is 25,560 units.
- The daily traffic flow at the entrance and exit of the T3 tunnel is 1,908 units, and the total amount of vehicle traffic in a month is 57,240 units.

7.8.4. There isn't traffic flow data available on all roads within the Site.

7.8.5. Recordings provided from a network of CCTV cameras operating at the Project Site have not been sufficient to provide detailed traffic flows for the Site, particularly given the expectation that traffic flows have a significant variation over time.

Access to the site

7.8.6. Access to the Site in Rogun City is via a single access point, which is security controlled, and is situated south of the main urban area of Rogun City and provides access to the construction Site and dam wall area.

7.8.7. Construction workers located in Rogun City and surrounding areas are transported to Site by buses.

7.9 WASTE

7.9.1. A summary of baseline conditions for Waste are presented in Figure 7-6. Further supporting detail for the Waste baseline conditions can be found within **Volume II, Annex 08**.

Site Visit

7.9.2. During the September 2023 site visit, WSP observed significant differences between the waste management measures implemented by the various contractors on site, ranging from considered bunded segregation to general waste areas with no discernible segregation. WSP was informed during the site visit that some waste storage areas (and areas with abandoned equipment) belong to contractors who have not operated on site for at least five years.

7.9.3. WSP were also informed that a number of the waste areas would only be cleared, on completion of the contractors' works, with a couple of contractors stating it was the responsibility of Rogun HPP to remove the waste. Hence, these reports contradicted discussions held with the Rogun HPP team.

7.9.4. It is recommended that a procedure is put in place to survey all abandoned wastes and equipment/materials across the site, and to ensure that materials requiring disposal are disposed of appropriately and in line with IFC EHS Guidelines.

Medical Waste

7.9.5. Medical waste generated at the HPP central clinic (which had previously been transferred to Obigarm Hospital for incineration) is now being taken to a new incineration facility at Rogun Hospital. WSP has been informed anecdotally that the Obigarm facility is not adequately equipped to process medical waste appropriately.

7.9.6. According to information provided, a new medical waste incineration facility, funded by UNICEF, has recently been installed at Rogun Hospital. The facility is reportedly equipped with an ampule crusher and dry sump for crushed-glass storage (WSP has been informed it has 40 years' capacity) and incinerator with 1m3 capacity, with burn temperature of 700-1000 °C. Waste from the Project site is delivered to the facility three to four times a week, and incineration is carried out every day or two. The incinerator is fitted with a 3-4 m emissions stack. According to information provided, the Project contributes 'only a small portion of the total waste received by the facility'.

Dump Sites

7.9.7. During the September 2023 site visit, WSP visited three 'dump' sites, two of which are located within an area of future impoundment, and one located in an elevated location downstream of the Project dam. WSP were unable to establish who controlled the 'dump' sites.

7.9.8. The 'dump' site located north of Construction Area 1 on the west bank of the dam was apparently not in use at the time of the site visit, although some of the materials and waste appeared to have been deposited recently. Most of the materials / wastes deposited where aggregate or soils, however, frequent anthropogenic inclusions including general waste, tyres, oil drums and food waste were also observed. The 'dump' site was divided by a water stream/outflow, with waste visible within the water channel itself. On the southern side of the stream/outflow, the proportion of general waste was significantly higher. WSP also noted a blackened, stagnant leachate leaching emanating from some of the waste stockpiled in this southern area.

Substations and Transformers

7.9.9. During the September 2023 site visit, a number of transformers and sub-stations were noted around the Project site. WSP did not visit or inspect any of the transformers or equipment, however, based on the age of the Project it is likely that transformer oil containing Polychlorinated Biphenyls (PCBs) was utilised historically onsite and may still be present within some of the legacy equipment.

7.9.10. During on-site discussion with a representative from the utility company onsite, the oil is tested before decommissioning to assess whether the oil is suitable for re-use or disposal off site.

7.9.11. It is recommended that handling and disposal of oils or decommissioned equipment potentially containing PCBs, is done so in line with World Bank ESS and IFC EHS Guidelines.

Asbestos

7.9.12. During the September 2023 site visit, possible Asbestos Containing Materials (ACMs) in the form of corrugated asbestos sheeting were noted on a handful of buildings within Construction Area 1.

7.9.13. Possible asbestos lagging was noted among the surficial debris and waste within the 'Cecharo' Demolition, however, due to the potential hazardous, the area was not further inspected.

Wastewater

7.9.14. During the September 2023 site visit, WSP were unable to fully establish the sewage effluent arrangements in place, with contradictory information provided by Rogun HPP and contractors.

7.9.15. A sewage WWTP is located in Construction Site 1. The works consist of three settlement ponds with chlorine manual dosing into one of the ponds (It should be noted that WSP were not able to witness or confirm the dosing during the site visit). At the time of the visit, a new settlement pond was in the process of being excavated to the east of the 'WWTP laboratory building'.

7.9.16. Unknown effluent appears to be bypassing the settlement ponds. The origin of the effluent could not be established during the site visit, however it appeared to be entering the area from multiple upgradient directions. No solid wastes were observed either within the settlement ponds or in the surrounding effluent. It was noted that effluent from the upper most settlement pond was overflowing and combining with the known effluent - this effluent was followed down gradient where it discharges into the dam.

7.9.17. WSP were informed anecdotally that the sewage solid wastes are 'collected' at the contractors' compounds / facilities and only the liquid effluent is piped to the sewage WWTP.

7.9.18. Across the wider site away from Construction Area 1, different contractors anecdotally utilised septic tanks to collect sewage. However, further discussions within the contractors indicated the liquid drained straight to ground and the solids were collected / disposed of (WSP were not able to verify this during the September 2023 site visit).

7.9.19. The majority of the workshops visited by WSP during the September 2023 site visit, had considered water runoff from workshop areas, with collection channels noted on the majority of the sites. However, once collected only one contractor had sufficient infrastructure to collect and treat the runoff. A number of contractors had excavated 'septic tanks' adjacent to the workshop areas. It should be noted that these 'septic tanks' were not contained and drained straight to ground with no collection or treatment witnessed. One 'septic tank' had visible Light Non-Aqueous Phase Liquid (LNAPL) (most likely engine oil) on the surface of the ponded water.

7.10 BIODIVERSITY

7.10.1. A summary of baseline conditions for Biodiversity are presented in Figure 7-7. Further supporting detail for the biodiversity baseline conditions can be found within **Volume II, Annex 09**.

CURRENT BASELINE

7.10.2. WSP Biodiversity Surveys were undertaken in spring 2023, and additional survey effort is planned for autumn 2023 to further corroborate findings and identify any seasonal variation in the biodiversity baseline that will require consideration within the Project mitigation plans.

Habitat Surveys

7.10.3. Habitats were mapped through a combination of the remote sensing exercise, supplemented with rapid, field-based ground-truthing and cross-reference to existing information on the habitat assemblage across the Project and surrounding area. Mapping was undertaken across the flooding zone and a buffer distance of 2km (hereafter the 'habitat study area'), which was later consolidated within the AoI.

Flora Surveys

7.10.4. Targeted botanical surveys were undertaken in April and May 2023 at the 15 representative sample sites focusing on rare and vulnerable plant species across the AoI. The aim of these surveys was to corroborate previous surveys and to update these findings given the time that has passed (ecological baseline data are generally considered valid for around two years). At each location, noteworthy species were recorded; in addition, suitable habitat was also identified for species considered likely to be present based upon desktop study results and surveyor expertise.

Fauna Surveys

7.10.5. Prior to the surveys, target species were identified which included amphibians, reptiles, birds and mammal species. These target species included rare and vulnerable species as well as species specific to ecosystems present within the study area. The targeted surveys were undertaken in April and May 2023, focusing on the 15 representative sample sites.

7.10.6. Bird surveys comprised walked transects of up to 1km in length and 50m wide. Birds were recorded as encountered, with the aid of binoculars and telescope; bird calls were also surveyed.

7.10.7. Herpetofauna (amphibians and reptiles) surveys were completed along transects of varying width dependent upon habitat type during both day and night-time, with surveyors recording individual animals as encountered.

7.10.8. Mammal surveys comprised various survey techniques. Visual observations, of both live animals and animal signs (such as tracks, droppings, and burrows) were made from walked transects.

Aquatic Surveys

7.10.9. Comprehensive sampling would require people in the water, and this would not be safe under the existing river conditions. As the result, the Vakhsh River has not been well studied, and any information gained is considered valuable.

7.10.10. Limited sampling using a range of equipment was conducted at four locations upstream of the Rogun HPP construction site. Sampling was completed using equipment that could safely be operated from the shoreline, and included, cast nets, rod and line (hooks) and basket traps. local fishermen were also consulted in an informal manner to determine what species they were targeting, catching and historically knew to occur within the Project area.

Protected Areas

7.10.11. There are no protected areas located within the area that will be affected by the Rogun HPP dam wall and flooded reservoir. However, there are four protected areas located within 50km of the Project:

- Kamarovsky;
- Nurek Species Management Area;
- Sarikhosor; and
- Romit.

Habitats

7.10.12. A high-level summary of overall habitat composition within the AoI follows:

- Pasture – 15,650 hectares.
- Agriculture – 5,850 hectares.
- River/floodplain – 4,220 hectares.
- Urban areas (inc. associated land) – 2,150 hectares.
- Woodland – 283 hectares.

7.10.13. No Critical Habitat has been identified within the AoI (as per ESS6); however, both the floodplain habitat (upstream of the confluence of the Vakhsh and Obikhingou rivers) and juniper woodland are considered to be Natural Habitats by virtue of the absence/partial absence of modification and the presence of natural plant assemblages (in the case of the juniper woodland).

Flora

7.10.14. Tajikistan supports a hugely diverse floral assemblage, with over 9,700 species of plant recorded, of which over 1,100 are endemic. Given the legacy of human influence across the AoI, the floral assemblage has been greatly reduced.

7.10.15. The 2014 ESIA described 63 species as being present across the Project site and wider area, with the majority of these species being common and widespread, and many being indicative of ongoing human influence. There were 11 species included within the TRB and this was increased to 18 following surveys undertaken in 2023; however, the majority of these were recorded from outside the Project AoI.

7.10.16. No invasive plant species were noted during studies to inform the 2014 ESIA, or from field surveys in 2023, although it is known that invasive plants are increasing in presence/extent across in the country (as per a Convention on Biological Diversity (CBD) progress assessment undertaken 2018). As such, the presence of invasive plants within the region is considered likely.

Fauna

7.10.17. Tajikistan supports over 80 species of mammals, one of which is endemic (the Bukhara or Pamir shrew Sorex buchariensis); and half of which have been designated a conservation status in the TRB.

7.10.18. A total of 38 species were recorded from literature review as being present within the Vakhsh River valley, which is one more than was presented within the 2014 ESIA. Of the mammal species recorded during the desktop studies, 12 are considered to be of increased interest/conservation status Eight common/widespread species were recorded during field surveys, with one (least weasel *Mustela nivalis*) being included within the Red Book of Tajikistan.

Amphibians

7.10.19. Tajikistan has 14 native amphibian species, two of which are endemic to the region. The desktop study recorded identified only two amphibian species within the Vakhsh River valley: green toad Bufo viridis; and lake frog Rana ridibunda. Both of these species were also recorded during the 2023 fields surveys and are common and widespread within the region, in areas where standing water is present.

Reptiles

7.10.20. A diverse reptile fauna is present across Tajikistan, with 46 species confirmed as being present, 22 of which are endemic to the region. Nine species were recorded during field surveys in 2023, and additional habitat suitability identified for four species. The vast majority of these are considered common and widespread, and not of any elevated conservation interest/status. Four species are listed in the Red Book of Tajikistan and/or are of increased conservation interest/status as follows:

- Asian tortoise *(Testudo horsfieldii)*
- Orange-tailed skink *(Eumeces schneiderii)*
- Tartar sand boa *(Eryx tatricus)*
- Blunt-nosed viper *(Vipera lebetina)*

Birds

7.10.21. Tajikistan supports a diverse bird assemblage, with over 380 species having been recorded, four of which are reginal endemic species. Most species recorded are considered to be common and widespread, which reflects the prevalence of habitat modification that has occurred; although 16 species are listed on the Red Book of Tajikistan and/or are of increased conservation interest/status via a separate classification.

Fish

7.10.22. Within the Vakhsh River valley, including the lakes of the Tigrovaya Balka Nature Reserve, 36 fish species are known to be present, with the upper reaches of the Vakhsh River having much lower species composition than the lower parts of the river (Mirzoev, 2019).

7.10.23. Based on the three studies that have taken place in 2011 and 2023, it has been determined that approximately 16 fish species occur within the Rogun Project AoI. Of these 16 species, 10 have been sampled, with 3 being recorded in 2011 (ESIA, 2014), and 9 being recorded during the two 2023 field surveys.

7.10.24. Of the 16 fish species expected to occur in the Project AoI:

- Seven (7) have been introduced into the Project AoI.
- One (1) is listed as Endangered in the Red Book of the Republic of Tajikistan.
- Two (2) are listed as Vulnerable in the Red Book of the Republic of Tajikistan.

- One (1) is Vulnerable on the IUCN Red List, although from the Aral Sea basin, Cyprinus carpio has been introduced into the Project AoI.
- One (1) is Near Threatened on the IUCN Red List, although Hypophthalmichthys molitrix has been introduced into Tajikistan. This status is based on the decline of natural populations from its native range in China.
- Seven (7) are currently listed as Least Concern (LC) on the IUCN Red List. Species in this category are considered to be widespread and abundant.
- Two (2) are currently listed as Data Deficient (DD) on the IUCN Red List, while five (5) have not yet been assessed.
- None (0) are listed under CITES.
- No (0) migratory species as listed under CMS are expected to occur within the Project AoI.

Environmental eDNA

7.10.25. Environmental DNA “eDNA” surveys were undertaken in September 2023, and are currently being analysis, with results expected to be available by the end of January 2024. The objectives of the eDNA analysis are to supplement and confirm baseline data collected to date, as well as to form a basis for future monitoring programmes. These results will be provided as a stand-alone annex once available with any identified significant effects and mitigation incorporated into the ESMP and biodiversity management plan as appropriate.

7.11 ECOSYSTEM SERVICES

7.11.1. Further supporting detail for the Ecosystem Services baseline conditions can be found within **Volume II, Annex 10**.

7.11.2. Information collected in the desk study and from other workstreams was interpreted with the objective of having sufficient information to describe the ecosystem services across the Project’s AoI and across the wider study area as appropriate (e.g. such as understanding the socio-economic impact on communities across the wider area).

7.11.3. The baseline for ecosystem services within the scope of the ESIA assessment is presented in **Table 7-4**.

Table 7-4 - Baseline Ecosystem Services within the scope of the ESIA assessment for Rogun HPP

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
1	Wild plants (e.g. sea buckthorn, wild rose, fruits, nuts)	Exact location unknown; Found in mountainous areas and cultivated in villages for medicinal plants Possibly found in woodland areas and/or savanna/grassland areas for nutritional plants	Provisioning	Wild plants (terrestrial and aquatic) for nutrition, materials, or energy	1.1.5	Local communities	Wild plants are collected by local communities in mountains and cultivated in villages (e.g., sea buckthorn, wild rose). They are used for a wide range of medicinal purposes and are an important element of local health practices/ customs. Wild plants are also possibly collected for nutritional purposes (e.g., wild fruits like apples and plums, and non-timber forest	Yes	Impacting affected communities	Volume I, Annex 11 Social

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
							products, like nuts).			
2	Trees used for memorials and shrines	Exact location unknown	Cultural	Spiritual, symbolic and other interactions with natural environment	3.2.1	Local communities	Trees are used as memorials and shrines (whether these practices are linked to specific species is unknown).	Yes	Impacting affected communities	Volume I, Annex 11 Social
3	Trees associated with local stories and taboo	Exact location unknown	Cultural	Intellectual and representative interactions with natural environment	3.1.2	Local communities	Some trees or tree species are associated with local stories and taboo (e.g., legends state that 1000 Mulberry trees were planted by criminals as an atonement; local red pears are not picked as they are believed to grown on the site of a Saint's	Yes	Impacting affected communities	Volume I, Annex 11 Social

N*	Valued Component	Location	Type: General class	Type: CICES group	Type: CICES group code	Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
							blood).			
4	Local healing and thermal waters	Freshwater systems near the Obi Garm community (1km outside AoI)	Provisioning	Other aqueous outputs	4.2.X	Local communities	The Obi Garm community maintains a practice of preserving local healing and thermal waters, which involves keeping local water sources clean, including by prohibiting cattle from drinking from or trampling them, and protecting them from erosion by planting trees.	Yes	Even though just outside AoI, possibly impacting affected communities due to possible hydrological connectivity through the Kojha-Obi Garm fault zone	https://globalforestcoalition.org/wp-content/uploads/2018/06/TAJIKISTAN-SUMMARY-WEB.pdf https://www.e3s-conferences.org/articles/e3sconf/pdf/2019/24/e3sconf_wri-162018_01011.pdf
5	Croplands and orchards	Exact location unknown	Provisioning	Cultivated terrestrial plants for nutrition,	1.1.1	Local communities	A large proportion of the area has been converted for	Yes	Impacting affected communities	ESIA 2014 and Volume I, Annex 09 Biodiversity

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
				materials or energy			cultivation. Cultivated plants or agricultural products harvested by people for human or animal consumption as food.			
6	Pastures	Exact location unknown	Provisioning	Reared animals for nutrition, materials or energy	1.1.3	Local communities	A large proportion of the area has been converted for cultivation. Animals are raised for domestic or commercial consumption or use.	Yes	Impacting affected communities	ESIA 2014 and Volume I, Annex 09 Biodiversity

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
7	Remaining woody areas (Juniper woodland)	Land habitats within the AoI	Provisioning	Cultivated terrestrial plants for nutrition, materials or energy	1.1.1	Local communities	Though most forested areas have already been strongly degraded by human use (logging and conversion to agricultural/pastureland), participatory forest management and community forestry occur in remaining areas of woodland. These areas provide non-commercial wood resources.	Yes	Impacting affected communities	ESIA 2014 and Volume I, Annex 09 Biodiversity
8	Remaining woody areas (Juniper woodlan	Land habitats within the AoI	Cultural	Spiritual, symbolic and other interactions with natural	3.2.1	Local communities	Though most forested areas have already been strongly degraded by human use	Yes	Impacting affected communities	ESIA 2014 and Volume I, Annex 09 Biodiversity

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
	d)			environment			(logging and conversion to agricultural/pastureland), participatory forest management and community forestry occur in remaining areas of woodland. These areas have social and cultural benefits for local communities.			
9	All natural habitats	All habitats within the AoI	Supporting	Other type of regulation and maintenance service by abiotic processes	5.3.X	Local communities	Providing habitats (terrestrial, floodplains, freshwater) for species and promoting biodiversity including important, IUCN red-listed and/or	Yes	Impacting affected communities (for specific species see Biodiversity Technical Annex)	Volume I, Annex 09 Biodiversity

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
							EU Habitat Directive Annex listed species.			
10	Floodplains	70km long stretch of floodplains going through different altitudinal zones and including to particularly special floodplain habitats.	Regulating	Regulation of baseline flows and extreme events	5.2.1	Local communities, downstream communities, global	Floodplains retain water, helping regulate water timing and flows (e.g., influencing the timing and magnitude of water runoff, flooding and aquifer recharge).	Yes	Impacting affected communities	ESIA 2014 https://link.springer.com/article/10.1007/s10750-022-04916-7
11	Floodplains	70km long stretch of floodplains going through different altitudinal zones and including to	Regulating	Mediation of waste, toxics and other nuisances by non-living processes	5.1.1	Local communities, downstream communities	Floodplains help purify water and can help treat and dilute waste.	Yes	Impacting affected communities	ESIA 2014, https://link.springer.com/article/10.1007/s10750-022-04916-7

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
		particularly special floodplain habitats.								
12	Floodplains	70km long stretch of floodplains going through different altitudinal zones and including to particularly special floodplain habitats.	Cultural	Physical and experiential interactions with natural environment	3.1.1	Local communities	Floodplains can provide areas for recreation.	Yes	Impacting affected communities	ESIA 2014, https://link.springer.com/article/10.1007/s10750-022-04916-7
13	Freshwater streams	Vakhsk, Surhob rivers	Provisioning	Wild animals (terrestrial and aquatic) for nutrition, materials or	1.1.6	Local communities	Providing fish and other aquatic foods that are caught by local communities for domestic or commercial consumption or use.	Yes	Impacting affected communities	ESIA 2014, WRI (2013)

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
				energy						
14	Freshwater streams	Vakhsk, Surhob rivers	Provisioning	Surface water used for nutrition, materials or energy	4.2.1	Local communities	Freshwater can be used for drinking and irrigation of fields.	Yes	Impacting affected communities	WRI (2013)
15	Freshwater streams	Vakhsk, Surhob rivers	Regulating	Maintenance of physical, chemical, abiotic conditions	5.2.2	Local communities	Streams can help retain and replenish soil and sand deposits that are used by local communities and/or mitigate existing erosion from conversion to cropland/pasture.	Yes	Impacting affected communities	WRI (2013)
16	All species	Throughout the AoI	Supporting	Genetic material from all	1.2.X	Local communities,	Species within the area provide a pool of genetic	Yes	Impacting affected communities	Expert judgement

N*	Valued Component	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritisation?	Reason for prioritisation	Source of information
			General class	CICES group	CICES group code					
				biota (including seed, spore or gamete production)		global	diversity that could contribute to maintaining or establishing a population or could be used for anthropogenic purposes like medicine and biochemical products. Specie include whole plants, seeds spores, other plant materials, whole animals, animal material, other organisms.		s	

7.12 SOCIAL

7.12.1. There are several summaries for social baseline conditions presented in the following figures:

- **Figure 7-8** - Local Economy and Employment.
- **Figure 7-10** - Community Assets and Infrastructure.
- **Figure 7-11** - Community Health, Safety and Security.
- **Figure 7-12** - Human Rights, Vulnerabilities and Gender Issues.
- **Figure 7-13** - Land Acquisition and Resettlement.

7.12.2. Further supporting detail for the social baseline conditions can be found within **Volume II, Annex 11**.

Local Economy and Employment

7.12.3. In 2019 it was estimated that 26.3% of the Tajikistan population was living below the poverty line. This demonstrates an improvement from the 2013 national poverty rate of 34.3%. Remittances, provided to households from members who are working as a migrant abroad, play an important role in reducing poverty and providing an income to an estimated 30-50% Tajikistan households. Incomes, particularly in the Rasht Valley region, tend to depend on unstable factors such as agriculture, livestock and remittances.

7.12.4. Agriculture makes up 28.6% of the country's GDP (2017 estimate) and provides 71.1% of employment in Tajikistan, and accounts for 43% of the labor force (2016 estimate), with the most important agricultural product being cotton.

7.12.5. Emigration out of Tajikistan is high, particularly amongst younger Tajiks, due to the limited availability of jobs and the higher incomes available abroad. In 2021, at least 40% of households had at least one migrant working abroad. As a result, there is often a reliance in households on remittances from Tajikistani migrant laborers working away in Russia and Kazakhstan.

Labor and Working Conditions

7.12.6. According to the local authority data, in Nurobod, the district with largest displaced population (23,284 affected persons), the unemployment rate was recorded as 7.5% in 2020, similar to the national average.

7.12.7. The 2016 Labor Code of Tajikistan is the key legislation which governs employment relationships in Tajikistan and is the main guiding legislation for all contractors working on the Project. There are no Project-specific labor management plans or policy in place, though some individual contractors have their own Human Resource systems and policies.

7.12.8. In August 2023, a total of 14,746 were identified as being engaged as workers on-site at the Project, and peak employment is likely to reach 15,000-20,000 people during the period between 2025-2028.

7.12.9. Overall women's share in the workforce is 5.1%. 18% of the total workforce is skilled workers (i.e., technical engineers), and the ratio of women skilled workforce is at 5.8%. Current employees are primarily Tajik nationals (93.8%), of which 5.3% are women (as of August 2023). In March 2023 it was understood that approximately 23% of the workforce was sourced from within 50 km of the Project.

7.12.10. Employment fairs are regularly held in the local area to attract local workers, and ADB have opened a Job Centre is Rogun as part of their Skills and Employability Enhancement Project to improve the vocational, technical and soft skills and employability of local youth (15-29 years old), women and migrant labor.

Community Assets and Infrastructure

7.12.11. A breakdown of community assets in the affected districts, specifically those associated with education and healthcare, and infrastructure. The availability of community facilities, such as schools, religious meeting places and healthcare services vary greatly across the affected Jamoats.

Nationality/Ethnicity

7.12.12. The household survey questionnaire included nationality/ethnicity in the household roster to cover all family members within the survey sample. Due to cultural and political sensitivities, it was not possible to ask about languages spoken at home. Out of the 5,148 family members, 5,129 (99.6%) were recorded as Tajik, 9 members as Uzbek, 7 as Russian, 2 as Turkmen, 1 as Ukrainian.

Religion

7.12.13. Islam is the primary religion in Tajikistan, with approximately 98% of the population identifying as Muslim (95% Sunni and 3% Shia).

Healthcare

7.12.14. Tajikistan has a health system which provides health services to individuals who fulfil particular criteria, unfortunately a significant number of people do not fulfil such criteria and are therefore not eligible for services. Health spending in Tajikistan is the lowest in the WHO European Region, despite increased spending over the past few years. The country also has the lowest ratio of healthcare workers to population in the WHO European Region, with significant inequalities in the distribution of such workers across the country.

7.12.15. Life expectancy in Tajikistan has improved in recent years and is higher than the central Asia average, but lower than the WHO European Region average.

7.12.16. Many of the worker accommodation camps have their own medical facilities with basic medicines and equipment, staffed by nurses and/or doctors. The closest medical center for workers who do not have access to on-site facilities is the Rogun Medical Centre. All serious injuries or operations would likely be treated in hospital in Dushanbe.

Infrastructure

7.12.17. The main road from Dushanbe to Obi Garm (M41) branches shortly before reaching Obi Garm to access the Project. Shortly after Obi Garm, short stretches of this road will eventually be submerged by the reservoir. This road is an important international and national road and will be replaced where required, with road and bridge access provided to those settlements which are not being relocated.

7.12.18. While the majority of the population in Tajikistan has access to electricity, many experience blackout during winter due to the current power system being unable to meet demand. From 1990, production and consumption of electricity declined due to an aging power infrastructure which was poorly maintained and not replaced.

Community Health, Safety and Security

7.12.19. Tajikistan is a relatively young country, with nearly 50% of the population under the age of 25 years old. A Population pyramid is shown in Figure 7-11.

7.12.20. Family planning services are limited in Tajikistan, and in 2017 it was estimated that 21% of women were using contraceptives. In 2017, the proportion of women of reproductive age (15-49 years) who were married or in a union and were using, or whose partner was using, a method of contraception was 29.3%. The estimated fertility rate in 2023 in Tajikistan is 2.42 children born per woman.

7.12.21. Traffic accidents have been decreasing in Tajikistan in recent years, from 1303 recorded incidents in 2017 to 1096 incidents in 2022. Deaths due to traffic incidents also decreased nationally from 2017-2021, from 431 to 375 deaths, although an increase in mortality was recorded in 2022 (416 deaths).

Inclusion, Vulnerabilities and Gender Issues

7.12.22. In the last decade, Tajikistan sustained economic growth and managed to reduce national poverty rates from 34.3% in 2013 to 22.5% in 2022 (World Bank, 2023, Tajikistan Economic Update). According to the World Bank, the poverty rate fell to 13.4% under the international poverty line of US$ 3.65 (2017 PPP).

7.12.23. Social protection and assistance systems are going through modernization to capture more vulnerable people in need. However, still the country faces challenges in ensuring the inclusion and protecting the rights of all members of society, whether along gender lines or issues faced by vulnerable populations.

7.12.24. Certain individuals and groups, such as those based on age, gender, ethnicity, religion, disability, social exclusion, or economic disadvantage, may be more vulnerable to negative impacts from the Project. They are likely to face the risk of social exclusion and not equally benefitting from the project. Vulnerable groups identified in the 2014 ESIA (Chapter 13.5.6) included:

- Disabled people, e.g. those with physical or mental disabilities or chronic illnesses, who will require physical assistance if the village is to be relocated.
- Female-headed households (as well as women acting as de facto HoH while the HoH is absent, e.g. for labor migration), who may require additional assistance in building their new houses.
- Elderly people with no younger family members within their household, who may also require additional assistance in building their new houses.
- Young people (aged 24 or under) who may require additional assistance in finding a job in their new location.

7.12.25. Details on vulnerable households are include in Figure 7-12.

Land Acquisition and Resettlement

7.12.26. 69 settlements situated within the future footprint of the Project (including both the future reservoir and the buffer zone). (See Figure 7-13). Information about the population of the Jamoats affected by resettlement was provided through interviews with Jamoat leaders. Table 7-5 provides initial information about the households and populations that constitute the affected Jamoats.

Table 7-5 Jamoat Populations (source: Jamoat interviews, July 2023)

District	Jamoat	Number of HH	Population size	Male * (%)	Female (%)	Population aged 6-17/18 yrs (%)	Population age 0-5 yrs (%)
Rogun	Sicharogh	276	1,272	49	52	27	8

District	Jamoat	Number of HH	Population size	Male * (%)	Female (%)	Population aged 6-17/18 yrs (%)	Population age 0-5 yrs (%)
Nurobod	Khakimi	1,209	6,396	49	54	---	---
	I. Halimov	181	1,544	46	54	---	60
	Khumdon	178	2,178	40	60	---	---
	Mehrobod	1,733	12,492	50	50	20	---
	Mujikharf	1,821	15,713	49	51	---	6
	Safedchashma	164	1542	48	52	17	16
Rasht	Boqi Rahimzoda	1,572	10,807	50	49	22	---
	N. Makhsum	2,133	15,599	51	49	13	23
	Obi Mehnat	170	1,326	45	55	---	---
	Qal'ai Surkh	332	3,047	37	29	21	---
	Navobod town	N/A	5,898	54	46	23	17
Faizobod	Buston	743	10,499	48	48	---	---
Tursunzoda	10 Solangii Istiklolіat (10 Years of Independence)	4,190	21,004	44	56	---	---
	Jura Rahmonov	5,574	32,779	51	49	---	---

* Note that the gender-disaggregated population statistics provided did not correlate exactly to the total population statistics. Age disaggregated statistics were not available in every Jamoat.

7.12.27. The reservoir will be filled over a period of 16 years, up to approximately 2036, with resettlement of the affected villages phased over this period, with resettlement due to be completed by 2032.

7.12.28. Resettlement of the affected villages began in the early 1980s as construction of the HPP commenced. In the early 1990s construction was paused after the breakup of the Soviet Union lead to the independence of Tajikistan. Many of those who had been resettled returned to their previous residences during this period. In 2008, construction and resettlement activities resumed.

7.12.29. According to DFZ data as of March 2023, the resettlement planning for the Project is due for completion by 2032 and covers 69 villages from Rogun City and the Nurobod and Rasht districts in the flooding zone.

7.12.30. In 2014 the first Resettlement Action Plan (RAP1) was prepared which covered the Phase 1 resettlement of 2,697 people residing in eight villages in the Rogun City and Nurobod District. These villages were either situated within the construction footprint or were due to be flooded by early reservoir filling.

7.12.31. The second RAP (2017-2025, RAP2) covers the resettlement of 16 villages up to the year 2025, situated in Rogun City and Nurobod District. A total of 13,280 affected people is covered by RAP 2, some of whom have already been resettled, or are in the process of being resettled.

7.12.32. Remaining 45 villages are planned to be resettled after 2025, with some still undergoing geotechnical studies to determine whether relocation will be required. These villages are located within 12 Jamoats (Khakimi, Sicharogh, Mehrobod, I. Halimov, Mujikharf, Safedchashma, Boqi Rahimzoda, Khumdon, Shahraki Navobod, Obi Mehnat, N. Makhsum, Qal'ai Surkh).

7.12.33. Additional RAPs will be prepared to cover the remaining 45 villages, including 30,651 affected people, who are due to be resettled in the period from 2025 to 2032.

Local Employment in Resettlement Communities

7.1.1. According to the household level data shown in Table 7-6 collected from the household surveys, the main source of income is based on the remittances from labor migration (33.1%), followed by pension (19.6%), public sector work (11.9%), agriculture (6.9%), self-employment (6.1%) and seasonal work (5.3%). Employment in the Project (either in Rogun HPP or construction sites) is only stated as being the main source of income by 5% of households. While the majority of the women headed-households are dependent on pensions, the main income source for male headed-households are remittances from migrant labor work.

Table 7-5 - Main source of income/occupation in households

Main sources of income / occupation in the household	By gender of household head		
	In male-headed households	In female-headed households	**Total**
Farmer (arable agriculture)	7.5%	4.7%	**6.9%**
Farmer (cattle breeding)	1.1%	1.0%	**1.1%**
Farmer (subsistence)	0.6%	0.7%	**0.6%**
Hired worker (private sector)	3.2%	4.4%	**3.5%**
Hired worker (public sector)	10.4%	17.4%	**11.9%**
Self-employed (craftsman, merchant, etc.)	5.5%	8.4%	**6.1%**
Daily/seasonal worker (construction, agriculture, etc.)	6.6%	0.7%	**5.3%**
Casual work (not seasonal)	1.7%	0.7%	**1.5%**
Pension	11.1%	52.0%	**19.6%**
Labor migration / Remittances	41.2%	2.3%	**33.1%**
Employed in Rogun HPP Project (construction or HPP site)	5.9%	1.4%	**5.0%**
Student	0.1%	0.0%	**0.1%**
Home-maker	0.3%	0.7%	**0.3%**

Main sources of income / occupation in the household	By gender of household head		
	In male-headed households	In female-headed households	**Total**
No income	0.5%	0.4%	**0.5%**
I don't know/ prefer not to say	0.1%	0.4%	**0.1%**
Other	4.4%	4.0%	**4.3%**
TOTAL	100.0%	100.0%	**100.0%**

7.1.2. Only 14 % of the women in the sample population reported as having a source of income. Among those who have source of income, 50% receive pension income, most likely from their husbands or other male relatives in the household. Around 17% (339 out of 2478 women) of the women population in the sample are engaged in public sector work (mainly as teachers, medical staff, civil servants) earning regular income. Household farming, often undertaken in the affected communities for subsistence, however only 7% of women are recorded as farmers. This could imply that women are undertaking unpaid agricultural work within their households.

7.1.3. According to the household level data, the highest level of formal education among family members of households is secondary education, including vocational education degrees (more than 30%). Of the members covered in the sample, 16.5% are pre-school aged children (Table 4-10).

Table 7-7 - Highest education level in affected households

Highest level of formal education among members	Total	Number of family members in survey sample
	%	Number
No formal education	4.8%	248
Primary education only	6.2%	318
Incomplete secondary education	11.5%	592
Complete secondary education	29.6%	1524
Professional secondary education	4.7%	241
Higher education / University	6.9%	354
Pre-school age child	16.5%	847
Currently in education	19.7%	1015
Don't know / prefer not to say	0.2%	9
Total	100.0%	5148

Public Infrastructure and Services in Resettlement areas

7.12.34. DFZ's mandate is to ensure that the reconstruction of all public infrastructure (i.e., water supply, health centers, education facilities, roads, electricity lines, etc.) and utility services in resettlement sites is complete before settlers physically move in. Construction of these facilities is the responsibility of the relevant ministry.

7.12.35. Connection to utilities is to be provided at no cost to PAPs.

7.13 GENDER ASSESSMENT

7.13.1. A summary of baseline conditions for Gender Assessment are presented in Figure 7-12. Further supporting detail for the Gender Assessment baseline conditions can be found within **Volume II, Annex 12**.

7.13.2. Baseline Data for the Gender Assessment was collected by:

- A Desktop Assessment of Country-specific Gender Related Reports and Data.
- A review of Rogun HPP Policies, Procedures and Management Plans.
- Household Surveys in August 2023.
- Focus Group Discussions in June and August 2023.

Gender-based Violence and Harassment

7.13.3. In 2013, Tajikistan introduced the Law on the Prevention of Domestic Violence and the State Program for the Prevention of Domestic Violence 2014 – 2023 to attempt to reduce the level of domestic violence within the community and encourage victims to seek support. However, GBV remains prevalent in Tajikistan with spousal abuse reported to occur in approximately one third of marriages. Physical abuse is most common, followed by emotional abuse as well as economic abuse. Comparatively, worldwide approximately 26 percent of women have experienced intimate partner violence and 30 percent have experienced either intimate partner and/or non-partner violence during their lifetime.

Female Employment and Income

7.13.4. The participation of women in the labor force in Tajikistan is low, with approximately 69 percent of working age females not in paid employment in 2016 and the proportion of females in the total number of employed declining (attributed partly to trends such as women exiting the labor market following the civil war, increased household wages as employment is sought outside of Tajikistan and remittances sent home to families, and a growth in the construction sector which almost exclusively employs men). Tajikistan's Labor Force Participation Rate (LFPR) gender gap of 21.5 percent is much higher than in comparable low-income countries (average 15.3 percent).

7.13.5. Young women in Tajikistan face significant barriers to entering the labor market which are exacerbated by limited skills, job mismatches, and cultural norms. Rural women in Tajikistan are often faced with limited access to education, early marriages, family restrictions, restricted access to financial resources including credit and grants, limited land resources or restricted rights to land ownership, which hinder their employment opportunities. The primary occupation for most women in the regions is unpaid domestic work and childcare.

Female Access to Education and Literacy

7.13.6. Literacy rates are high in Tajikistan among both men and women (95 percent) with access to education becoming more equal with an increase in schools in remote villages, an increase in the legal age of marriage from 17 to 18 years and the establishment of a pathway to tertiary education – the Presidential Quota System - for both women and men residing in remote districts. However, female enrolment in preschool, secondary school and tertiary education is still lower than for males and women are often selected for traditionally female-dominated and low paying areas of study such as education and nursing.

7.13.7. A lack of financial resources for books and uniforms etc., and social norms that mean that education is prioritized for boys contribute to this, as does a frequent lack of sanitation facilities for girls in schools that can negatively impact female attendance at school.

7.13.8. Girls with disabilities have particularly limited opportunities for education, with families not expecting them to work or marry and not prioritizing their education or being concerned for their safety.

Female Voice and Agency

7.13.9. No laws prevent the participation of women in political processes and the government has a goal of 30 percent representation by women in governing bodies of the legislative, judicial, and executive branches. Efforts have also been made to mainstream gender into national strategies and plans such as Poverty Reduction Strategies, the National Development Strategy for 2030, and Interim Development Strategy 2020.

7.13.10. However, cultural practices dissuade participation of women in politics and women are underrepresented at all levels of political institutions, with women facing hurdles in the form of a lack of resources and family support. Women account for only 19 percent of parliamentarians and five percent of ministers in central government. In 2014, women occupied over 23 percent of central and local government positions, but only 17 percent of leadership positions at the central level. At local government level, however, 40 percent of jamoat chairpersons are women.

Social Norms and Traditions

7.13.11. As described throughout this section, social and cultural norms and traditional gender stereotypes that position women as homemakers remain persistent within Tajikistan, particularly in rural and remote areas. These attitudes require women to take on an unequal responsibility for childcare and household chores. Cultural norms relating to marriage impact women's employment prospects, with many husbands restricting their wives from seeking employment. Even if women are allowed to work officially, they are still expected to manage all the household chores and take care of children - women devote 7 hours and 40 minutes to unpaid care and domestic responsibilities daily.

7.13.12. Unpaid care work is recognized as one of the main barriers prevent women from entering and progressing in the labor force and prevents gender equality and women's economic empowerment. In rural areas where women start participating in economic activities from a very young age by keeping and tending livestock and poultry in addition to a number of other tasks that add to the family income.

7.13.13. Approximately 65 percent of men and almost 60 percent of women in Tajikistan believe that a women should do household chores even if her husband is not working.

Religious and Unregistered Marriages

7.13.14. Family gender discrimination is evident in religious marriages that are commonly substituted for civil marriages in Tajikistan due to the high marriage registration fees and the power afforded to men under religious law. While polygamy is banned within Tajik legislation, it is not uncommon with second and third wives taken on through religious ceremonies. The prevalence of polygamy surged following independence and a 2010 survey by the Centre for Strategic Studies in Tajikistan indicated that one in ten men had more than one wife, with a gender imbalance caused by a loss of life / displacement for many males during the 1992-97 civil followed by mass labor migration as men sought work in other countries.

7.13.15. Women in religious and unregistered marriages are left vulnerable with a lack of legal standing or rights Sharia law allows men in registered religious and unregistered marriages to divorce their wives by repeatedly saying “talaq”. Women informally divorced in this way and left in a position where they need to provide for their families are also more vulnerable to human trafficking.

Migrant Workers and Impact on Women

7.13.16. Unemployment, particularly in rural areas, has led to a high proportion of Tajik migrant workers who seek employment and better opportunities elsewhere (particularly Russia), with remittances sent home an important source of income for many families. The International Labor Organization (ILO) reports that 25 percent of all household incomes comprise remittances sent by labor migrants, with the official remittances in 2007 amounting to 36 percent of Tajikistan's GDP or USD 1.8 billion. Women are reported to comprise 14 percent of migrant workers in 2017 and are largely excluded from decision-making about migration.

7.13.17. It is estimated that about 30 percent of the wives left behind by their migrant husbands have been abandoned adding to the family’s financial burden on their shoulders along with traditional responsibilities of taking care of children and the elderly and dealing with domestic work.

Female-headed Households

7.13.18. Migration as described above has led to an increase in the numbers of female-headed households. Many of these women work in the informal economy where they earn relatively low salaries and do not have access to social benefits or skills development, leaving them economically dependent and vulnerable to economic shocks.

7.13.19. Overall, approximately 23 percent of households in Tajikistan are headed by females and they tend to be smaller households. They are more common in urban areas (38 percent of people in urban areas live in female-headed households, compared to approximately 16 percent of people living in rural areas), attributed to social norms in rural areas preventing women from residing there as heads of household. Female headed households have a higher risk of poverty than those headed by males.

7.14 CULTURAL HERITAGE

7.14.1. A summary of baseline conditions for Cultural Heritage are presented in Figure 7-14. Further supporting detail for the cultural heritage baseline conditions can be found within **Volume II, Annex 15.**

Site Surveys

7.14.2. A team of archaeological and ethnographic experts from the A. Donish Institute of Archaeology, History and Ethnography undertook a programme of rapid, targeted field reconnaissance and community consultation in June 2023, and in August - September 2023. These field missions sought to characterise the baseline cultural heritage environment in support of the ESIA update. The targeted site surveys were informed by a thorough desktop review of pertinent literature and cartography, ongoing stakeholder engagement activities, and the results of the M-Vector household surveys (August 2023). Full details of the baseline methodology are provided in **Volume II, Annex 15.**

Current Baseline Summary

Archaeological, Historic and Palaeontological Resources

7.14.3. A total of 45 archaeological, historic and palaeontological resources have been recorded within the baseline study area. The palaeontological resource includes multiple sets of fossilized dinosaur footprints from different species on a steeply dipping sandstone slab dating from the Cretaceous period (~145 – 65 million years ago).

7.14.4. Several Prehistoric resources have been located within the inundation zone including Stone Age lithic scatters (~50,000 BCE) and raised earthen mounds that may be associated with the arrival of nomadic tribes (e.g., Saks / Scythian) into the Karategin territory between the 4th – 6th centuries.

7.14.5. Nineteen fortress sites, broadly dated to the 10th – 19th centuries CE were also recorded, commonly situated on the upper terraces and the outskirts of currently populated villages. It is possible that many of the villages in the study area originated during this period, potentially associated with historic trading centres strategically positioned in proximity to the Karategin sub-section of the ancient Silk Roads Route, linking Uzbekistan and China (and the development of small fortresses or outposts to deter raiders).

7.14.6. Remains of relict agricultural features have also been identified through the Central Asian Archaeological Landscapes (CAAL) mapping Project, concentrated on the north-eastern slopes of the Vakhsh Valley, including remnants of field systems such as terraces and lynchets (terraces formed on slopes as a result of ploughing).

7.14.7. These historic origins of settlements within the study area are further substantiated by the findings of the ethnographic survey, which recorded several ancient burial sites. The villages of Hakimi Bolo, Khumok and Luguri Poyon have burials dating from the 16th to 18th centuries CE, for example.

None of the archaeological and historic resources within the study area have yet been subject to intrusive, detailed archaeological evaluation and their cultural heritage value cannot therefore be easily determined. However, they have high research potential, particularly in informing the archaeological record on the lower Karategin Silk Roads route, and the Surkhob-Vakhsh river valley.

7.14.8. Detailed information, related mapping and a gazetteer of all archaeological, historic and palaeontological baseline resources identified within 20 km of the maximum inundation zone is provided in **Volume II, Annex 15**.

Cultural and Sacred Resources

7.14.9. During the ethnographic surveys, consultations were carried out by the A. Donish team in the villages of Hakimi Bolo, Hakimi Poyon, Khumok, Obi Boriki Bolo, Obi Boriki Poyon, Mehrobod (Komsomolobod), Roghuni poyon, Aligalaboni bolo, Chanor and Bedikho and Luguri Poyon.

7.14.10. A total of 36 cultural and sacred resources, representing the tangible manifestation of local cultural values and identity, were recorded in consultation with Project affected communities within the inundation zone. These broadly incorporate:

- Natural features embodying spiritual values, particularly sacred spring sites and cultural trees (with associated stories, oral history and legends).
- Mosques, cemeteries and memorial sites / shrines (*mazars*).
- Central 'magical greeting' pillars found within traditional houses.

7.14.11. Detailed information, related mapping and a gazetteer of all cultural and sacred resources identified within the villages being resettled under RAP 2 of the resettlement programme, is provided in **Volume II, Annex 15**.

7.14.12. Measures and strategies to mitigate potential impacts on cultural and sacred resources are outlined in **Volume II, Annex 15** and explained in detail in the Cultural Heritage Management Plan (CHMP; **Volume III, Chapter 10**). These include:

- Avoidance – the CHMP includes constraints mapping and construction avoidance area plans, showing sensitive receptors within the AoI but outside the inundation zone, appropriate buffers and the associated community access routes, as agreed with the site guardian / representative.
- Minimization – where indirect environmental effects are predicted, mitigation might include:
  - Plans for environmental screening (e.g., planting or additional noise barriers);
  - Plans for continued safe community access to specific locations; and
  - Plans for on-going consultation with village representatives and site guardians to monitor ongoing residual impacts and the effectiveness of proposed mitigations.
- Relocation – through close cooperation with local communities and the Client, the most appropriate destination for receptors to be located will be determined (e.g., new villages or local museums). For cemetery sites which cannot be avoided, a Cemetery Relocation Best Practice Guide will be developed and implemented through the CHMP, in close consultation with local communities.

Intangible Cultural Heritage

7.14.13. Evidence of local intangible cultural heritage was also recorded during the ethnographic studies undertaken in 2023. Although much of the Nurobod culture is similar to that found elsewhere in Tajikistan, there remain local peculiarities and differences which can be explained, in part, by the geography of the region and the isolation of many of the settlements.

7.1.4. A number of common themes emerged over the course of the interviews and surveys which are summarised below. Specific examples of intangible cultural heritage for different villages are outlined in **Volume II, Annex 15,** Appendix A15C.

Traditional Construction Styles and Techniques

It was noted that many buildings in the villages surveyed retain traditional features characteristic of this mountainous region of Tajikistan. Dwellings generally have small terraces on their northern side and feature traditional wooden beam ceilings. Locally made traditional clay hearths, dug into the ground, were observed. Hearths are often made at home, although they can be bought ready-made. In new houses, a straight log, called "*dstak*", is placed on top of the house with a horn on it, for good luck.

PAP will decide whether to relocate such traditional features to the resettlement villages. Anecdotal evidence from villagers from the districts of Nurobod and Rogun interviewed during a 2015 ethnographic study suggests that many are unsure whether they will install a *dstak* in their new house. Key examples of traditional construction styles that may be 'lost' as a result of the Project will be recorded prior to demolition, as per the commitments outlined in the CHMP (**Volume III, Chapter 10**).

Traditional Crafts

Needlework, carpentry, ceramics and instrument making were observed. Women continue to make clothes, carpets and decorations, such as ribbons for wedding bedspreads and cradles. Younger generations were noted as less interested in preserving craft traditions which are no longer seen as sources of income.

Traditional Medicine

7.14.14. Traditional medicine was observed including the use of dried herbs and plants helps to cleanse the blood of toxins and 'refresh' it. The most commonly eaten herbs and plants are mint, rhubarb, dandelion root, sorrel, mountain onions, cumin, blackcurrant and barberries. Plantain is used to treat stomach pain.

Traditional Food

7.14.15. The process of making bread, such as *chahlak*, *tanur* and *nonichavi*, is widespread throughout the villages surveyed. Traditional dishes include *umoch*, which is a flour soup with small dumplings; *atoll*, which is flour porridge; *atoli ordbieren*, which is made from milk, flour, meat, onions and dried apricots and *atolai bo shir*, which is made from flour and milk with salt. *Shurpo* (soup) is served at funerals.

Traditional Clothing

7.14.16. There is a mixture of styles from different regions and countries in the clothing of the inhabitants of the villages. Women mostly wear modern, Soviet style clothes rather than traditional dresses. They often wear small *rumol* (headscarves), and some wear larger headscarves that cover their shoulders. Some young girls wear hijabs. Men mostly wear European clothing, such as shirts, jeans and jackets. Some wear a white calico skullcap, particularly in the month of Ramadan and during the reading of prayer.

Traditional Practice – Family Life, Occupation, Beliefs, Rituals and Ceremonies

7.14.17. Families in the villages are generally large. Women play an important role in ritual and ceremonial life, and they are expected to preserve and pass on their traditions to the next generation through the female line. Amulets are traditionally used to protect wearers. The bones of mountain goats, the teeth of bears and pieces of wood are commonly used to make amulets to protect a baby from evil spirits and prolong their life. Other traditional rites for children and babies include *gavhorabandon,* centred around a first-born's cradle.

7.14.18. Several complex traditions exist for marriage, primarily centred around specific food, fabric, gifts and the details of the ceremony.

Future Baseline

Archaeological, Historic and Palaeontological Resources

7.14.19. In the absence of the Project, it is likely that the archaeological, historic, and palaeontological resources within the Area of Influence (AoI) would continue in their existing condition, though potentially subject to pressures through localised settlement growth, agriculture, and environmental degradation (erosion, flooding etc.).

7.14.20. As a result of continued Project progress, the Rogun dam will be fully constructed, and the reservoir fully inundated by 2036. The entirety of the flood zone will be cleared, inundated and therefore, effectively archaeologically sterilised as a result of Project.

7.14.21. Archaeological remains on the upper terraces (above the maximum inundation zone) may survive, but are likely to be at a greater risk of damage and / or complete loss as a result of erosion and landslip caused by seasonal change in the reservoir's water level.

Cultural and Sacred Resources

7.14.22. In the absence of the Project, it is likely that (tangible) cultural and sacred resources within the AoI would continue in their existing condition, though potentially subject to pressures through localised settlement growth, agriculture and environmental degradation (erosion, flooding etc).

7.14.23. All directly affected villages (within the inundation zone) are due to be resettled by 2032, meaning there is no future baseline for the majority of cultural and sacred sources, as these villages will cease to exist. However, cultural sites and areas in proximity to, but not within, the flood zone (i.e., in the indirect area of impact) may be impacted. Potential operational impacts may relate to loss of access to the sites, change in setting, changing demographics and tourist influx.

7.14.24. In the absence of the Project, it is likely that any cultural landscape features would continue in its existing condition. As a result of the Project, by 2036 the local landscape and sense of place will be fundamentally and permanently altered. 170 km² will be inundated and current views of the valley floor will be entirely lost and replaced with views of a significant body of water. This impact will be gradual. The upper viewshed in key views (i.e., views of mountain peaks) will endure. Increased tourism and recreational activity in the area (e.g., people visiting the dam and partaking in water sports on the reservoir) may have an impact on the sense of place.

Intangible Cultural Heritage

7.14.25. In the absence of the Project, it is likely that the intangible cultural heritage resources within the AoI would continue in their existing condition, although it is recognised that some adjustments in cultural behaviours and social organisation are inevitable over time.

7.14.26. All directly affected villages (within the inundation zone) are due to be resettled by 2032. Given that it is inherently tied to the people and villages being resettled, there is limited future baseline to consider. However, sites and areas of traditional practice in proximity to, but not within, the flood zone (i.e., in the indirect area of impact) may be impacted. Potential operational impacts may relate to loss of access to the sites, change in setting, changing demographics and tourist influx. The loss of access to cultural and sacred spaces, which are a focal point for community activities, may result in an impact to intangible cultural heritage longer term.

7.15 RESERVOIR SLOPE INSTABILITY

7.15.1. Further supporting detail for the Reservoir Slope Instability baseline conditions can be found within **Volume II, Annex 13**.

Site Specific Slope Instability Analysis

7.15.2. The 1,100 m ASL reservoir raise assessment characterizes the slope instability hazards affected by lake filling as:

- L1-B, L1-D, L1-E, R1-F, and R1-G: alluvial terraces on the left and right bank of the Vakhsh River, directly facing the river and affected by active fluvial erosion; potential collapse of the terrace edges related to the impounding phase and to oscillations of the 1100 supply level during hydropower generation.
- L2-A: composite area including both rock slopes cut by the river in the basement and alluvial terraces on the left and right bank; the riverbanks are prone to erosion and partial collapse during the impounding phase, before full submersion of the area.
- L1-F: collapse of the artificial embankments upon which some service roads are located; potential triggering of slope-scale instability.
- R1-B: potential reactivation of a large rockslide resting on the slope above the elevation of 1100 m (marginally affected in this phase).
- R3-B: potential collapse of an active landslide located by the watershed.

Summary of Known Reservoir Landslides

7.15.3. The key recognised landslide types and mechanisms include:

- Scree deposits and 'ancient landslides' around the dam site and tunnels.
- Scarps in alluvial terraces interpreted to be large scale landslide features activated by dissolution of salt deposits at the toe of the slopes. These landslides could by up to hundreds of thousands of cubic metres in volume.
- Rockslides within the catchment of up to 100 Mm^3.
- A very large structurally controlled landslide (up to 100s Mm^3 in volume) on the right bank downstream of the dam is under investigation.
- Rockfalls of relatively small volume are common on steep slope but of minor consequence.
- Evaporite dissolution and karst processes associated with salt and gypsum deposits can cause large scale deformation.
- Large scale landslide deformation is implied by 'seismic scarps'.
- Debris flows or mud flows are common in the area (reported as annual occurrences) and of very large volume (up to several thousands or millions m^3).

7.16 LANDSCAPE & VISUAL

7.16.1. A summary of baseline conditions for Landscape & Visual are presented in **Figure 7-15**.

7.16.2. The landscape in the AoI is rural in character, with limited infrastructure. The local population are mostly involved in agricultural activities and cattle rearing for their livelihoods. The River Vakhsh cuts a V-shaped channel into the original U-shaped glacial valley, resulting in the river being framed by high mountains. A number of steep tributary streams join the river Vakhsh draining the adjoining hills. The landforms observed in the AoI include riverbeds, floodplains, river terraces, agricultural land on the floodplain, and predominantly steep sided mountain ranges.

7.16.3. The Vakhsh River valley has a Köppen climate classification of Dsa and typically experiences wet and cold winters with dry cool summers. The Vakhsh is fed by the glaciers of the Pamirs, and the river valley is used intensively for agriculture along with heavy industries located near the Vakhsh's dams.

7.16.4. Forests are rare in the project area as most trees have been cut for fuel and/or the steep mountain sides and elevation limit tree growth. Scrubby vegetation has colonised the sloping landform of the hills, but this type of vegetation is also decreasing in coverage since most of the areas are cleared to make way for cultivation.

7.16.5. The larger area around the project site is reported to have 14 archaeological resources (identified in the 2014 ESIA). These sites fall into three broad categories: Neolithic settlement (3rd – 1st Millennium BCE); towers/fortresses, visible as earthworks (5th – 17th Century CE) and cemeteries (2nd Century BCE – 1st Century CE). All fourteen resources, except for the ancient fortresses at Navdonak village, were found to be in poor condition / damaged by road construction or other development.

7.16.6. The region close to the proposed Rogun Dam site has high hills on both sides which are generally devoid of any vegetation. Figure 7-15b and Figure 7-15c shows a construction camp (no. 4) and, in the background, Rogun Town (no. 5) is located further upstream. Once the reservoir is filled, the construction camp will be submerged. An existing pedestrian bridge crossing is also clearly visible (no.3) which will also be submerged.

Figure 7-15b Landscape aerial view of the river reach looking upstream to the Rogun Dam

Figure Note: 1 &2 = adjacent hills, 3 = walking bridge, 4 = construction camp

Figure 7-15c Photo from proposed Rogun dam location looking upstream

Figure Note: 1 &2 = adjacent hills, 3 = walking bridge, 4 = construction camp

7.16.7. The River enters a wider floodplain about 10 km upstream of the dam location, close to the Village of Aligalaboni bolo, where river terraces, used mostly for agriculture purposes, can be seen on either side of the river (Figure 7-15c). The villages of Bedikho, Aligalaboni bolo and Roghuni poyon will be relocated due to increase in reservoir levels in the future. The current land use of river terraces and agricultural land will be submerged, although the snowclad peaks in the background will remain unaltered.

7.16.8. A number of villages were resettled as part of an earlier phase of works, to locations chosen by the villagers. One such village was Chorsada which was located in the river valley. The village was located about 15 km upstream of the Project site. The right-hand side of the riverbank is quite flat whilst the left bank of the river is abutted by high hills, resulting in limited extent of submergence. The village of Sengdevor will remain unaffected and thus will not require resettlement. The landscape character of the area is similar to that around the dam site.

Figure 7-15d View from M41 road close to village Delvokhak looking 25km upstream

7.16.9. Approximately 25km upstream of the proposed dam site, close to the village of Ani, there is a wide flood plain characterised by sandbars and braided channels. This part of the valley exhibits a wider flood plain and submergence will be limited to a point between the villages of Ayni and Yakhch. These villages however will be moved as a precaution due to their proximity to the FSL 1290.

Figure 7-15e Landscape view of area about 34 km upstream of proposed dam site

Figure notes: 1= River Khingob; 2, 4 and 5 = Hills, 3 = Yakhch Footbridge, 6 = M41 road bridge on river Surkhob, 7= floodplain between river Surkhob and Khingob

7.16.10. The Surkhob river and the Khingob river join to form the river Vakhsh about 34 km upstream of the proposed dam site, as seen in Figure 7-15e. This area currently has two bridges: a footbridge (No. 3) and a traffic road bridge (No. 6). All the hills in the view will remain unaffected and submergence will only be experienced in the lower flood plain zones. Between Hills No 4 and 5, land is low lying and will be submerged. This area has 3 different villages which will require resettlement – namely Surkhoob Moot (mostly relocated already), Pandovchi Poyon and Pandovchi Agba.

7.16.11. The area between the confluence of the Surkhob and Khingob rivers and the village of Nurobad (where the river Muksu meets the Surkhob river), is characterised by high sediment deposits which form distinctive braided channels and sand bars. Large areas of flatter land are present here which is mostly occupied by village settlements and agricultural land use. The floodplain is quite wide in this area and submergence due to FSL 1290 will be contained by the existing riverbanks. Maximum resettlement is anticipated in this area during the second stage of the resettlement programme due to the extent of lower-lying land. The existing elevation of the riverbed varies between 1,230 and 1,260 m amsl.

7.16.12. The landscape of the project site is quite similar, where the river has low-lying flood plains with agricultural land and settlements on one side and high hills on the other side. There are also limited stretches where the river is confined within high hills on both sides (refer to Figure 7-15e). These enclosed reaches of the valley have narrower floodplains and are prone to landslides every year, contributing to the sparse vegetation on these unstable slopes.

Figure 7-15f Landscape view of constrained river valley between high hills

7.17 AREA OF INFLUENCE

7.17.1. The Area of Influence (AoI) is the area surrounding the site which can be impacted positively or negatively, which could be direct or indirectly impacted, such impacts occur due to the proximity of the receptor.

7.17.2. The full extent of the Project (including the inundation zone and associated components), and an area surrounding or, 'buffering', these elements, has been used to define the spatial influence of the Project. This extent potentially impacted by the Project is known as the Area of Influence (AoI).

7.17.3. For most topics the maximum AoI corresponds to the project boundary at full inundation of the reservoir, with some buffering up to 1km outside of this boundary.

7.17.4. The AoI is presented in **Figure 7-17.**

7.17.5. For some topics the AoI may extend to the wider region and a summary of the extended AoI's are presented below. Further supporting details are found in Volume II of this ESIA

Biodiversity

7.17.6. From a terrestrial biodiversity perspective, this is initially extended to the end of the Vakhsh catchment beyond the flooding zone, within which a level impact from displaced biodiversity and humans can reasonably be expected to occur, e.g., territorial fauna being displaced into neighbouring territories, livestock farmers being displaced into previously unused areas, etc. Beyond this distance, and in the absence of any evidence to the contrary, it is assumed that any such Project influence will be negligible.

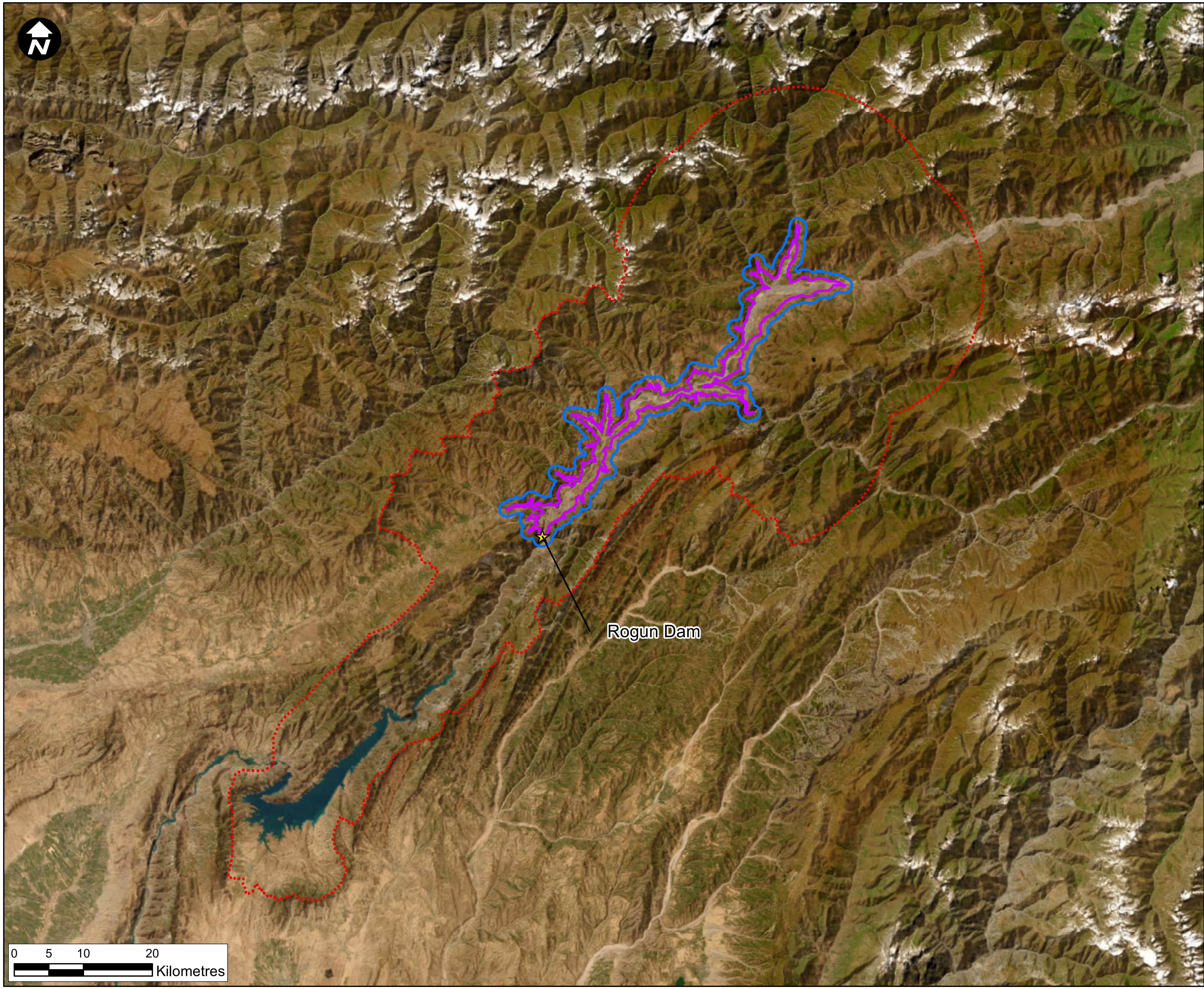
7.17.7. From an aquatic biodiversity perspective, the AoI has been defined as Vakhsh River upstream of the Nurek Reservoir, to its full capacity at 1290 m asl. (Novabad area), and includes tributaries directly impacted by the flood zone or resettlement.

Social

7.17.8. From a social perspective, the AoI is extended to incorporate the areas affected by all project activities, e.g., resettlement. This includes existing and new settlements, including but not limited to:

- Rogun City (which includes settlements which fall both within the Flooding Zone, and which are hosting resettled people);
- Nurobod District (which includes settlements which fall both within the Flooding Zone, and which are hosting resettled people);
- Rasht District (which has settlements which fall within the Flooding Zone);
- Faizobod (which has a settlement hosting resettled people);
- Tursunzoda (which has settlements hosting resettled people);
- Rudaki;
- And other surrounding districts in the regions (Rayons)

7.17.9. Further supporting details for Social AoI can be found in Volume II, Annex 11.



Legend

- 1290m Inundation Boundary
- Area of Influence
- Area of Influence Outer Limits
- Site Location

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

wsp

PROJECT TITLE

Rogun HPP E&S Support and Monitoring for World Bank

DRAWING TITLE

Figure 7-17
Area of Influence

DRAWING STATUS			
FOR INFORMATION			
DRAWN	CHECKED	APPROVED	AUTHORISED
JO	CB	RP	AB
SCALE @ A3 SIZE	DATE	REVISION	
1:500,000	10/12/2023	P00	
DRAWING NUMBER			
ROGUN-WSP-DR-GI-0066			

7.18 VALUED COMPONENTS

7.18.1. Valued Components (VCs) are the element of the receiving environment that is impacted (this could either be a component of the physical, ecological or human environment such as water quality, e.g., for the above example, species living on or in the watercourses affected.

7.18.2. The VC sensitivity is based on two components:

- Value attributed to the VC by stakeholders or applicable regulations/policies.
- Degree to which a VC is resilient to a change.

7.18.3. The value considers whether, for example, the VC/receptor is rare, unique, has protected or threatened status, has importance at a local, regional, national or international scale and, in the case of biological VCs, whether the species has a key role in the ecosystem functions.

7.18.4. The ability of a VC to adapt to change, tolerate, and/or recover from potential impacts is key to assessing its sensitivity to the impact under consideration. The overall VC sensitivity is determined by considering a combination of value, adaptability, tolerance and recoverability. This is achieved through applying known research and information on the status and sensitivity of the feature under consideration coupled with professional judgement and past experience.

7.18.5. VC Sensitivity is categorised as:

- **Low Sensitivity** – for example, common species; found in abundance; not a large population/mass affected; can recover from the impact.
- **Medium Sensitivity** – for example, common species; affected in large numbers/mass/area and takes a long time to recover.
- **High Sensitivity** – for example, where the VC is Internationally / nationally important; peculiar to the area affected, large population is impacted, and does not have capacity to recover.

7.18.6. A summary of the VCs is presented below in Table 7-. Further details are described within **Volume I, Chapter 5**.

Table 7-8 - Summary of Valued Components

Annex	Aspect	VC ID	Component	Sensitivity	Description
A01	**Air Quality**	VC1-1	Outdoor air quality, where the receptors could be workers, off-site communities/people, and off-site crops and vegetation	High	The presence of sensitive human receptors near Project emission sources with the potential to cause nuisance impacts from fugitive dust releases. Nuisance impacts from dust are usually associated with coarse particles and particles larger than 10 micrometres in diameter (PM_{10}).
		VC1-2	Indoor (underground) air quality, where the receptors would be workers	Medium	
A02	**Noise**	VC2-1	Human receptors off-site	High	Noise sensitive receptors off-site in Rogun City. In this group, worker accommodation and other nearby dwellings have been considered, and the healthcare clinic.
		VC2-2	Human receptors within the site	High	Noise sensitive receptors within the site. In this group the worker accommodation has been considered.
		VC2-3	Personnel working on site	High	Workers active on the site, undertaking normal activities during their working hours.
A03	**Soils & Geology**	VC3-1	Soil Health	Medium	Soil is described as healthy when it is in such a state that it meets its environment-appropriate ecosystem functions. Soil health arises from favourable interactions between all living and non-living soil components including microbiota, plants, and animals. It is possible for a soil to be healthy in terms of eco-system functioning but not serve crop production or human nutrition requirements.
A04	**Contaminated Land**	Impacts from contamination is considered under A03 Soils and Geology, where any discharges of polluting materials is to land, and under A05 Water where discharge is to a receiving water body (ground or surface waters).			

Annex	Aspect	VC ID	Component	Sensitivity	Description
A05	**Water**	VC5-1	Reach of the Vakhsh River located up to 1km upstream of the inundation zone for the dam (i.e. above 1290 m asl, the proposed Full Supply Level (FSL) for the reservoir	Medium	The existing free flowing Vakhsh river will become inundated by the Rogun impoundment and so will undergo a permanent change from the current baseline.
		VC5-2	Reach of the Vakhsh River located upstream of the dam and within the construction area	Low	This section of the river is heavily modified by the ongoing construction operations associated with the Rogun dam and impoundment by the coffer dam.
		VC5-3	Reach of the Vakhsh River located downstream of the Rogun dam and upstream of the Nurek Reservoir	Medium	This section of the river will be directly affected by the change in flow regime, sediment load and water quality during both the construction and operational phases.
		VC5-4	The Nurek dam reservoir	Medium	The Nurek dam is the largest hydropower project and second largest regulation reservoir in the Amu Darya catchment (Pöyry, 2014), and therefore is of significant importance to the local and regional water environment. Being directly downstream of the Rogun dam makes it particularly sensitive to the operation of the Rogun dam.
		VC5-5	The river channel downstream of the Nurek Reservoir to its eventual outfall into the Aral Sea, via the Amu Darya river.	Medium	Water that has travelled through the Rogun dam will inevitably find its way into the downstream reaches of the Vakhsh river, and then on to the Amu Darya river and the Aral Sea. It is for this reason that the full extent of the downstream drainage reach is considered, allowing transboundary effects to be assessed.
		VC5-6	Groundwater regime upstream of the Rogun dam	Medium	This supports the surface water systems of the area in the vicinity of the Rogun project providing baseflow. that is heavily influenced by the topography and land use of the area.

Annex	Aspect	VC ID	Component	Sensitivity	Description
A06	**Minimum Environmental Flows**	VC6-1	Floodplain Habitat	Medium	Habitat diversity for freshwater biota within the Vakhsh River was limited and most river reaches were relatively homogeneous. In general, the river could be described under three main habitat types; including confined channels (gorges) with steep banks, open gorges with alluvial cobbles and boulders, and braided channels. These fall under the floodplain habitat which can be impacted by changes in flows due to operational changes of the Project. Low levels of modification were noted and based on the functioning role played by this habitat, it is considered to be Natural Habitat as per ESS6.
		VC6-2	Flora	Medium	No specific flora of interest were within the Project AoI and therefore will not feature in the EFlow impact assessment. According to the 2014 ESIA, impacts to the terrestrial ecology would be negligible and not significant due to the prevailing modified habitat conditions and lack of species of conservation interest/value. The exception requiring further evaluation was the identification of two floodplain habitats, which would be lost within the flooding zone.
		VC6-3	Fauna	Low	The 2014 ESIA concluded that impacts to fauna will be small by virtue of the project AoI being heavily modified and therefore not supporting important populations of any rare/notable species, most of which were recorded from higher altitudes, therefore not falling within the floodplain habitat.
		VC6-4	Aquatic Ecology	Medium	The aquatic habitat across the AoI has been given a value of Low as a result of the high sediment loads within the river, poor habitat availability and existing interruption in longitudinal connectivity.
		VC6-5	Human Livelihoods	Low	The Vakhsh river provides water for several irrigation schemes, which are all located downstream of Nurek dam. The main irrigation infrastructures are the Dangara tunnel with a capacity of

Annex	Aspect	VC ID	Component	Sensitivity	Description
					100 m³/s, the Yavan tunnel with a capacity of 75 m³/s and the Vakhsh main canal with a capacity of 210 m³/s, in addition to several smaller irrigation systems (Poyry, 2014). In the upper Vakhsh river, upstream of Nurek, the demand for irrigation is limited due to the lack of suitable land (Poyry, 2014).
A07	**Traffic & Transport**	VC7-1	Accidents and Safety	Medium	A significant increase in overall traffic volumes and abnormal loads may raise concerns over road safety.
		VC7-2	Driver Delay	Low	Driver delay occurs due to additional traffic present on the road network. IEMA guidelines note that additional delays are only likely to be significant if the traffic on the network is already at, or close to, capacity.
		VC7-3	Pedestrian Amenity	Medium	This is broadly defined as the relative pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width / separation from traffic.
		VC7-4	Severance	Medium	The term is used to describe a complex series of factors that separate people from places and other people. Severance can also result from difficulty in crossing a heavily trafficked road.
		VC7-5	Pedestrian Delay	Medium	Changes in the volume and composition or speed of traffic on the road network may affect the ability of people to cross the roads. In general, increasing traffic volumes will lead to an increase in pedestrian delay.
A08	**Waste**	VC8-1	Waste disposal facilities for Project waste (including Rogun landfill, Vahdat landfill, Dushanbe waste disposal site).	Medium	There is limited information on capacities of the waste disposal sites currently being, however based on the status of waste management infrastructure nationally, it has been assumed that capacity of sites used by the Project is fairly limited.

Annex	Aspect	VC ID	Component	Sensitivity	Description
		VC8-2	Recycling facilities for Project waste.	High	Based on the general shortage of recycling facilities nationally, it has been assumed that there are limited licensed facilities available within the region.
		VC8-3	Waste sites for waste from resettled communities, such as Darband.	High	There is limited information available on the waste disposal sites being used for waste from resettled communities, however based on the status of waste management infrastructure nationally, and the description (in the 2014 ESIA) of management of household waste in local communities, it has been assumed that there are limited facilities available. Lack of general waste removal contractors servicing local communities.
A09	**Biodiversity**	VC9-1	Floodplain habitat	Medium	The floodplain habitat across the AoI is heavily modified and lacking any notable species/species composition that would signify Natural Habitat (as per ESS6). A notable exception to this is found upstream of the confluence of the Vakhsh and Obikhingou rivers, where deposited materials appear to have altered the braided channel here, creating a 'new' floodplain which exhibits far more natural habitat composition. Given low levels of modification here, this area is considered to be Natural Habitat and therefore of Medium sensitivity. The EAAA for the floodplain VC is the extent of this Natural Habitat floodplain.
		VC9-2	Juniper woodland	Medium	The juniper woodland recorded from the AoI is a remnant feature of habitat that would have been extensive in the past. It shows some signs of modification (from grazing/animal movements and firewood collection), but not to the extent that its integrity as a functioning habitat is compromised. It is therefore considered to be Natural Habitat as per ESS6 and therefore of Medium value.
		VC9-3	Notable flora	Medium	The baseline studies identified 20 TRB species as being present/potentially present across the AoI. It's considered likely

Annex	Aspect	VC ID	Component	Sensitivity	Description
					that the populations of any such species will not be of significance outside of the flora EAAA; however, in the absence of robust evidence to corroborate this, a precautionary value of Medium sensitivity is considered appropriate here.
		VC9-4	Notable reptile species	Low	Four species of reptile were recorded during baseline studies that are on the TRB, including one also listed as Vulnerable by IUCN. There is no indication that the reptiles recorded are of particular importance outside the EAAA, with species either being common and widespread (regionally and beyond), or rare within the EAAA. On this basis, a value of Low sensitivity is considered appropriate.
		VC9-5	Notable mammal species	Low	Baseline studies recorded 17 species of mammal that are on the TRB, with several also having IUCN Red List classification. However, only one of these was encountered during field surveys in 2023 (least weasel), and a number of the rarer species are not considered present within the updated AoI. None of the species considered present/potentially here have populations of value beyond the EAAA and therefore a value of Low sensitivity is considered appropriate.
		VC9-6	Migrating birds	Low	Baseline studies (including spring 2023 field surveys) have not identified any particularly important migratory bird populations being supported by habitats within the AoI, and the habitats do not appear to offer optimal conditions for birds that will stop on their migration through the Vakhsh River valley. However, it is possible that the floodplain habitats and exposed braided channel might be of use to roosting/resting birds and value of Low sensitivity is considered appropriate.
		VC9-7	Aquatic Biodiversity (fish)	Medium	Given that the Vakhsh River has been fragmented by 5 dams, including the Nurek Reservoir, any long-range fish migrations that would have occurred between the Amu Darya or the lower parts of Vakhsh River to its headwaters have already been interrupted.

Annex	Aspect	VC ID	Component	Sensitivity	Description
					Given this level of modification to the longitudinal connectivity across the EAAA, a value of medium sensitivity is considered appropriate.
		VC9-8	Aquatic Ecology (general)	Low	The aquatic habitat across the AoI has been given a value of Low as a result of the high sediment loads within the river, coupled with the above-mentioned interruption in longitudinal connectivity.
A10	**Ecosystem Services**	VC10-1	Wild plants	Medium	Wild plants are valuable to local communities for their medicinal purposes and local practices and customs. Local communities are not highly dependent on them.
		VC10-2	Trees used for memorials and shrines	Medium	Trees used for memorials and shrines are valuable to local communities for local practices and customs. Local communities are not highly dependent on them.
		VC10-3	Trees associated with local stories and taboo	Medium	Trees associated with local stories and taboo are valuable to local communities for local practices and customs. Local communities are not highly dependent on them.
		VC10-4	Protected areas	Negligible	Not prioritised.
		VC10-5	Local healing and thermal waters	Medium	Local healing and thermal waters are valuable to local communities for local practices and customs. Local communities are not highly dependent on them.
		VC10-6	Croplands and orchards	High	Local communities are highly dependent on agricultural lands for food provision.
		VC10-7	Pastures	High	Local communities are highly dependent on pasture lands for food provision.

Annex	Aspect	VC ID	Component	Sensitivity	Description
		VC10-8	Remaining woody areas	Low	Local communities sometimes used the remaining forested areas for wood resources. Community management also provides some cultural and social benefit.
		VC10-9	Natural habitats (terrestrial, riparian floodplains, freshwater)	Medium	Habitats provide an important place to believe for a wide variety of species, that can be of value to local communities.
		VC10-10	Floodplains	Medium	Floodplains provide a wide range of benefits such as waste mediation, water flow regulation and recreation which the local and downstream communities rely on. However, local and downstream communities are not highly dependent on these services.
		VC10-11	Freshwater streams	Medium	Freshwater streams provide a range of services including fishing, drinking and irrigation and soil sedimentation which the local communities rely on. However, local communities are not highly dependent on these services.
		VC10-12	Species	Low	Species provide with the area provide a pool of genetic diversity that helps maintain their populations and may provide sources for medicinal and biochemical products in the future, which is to some value to local and global communities.
A11	**Social**	VC11-1	Local Economy and Employment	High	There is a high level of sensitivity associated with local economy and employment due to the levels of poverty and employment in the local area.
		VC11-2	Labor Influx	Medium	There is a medium level of sensitivity associated with labor influx due to the long-term duration of the construction of the Project and the impacts associated with workers from outside the local area.
		VC11-3	Gender Issues within Labor Working Conditions	High	There is a high level of sensitivity associated with gender related issues within labor working conditions.

Annex	Aspect	VC ID	Component	Sensitivity	Description
		VC11-4	Labor Management	High	There is a high level of sensitivity associated with labor management due to evidence of poor working conditions.
		VC11-5	Occupational Safety	High	There is a high level of sensitivity associated with occupational health and safety due to large scale of construction activities and the potential for a high rate of occurrences of accidents.
		VC11-6	Community Assets and Infrastructure	Medium	There is a moderate level of sensitivity associated, although the loss is permanent, communal assets are being replaced with more improved assets and infrastructure.
		VC11-7	Community Health, Safety and Security,	High	There is a high level of sensitivity associated with the excavation and ground works of the Project, which could lead to direct health and safety impacts within local communities. Also transboundary impacts could be significant in failure of dam safety.
		VC11-8	Inclusion, Vulnerabilities, and Gender Issues	High	There is a high level of sensitivity associated with the series of impacts women and other vulnerable groups may be exposed to.
		VC11-9	Land Acquisition and Resettlement	High	There is a high level of sensitivity associated with the resettlement of vulnerable groups such as elderly people, people with disabilities and households headed by women.
A12	**Gender Assessment**	VC12-1	Women and Girls within Project Affected Communities	High	There is a high level of sensitivity associated with the resettlement, employment, health & safety of Women and Girls within the Project Affected Communities.
A13	**Cultural Heritage**	VC13-1	Archaeological and Historic Resources	High	Tangible, material remains of past human occupation of a landscape and all associated activities. Encapsulates all periods from prehistory through to the historic era. Resources include

Annex	Aspect	VC ID	Component	Sensitivity	Description
					archaeological and historic sites or individual artefacts and groups of artefacts.
		VC13-2	Cultural and Sacred Resources	High	Tangible, physical features or natural objects embodying spiritual and cultural values. Historic and active landscapes, places and objects used by a community for long-standing cultural and religious purposes.
		VC13-3	Intangible Cultural Heritage Practice	High	Unique cultural activities and belief systems, including indigenous cultural knowledge and traditional lifestyles.
A14	**Reservoir Slope Instability**	VC14-1	Population living around the reservoir perimeter and downstream of the dam	High	Communities are potentially highly vulnerable to sudden inundation by impact waves.
		VC14-2	Private and public property and associated infrastructure around reservoir perimeter	High	Property and infrastructure may be highly vulnerable to landslide activity due to reservoir filling and operation.
A15	**Landscape & Visual**	VC15-1	Character Area	Medium	There is a local landscape character and visual receptors amenity at a localised level only with medium sensitivity as a result of , loss of some floodplain land.
		VC15-2	Visual Amenity	Medium	

8 IMPACT ASSESSMENT

This chapter sets out the summary of key issues and significance effects identified through the Impact Assessment Process.

Where mitigation is proposed, this has been identified to be "technically and financially feasible" and in line with Good International Industry Practise (GIIP) to implement on the Project and reduce the Environmental and Social effects where practicable.

8.1 AIR QUALITY IMPACT ASSESSMENT

8.1.1. The following section outlines the Air Quality Impact Assessment, presenting a qualitative assessment of potential impacts on air quality associated with the construction of the Rogun HPP project.

8.1.2. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 01**.

KEY MESSAGES

- A substantial amount of fugitive dust is generated due to the movement of construction traffic on dry and dusty haul roads within the site, primarily on the left bank. This is the case only in dry conditions, which would prevail in summer and early autumn. Most aboveground roads are unpaved, and watering of road appears to be inconsistent across the site, with left bank roads better (but still not adequately) watered. The Lot 3 right bank access road to the site was observed to be extremely dusty and poorly watered, resulting in large fugitive dust emissions when used by vehicles.
- Fugitive dust is generated by handling of dusty materials, and evidently from trucks dumping materials down the side of embankments on a regular basis.
- Borrow pits, spoil storage areas and stockpiles are uncovered and observed as major sources of fugitive dust under windy conditions, although there are relatively few workers present to be exposed.
- Trucks carrying materials are not covered, but nevertheless appear to be a relatively minor contributor to fugitive dust across the site.

The existing conveyor belts transporting materials from the upstream stockpile and primary crusher to the dam site is covered and generates little dust. These have replaced a fleet of dump trucks, thus reducing traffic and dust (and greenhouse gas emissions) by a significant amount in recent years.

- A new 8-9km covered conveyor (called the 'flying belt') now takes materials from the downstream quarry and stockpiles to the dam site and has further reduced the number of vehicles required for material transfer and thus reduced fugitive dust and exhaust emissions.
- Fugitive dust and particulates are generated from machinery and vehicles used underground and will continue to be. In most locations, there is poor or no mechanical ventilation, and when underground roads do not daylight on both ends there is visible dust along those roads, although exiting water ingress into tunnels from pipe work and other sources mitigates this considerably in many locations.

- The high intensity of diesel-powered vehicle movement in the tunnels continue to emit PM2.5, NO2 and CO resulting in poor underground air quality. A deep haze in the air of many tunnels and in the powerhouse and other underground workplaces (especially where penstock and intake tunnels and shafts are being excavated) is likely to be a combination of humidity, diesel emissions, and fine particulates, which is considered almost certainly to present a significant health hazards to those who experience chronic exposure—this includes powerhouse staff and also construction staff since construction has been ongoing for nearly a decade and will continue until 2029.
- Ventilation of underground spaces and works is not considered sufficient, and the equipment observed (large fans with no connecting ducts or tubes) simply moves dirty air around the tunnels as opposed to introducing clean air from outside.
- Visible dust generation aboveground and the deep haze underground demonstrate that more comprehensive management is required to improve current conditions at the site and reduce risks for those working on site (particularly underground), those now residing in nearby Construction Camp 1, the settlement located in Construction Site 2, and future worker accommodation in Construction Site 2 and Area 5 downstream of the dam.
- Some monitoring of air pollutants is undertaken by Rogun JSC and some contractors, who monitor nitrogen dioxide, carbon monoxide and dioxide, and other pollutants with handheld instruments. At least some instruments are apparently not calibrated regularly, and results are not compiled systematically. Overall, monitoring data are not considered sufficiently robust to demonstrate quantitively that standards are being exceeded or to allow modelling. Even so, the demonstrably poor quality justifies further assessment and the implementation of mitigation measures as needed to achieve standards.

SUMMARY OF BASELINE CONDITIONS

8.1.3. A summary of air quality baseline conditions can be found in **Volume I, Chapter 7**. Further details on the baseline conditions can be found in **Volume II, Annex 01**.

Area of Influence

- 400 m from the construction activities applied for the consideration of fugitive dust emissions.

SCOPE OF THE ASSESSMENT

8.1.4. The assessment scope considers fugitive dust and particulate matter (PM_{10} and $PM_{2.5}$) emissions and elevated ambient concentrations of nitrogen dioxide (NO_2), sulphur dioxide (SO_2), PM_{10} and $PM_{2.5}$ due to exhaust emissions from diesel-fuelled mobile sources such as trucks and excavators, as well as non-mobile sources such as temporary diesel generators both above and underground, but primarily underground due to construction phase activities including:

- Ongoing main dam construction – Lot 2 works, including placement and compaction of earthen material, concrete works, and grouting.
- Left bank upstream Area – Stockpiles, Plants, Conveyors and Transport Routes for material transfer to the dam or downstream stockpiles (in future).
- Downstream Area – Quarries, stockpiles, Plant, Conveyor and Transport Routes for material to the dam.

- Ongoing construction works (primarily tunnelling, material transport to spoil disposal piles, and slope stabilization works on the right bank – Lot 3 works by current Lot 3 EPC Contractor and future Lot 3A EPC Contractor.
- Ongoing construction works (primarily underground excavation and material transport to spoil disposal piles) on the left bank – Lot 4 works by current non-EPC Contractors and future EPC Contractor.
- The removal of stockpiles, conveyor, and right bank road, expected by 2026.
- The demolition and rehabilitation of Construction Site 1 and other infrastructure prior to reservoir inundation, expected by 2027.
- Construction of new construction camps in Construction Site 2 and Area 5.

ASSESSMENT METHODOLOGY

Valued Components

- Outdoor air quality, where the receptors could be workers, off-site communities/people, and off-site crops and vegetation (**VC1-1**).
- Indoor (underground) air quality, where the receptors would be workers. (**VC1-2**).

Impact Factors

- Impact Factor 1 (IF1-1): Fugitive dust and particulate matter (PM10 and PM2.5) emissions due to construction phase activities.
- Impact Factor 2 (IF1-2): Elevated ambient concentrations of nitrogen dioxide (NO2), sulphur dioxide (SO2), PM10 and PM2.5 due to exhaust emissions from diesel-fuelled mobile sources such as trucks and excavators, as well as non-mobile sources such as temporary diesel generators both above and underground, but primarily underground.

ASSESSMENT OF IMPACTS

Outdoor Air Quality (VC1-1)

8.1.5. The construction associated with Lot 2 (WeBuild) is ongoing and will extend until the end of construction phase in 2029. Lot 2 includes the construction of the main dam, and the extent of Lot 2 is substantial, covering upstream right bank and downstream areas, including stockpiles, quarries, conveyors and transport routes.

8.1.6. The ongoing earthworks and material transfer are extensive and the magnitude of the dust emission is considered to be large when using the IAQM approach (i.e. the total site area >10,000m2, materials being handled are dusty and prone to suspension when dry due to small particle size, there are >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, and total material moved >100,000 tonnes). This is confirmed by visual observation. This area will continue to be used until approximately 2026 when they are flooded by the Stage 1 reservoir. Before that time, 12,000,000m^3 of material will be conveyed to downstream of the dam and stored, all stockpiles will be exhausted, the conveyor and other facilities will be removed, and any areas of contamination from spills and the like will be cleaned up. At present, several bowsers water the road and dampen dust along many sections, but visual observation shows this is not entirely adequately and that further effort is needed.

8.1.7. The extent of the ongoing and future downstream construction work for Lot 2 is similarly as extensive and includes borrow areas, loam plant, large open stockpiles, batching plant, a large quarry, and a 7-8km conveyor will come online in 2023. Area 5 will also contain extensive Contractor accommodations, workshops, laydown areas, offices, etc. The magnitude of dust emission in these areas is also considered to be large, again confirmed by observation. It is noted that the new conveyor will substantially reduce the number of vehicles required to transfer materials to the dam site and thus will reduce fugitive dust emissions from unpaved roads.

8.1.8. It is noted that the closest residential receptors to the Lot 2 works are workers currently residing at Construction Camp 1 which is over 450m from the nearest construction activity. However, land close to Area 5 in the downstream area will be allocated for establishing a construction camp once Construction Camp 1 is removed due to reservoir inundation. The dust risk at this location is therefore considered low but may increase depending on where the land for future worker accommodation is allocated. Regardless, best practice mitigation and management measures will be required to minimize dust to an acceptable level throughout the construction phase up until 2029. Roads in the downstream area are not linear, as they are upstream, so it is more difficult to attribute dust to roads versus quarrying. However, additional effort is required to control dust generation.

8.1.9. The construction associated with Lot 3 (TGEM) on the right bank includes a series of underground tunnels and spillways that will provide adequate flood discharge capacity as the height of the main dam increases and lower tunnels are decommissioned. At present, works are supervised by Rogun JSC. Works not yet completed under Lot 3 is being retendered internationally as Lot 3a prior to financing and the new Lot3A EPC Contractor will be appointed soon after international financing is available. At that point, TGEM's EPC 3 contract will be terminated, and site handover will occur when aeras under their control meet contract conditions for cleanup and stabilization. It is understood that the construction works associated with Lot 3 will substantially increase when Lot3A is awarded, resulting in an increased number of vehicles accessing the right bank on what is currently a very dusty and poorly mitigated access road which runs through Construction Site 2 and a small village of approximately 10-12 houses. The ongoing earthworks, construction activities and material transfer for Lot 3 is extensive and the magnitude of the potential impact to ambient air quality is Large, with concerns regarding the access road and the extent to which fugitive dust from vehicle movement occurs.

Rogun JSC -- Site Access Road

8.1.10. The main access road to the main transportation tunnel, which provides access to the main dam and other construction areas is over 4km and starts at a security gate in Rogun town. Vehicle do not have to pass through Rogun town before entering or after leaving the site. The road winds down and through Construction Site 1 before entering the site through a portal on the right bank. This main access road from Construction Site 1 is paved and in good condition and fugitive dust from the road is not considered to be of concern. The number of heavy vehicles accessing the site per day is generally less than 100, about 33 of which are trucks bringing cement from Dushanbe. The impact to ambient air quality from trucks using this access road is considered small and impact to air quality from exhaust emissions is not considered likely.

Rogun JSC and Contractors -- Construction Site 1

8.1.11. Land in this Construction site has been allocated to the Lot 3 Contractor and the non-EPC Contactors, and some remains under the control of Rogun JSC. Here, the Contractors have their worker accommodations, warehouses, maintenance workshops, laydown areas, boneyards, etc.

8.1.12. Before inundation in 2027, all parties will demolish their facilities in Construction site 1. Contractors will either move to new sites or will have been terminated and depart. The demolition of buildings at construction Site 1 and other buildings at Construction Site 2 will occur within 500m of Rogun Town in some cases and very close (within 100m) to the village located on Construction Site 2. The sensitivity of the area is therefore considered high, and with a large dust emission magnitude, the risk to human health and local amenities is considered large. This process will require these Contractors to apply appropriate mitigation measures to suppress dust to an acceptable level and will require continuous monitoring and audits to ensure that Tajikistan ambient air standards are met. The same demolition of unused buildings and facilities will be true for land under the control of Rogun JSC, and this will include areas abandoned by some Contractors in the past. Once financing is available, all EPC Contracts will require control that dust and other emissions be controlled to meet standards, and this will be enforced by the PMC.

Indoor (Underground) Air Quality (VC1-2)

8.1.13. The underground air quality at the site is of poor quality along many of the roads and in many or most working areas, and this is supported by visual observations. Poor indoor air quality was also cited in the previous ESIA in 2014 with limited or no management plans in place to manage the issue. Workers are spending substantial amounts of time in the tunnels and underground spaces and respiratory PPE is not used except for some workers utilizing surgical face masks, which are not appropriate for mitigating against the adverse health implications associated with PM2.5, CO and NO2. The “indoor” human health risk from poor air quality is therefore considered to be of material importance.

8.1.14. More than 80km of underground road currently exists and more than 400 vehicles and self-propelled plant, which are sources of air emissions, move thorough the tunnels each day. This includes trucks, sprinklers, fuel pumps, cars and other items of mobile plant. The indoor air quality is somewhat already mitigated because of water leaking from pipes within the tunnels, dampening the surfaces of roads and mitigating fugitive dust emissions as vehicles pass through the tunnels. In addition, some tunnels daylight on both ends and are naturally ventilated to some extent.

8.1.15. There are at least a few powerful ventilation fans in place, but there is no ducting to connect them in order to bring clean air in or exhaust “dirty” air out. As a result, the fans merely move “dirty” air around except where tunnels daylight at both ends and there is at least some natural ventilation to provide clean air.

8.1.16. Instantaneous measurements of concentrations of oxygen, carbon monoxide and dioxide, methane, nitrogen oxides and other pollutants are taken in the powerhouse and a few other locations on approximately a weekly basis using handheld instruments, but calibration is at best inconsistent. Monitoring records are kept in paper copy only and are not compiled into summary form. Overall, data are not considered adequate for analysis or modelling. Knowledgeable specialists report that there have been no known instances when standards for O_2, CO, CO_2, CH_4 have been exceeded, but there have been a few when NO_2 exceeded standards.

8.1.17. Forced-air ventilation is planned to be installed for the powerhouse and transformer cavern, but this will not be in place until after the Lot 4 EPC Contractor is appointed.

8.1.18. Underground air quality, in tunnels and other works, will require improved management. This will include the addition of forced-air ventilation in some tunnels unless continuous automatic monitoring using reference or equivalent methods show that air quality consistently meets standards. As needed, additional measures mitigations may be necessary if monitoring shows standards are not being met.

SUMMARY OF IMPACTS

8.1.19. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 01**.

8.1.20. The Institute of Air Quality Management (IAQM) guidance suggest that when correctly applying and actively managing the mitigating controls the impacts to receptors are not likely to be significant for the large majority of the time. However, due to the nature of construction activities, the scale and duration of the construction phase, and the possibility of extreme weather conditions, receptors may experience occasional adverse effects.

8.1.21. The IAQM states "the likely scale of this would not normally be considered sufficient to change the conclusion that with mitigation the effects will be 'not significant'. On this basis, it is concluded that construction phase activities, once financing is available and mitigations are in place, are likely to result in low impacts, and in most cases minor or no impacts post-mitigation. The same will be the case for the operations phase, as forced-air ventilation will be in place for the powerhouse and transformer cavern and air quality will be monitored to verify compliance with standards.

Table 8-1 - Air Quality – Summary of Impacts

Impact Factor	IF1-1 - Fugitive dust and particulate matter (PM_{10} and $PM_{2.5}$) emissions due to construction phase activities.		IF1-2 - Elevated ambient concentrations of NO_2, SO_2, PM_{10} and $PM_{2.5}$ due to exhaust emissions from diesel-fuelled mobile sources	
Valued Component	**VC1-1 – Outdoor Air Quality**	**VC1-2 – Indoor Air Quality**	**VC1-1 – Outdoor Air Quality**	**VC1-2 – Indoor Air Quality**
Sensitivity	Medium	Medium	Medium	Medium
Type	Negative	Negative	Negative	Negative
Extent	Local	Local	Local	Local
Duration	Medium-term	Medium-term	Medium-term	Medium-term
Frequency	Periodic	Constant	Periodic	Constant
Likelihood	Likely	Certain	Likely	Certain
Reversibility	Reversible	Reversible	Reversible	Reversible
Magnitude	Large	Large	Medium	Large
Significance	Major	Major	Moderate	Major
Additional Mitigation?	Yes	Yes	Yes	Yes
Residual Significance	**Minor**	**Minor**	**Minor**	**Minor**

MITIGATION AND RECOMMENDATIONS

8.1.22. The following mitigation measures are recommended to reduce all residual effects to Minor.

Table 8-2 Air Quality - Mitigation Measures and Recommendations

Valued Component	Overview of Mitigation Measure
VC1-1 **VC1-2**	**Implement an Air Quality Management Plan** ▪ Prior to the effective date, a site-wide Air Quality Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractors will develop detailed plans for management of air quality in their respective areas and for their respective activities, to be approved by the Project Management Consultant (PMC) within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ The Rogun JSC Plan will require EPC Contractors (Lots 2,3,4) to install ventilation systems in all tunnels over 0.5km from a portal/adit unless air monitoring data collected over a 30-day period by the Contractor responsible for the road/tunnel demonstrates with continuous monitoring data that air quality remains within applicable standards. It is noted the Lot 1 contract requires the Contractor to install a ventilation system for the powerhouse and transformer cavern. ▪ Contractor Plans will identify the locations at which monitoring will be conducted, how data will be recorded and reported, and who will be responsible for collecting and analyzing data. They will also identify the site-specific mitigation measures they will implement, identified by location, frequency, responsibility, monitoring, etc. ▪ The Rogun JSC plan will identify the general mitigation measures that may be used by Contractors but will not specify what will be used where, and when--that will be left to Contractor Plans. **General GIIP measures that Contractors may propose to use may include, but by no means be limited to:** ▪ Continuous visual observations by ESHS staff, supervisors, other site managers, and all responsible personnel, who will have been trained to report instances of visible dust or haze to HSE managers, who will then address the issue immediately. ▪ Workers who may be exposed to dust or other air pollutants periodically or more or less continuously will be provided with PPE appropriate to the dust size fraction and/or other air pollutant. Improved ventilation systems within the tunnels over 0.5km, will need to install if air quality is shown to not meet applicable standards after monitoring, and dust and other air pollutants must be as low as reasonably possible (ALARP). PPE must be used as a last resort, only after all other measures have failed, and only for short periods.

Valued Component	Overview of Mitigation Measure
	▪ Weekly visual inspections during dry periods of all roads and work areas by HSE specialists, who will also take measurements with handheld instruments. ▪ Watering to suppress wind and physical disturbance dust generation (i.e., on roads, stockpiles, spoil piles etc.). It is noted that at least some additional bowsers will be required on Lot 2 and substantially more on Lot 3A than are currently used on Lot 3. ▪ Drop heights from conveyors, loading shovels and hoppers will be minimised. If long-distance dumping down slopes is to continue under EPC Contractors, those Contractors should be required to slightly dampen of loads to be dumped unless they can show why this is not a feasible measure. **Mitigations specific to underground air quality may include:** ▪ All vehicles and engines will be switched off when not in use, with no idling vehicles. ▪ All vehicles will be maintained and serviced in accordance with manufacturers' specifications to ensure engines are running efficiently. ▪ Vehicles and equipment that emit black smoke, other than for seconds after daily startup, will be taken out of service until their engines are running properly and there are no more visible emissions. This will be included on the daily vehicle checklists required by Traffic and Transport Management Plans. ▪ Use electrical equipment where practicable, including consideration of electric-powered HGVs and other vehicles. ▪ Post and always maintain a speed limit of 20kph inside tunnels. This limit to be enforced by the PMC and each Contractor as well as the existing program of monitoring. Drivers will be sanctioned for repeated violations, including ultimate termination. ▪ Rules for passing will be enforced similarly. ▪ Air quality data will be actively monitored to ensure standards for human health are not exceeded. This will include real-time continuous air quality monitors at Contractor-proposed 'active' construction sites. The monitoring will be managed by a suitably qualified professional. ▪ Install ventilation systems in all tunnels over 0.5km from a portal/adit unless air monitoring data collected over a 30-day period by the Contractor responsible for the road/tunnel show that air quality remains within applicable standards (see air quality management plan requirements above). **Mitigations specific to Construction Site 1 include:** ▪ When relocating Construction Site 1 to Construction Site 2 and Area 5, the sites will be located further than at least 400m from dust causing activities unless mitigations measures can keep visible dust to a minimum (in time and magnitude).

Valued Component	Overview of Mitigation Measure
	▪ Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust), with due regard for the presence of asbestos. ▪ Ensure effective water suppression is used during demolition operations. ▪ Avoid explosive blasting wherever possible, using appropriate manual or mechanical alternatives.

8.2 NOISE IMPACT ASSESSMENT

8.2.1. The following section outlines the Noise Impact Assessment, identifying potential impacts during construction and operation phases with additional mitigation and recommendations.

8.2.2. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 02**.

KEY MESSAGES

- At present, there is limited or no monitoring of noise levels at HPP construction workplaces other than on Lot 2 sites, and none off-site. None is known to occur at DFZ construction sites.
- Noise at some workplaces exceeds applicable standards by a wide margin, with noise at one workplace measured at over 110dB (open ventilation fan). Although workers were reported to have received ear plugs, none were observed in use—even if used properly, they would reduce noise only by 15-30dB and leave worker exposed to excessive noise.
- Night-time construction noise levels could affect human receptors off-site in worker accommodation and other dwellings and on-site at Rogun.
- There are no off-site residences or other sensitive locations within about 1 km of the nearest site boundary. Relatively small-scale construction does occur at new resettlement sites where there are nearby residences and construction is not yet complete.
- Operational activities do not currently, and should not in the future, generate noise that exceeds applicable standards.
- Impacts from construction activities can be readily mitigated to reduce noise sensitive receptors. A Noise Management Plan prepared by Rogun JSC will establish requirements for Contractor management programs and plans, which will be approved and monitored by the Project Management Consultant.

SUMMARY OF BASELINE CONDITIONS

8.2.3. A summary of Noise baseline conditions can be found in **Volume I, Chapter 7**. Further details on the baseline conditions can be found in **Volume II, Annex 02**.

Area of Influence

Construction Phase

- 1 km from above-ground construction activities.
- 50 m from construction routes.
- 500 m from the construction and demolition activities related to resettlement villages.

Operational Phase

- 1 km around powerhouse and permanent roads.

SCOPE OF THE ASSESSMENT

8.2.4. The assessment scope is based on information gathered during a site visit in May 2023, review of historic data and information provided by the Contractors related to noise. A quantitative noise assessment has not been undertaken. The qualitative assessment and professional judgment.

ASSESSMENT METHODOLOGY

Valued Components

- Human receptors off-site (**VC2-1**).
- Human receptors within the site (**VC2-2**).

Impact Factors

During construction:

- Impact Factor 1 (**IF2-1**): The likely noise impacts arising from construction vehicles.
- Impact Factor 2 (**IF2-2**): The likely noise impacts arising from the construction activities (i.e., blasting, crushing etc).

During operation:

- Impact Factor 3 (**IF2-3**): Likely noise impacts arising from the Project related road traffic.
- Impact Factor 4 (**IF2-4**): Likely noise impacts arising from the operation of permanent plant of the Project.

8.2.5. The potential for noise impacts is assessed against World Bank guideline values. Guidance on construction noise thresholds is adopted from guidance in BS 5228. The magnitude of impact criteria adopted for assessment of construction and operational noise impacts are presented in Table 8-3, with further supporting detail presented in **Volume II, Annex 02.**

Table 8-3 Magnitude of Noise Impact

Magnitude of Impact	Construction Noise Criteria	Operational Noise Criteria
High	More than 5dB above construction threshold	More than 3dB above World Bank Group Criteria
Medium	Up to 5dB above construction threshold	Between 1 and 3dB above World Bank Group Criteria
Small	Up to 3dB above construction threshold	Up to 1dB above World Bank Group Criteria
Very Small	Below construction threshold	Up to 3dB below World Bank Group Criteria
Negligible, no change respect to guidance	Less than 5dB below construction threshold	Less than 3dB below World Bank Group Criteria

8.2.6. This assessment uses the Impact Significance Matrix presented in **Volume I, Chapter 5**. The valued components have a high sensitivity to noise from the Project. Furthermore, there are no noise impacts of a beneficial nature.

ASSESSMENT OF IMPACTS

Direct Construction Impacts

8.2.7. The main activities contributing to noise impacts are related to crushing plant, dump trucks on the haul road, main conveyor and secondary conveyors in the stockpiles, earthworks at the Cofferdam area and the asphalt plant (when active).

8.2.8. Offsite human receptors are considered at Rogun City, approximately 1,500m northwest of the site.

8.2.9. Onsite human receptors consider Construction Site 1, approximately 450m from ongoing construction activities, and the workers on site.

VC2-1 – Human receptors off-site

8.2.10. The predicted construction noise levels at Rogun City indicate an impact of negligible magnitude during the daytime and an impact of small magnitude during the night-time. These impact magnitudes result in effects of **negligible significance** during the daytime and **moderate significance** during the night-time, pre mitigation.

VC2-2 – Human receptors within the site

8.2.11. Whilst noise varies for personnel working on-site dependent on the construction activities undertaken, noise monitoring results indicate a potential noise exposure in the high or unacceptable categories.

8.2.12. Based on the measurement data and predicted construction noise levels, impacts on human receptors within the site would be of **moderate significance**, pre mitigation.

Direct Operational Impacts

Operational Phase Noise Levels

8.2.13. In consideration of operational traffic, it is assumed limited operational traffic flows will present on site for the maintenance and operational activities of the Project, therefore; it is anticipated that flows of vehicles will tend to be insignificant and will not give rise to any adverse noise impacts.

Resettlement Areas

8.2.14. A number of occupied settlements are to be relocated as part of the Project. At this time, not all resettlement locations are confirmed. Resettlement areas will be at least 500m from any existing settlement. As such, construction of resettlement areas is considered unlikely to exceed the construction noise thresholds set out in at any existing settlement.

SUMMARY OF IMPACTS

Table 8-4 Noise – Summary of Impacts

8.2.15. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 02**.

Impact Factor	IF2-2 - Construction Activity	
Valued Component	**Human receptors off-site (VC2-1)**	**Human receptors within the site (VC2-2)**
Sensitivity	High	High
Type	Negative	Negative
Extent	Local	Local
Duration	Medium-term (during construction phase, ending in 2029)	Medium-term (during construction phase, ending in 2029)
Frequency	Constant	Constant
Likelihood	Certain	Certain
Reversibility	Reversible	Reversible
Magnitude	Small	Small
Significance	Moderate	Moderate
Additional Mitigation?	Yes	Yes
Residual Significance	**Minor**	**Minor**

MITIGATION AND RECOMMENDATIONS

8.2.16. The following mitigation measures are recommended to reduce all residual effects to Minor.

Table 8-5 Noise - Mitigation Measures and Recommendations

Valued Component	Overview of Mitigation Measure
VC2-1 VC2-2	**Implement a Noise Management Plan** ▪ A Noise Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will b promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of noise in their respective areas and for respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or b the time of mobilization for Lots 3A and 4 Contractors. ▪ GIIP measures include, but not be limited to: o Install rubber linings in truck beds. o Reversing alarms without tonal component (i.e., broadband). o Enclose noise sources near workplaces and site boundaries. o Loading and unloading will be done away from noise-sensitive areas. o Locate of any stationary machinery (i.e., pumps, compressor, concrete mixing, etc) away from noise-sensitive receptors. o Minimise drop height of materials. o Start-up machinery and vehicles sequentially rather than all together. o Regular and effective maintenance for the construction machinery and any sound-reducing equipment. o Install temporary local noise barriers for noisy equipment. o Switch off equipment when it is not in use. o Carry out construction works during the daytime and avoid night-time construction traffic movements. o Install acoustic enclosures to ensure long distance conveyors do not exceed 75dB at 10m. o Install partial acoustic enclosure or noise barriers at primary crushers to reduce noise level by 10dB. o Monitor noise at site boundaries within 200m of construction activities at least monthly. Where noise exceeds 75db, implement mitigation measures t reduce noise to acceptable levels. o Monitor noise at all workplaces at least weekly. o Install noise barriers between construction activities, including truck traffic, and worker accommodation. o Provide and enforce use of hearing protection PPE for workers routinely exposed to noise.
VC2-2	**Worker Exposure Monitoring**

	- Rogun JSC to undertake worker noise exposure monitoring, initially focussing on any workers potentially at higher risk of noise exposure, to ensure t noise exposure does not exceed 87dBA Led or 140dBC Lp,peak during a working shift. Continuous monitoring should be undertaken in line with the requirements of the existing 'Occupational Health and Safety Management Plan and Hazard Effe Management Process' for LOT 2 and be applied to all EPC contractors and supervised by the appointed Project Management Consultant.

8.3 SOILS & GEOLOGY IMPACT ASSESSMENT

8.3.1. The following section outlines the Soils & Geology Impact Assessment, identifying potential impacts during construction and operation phases with additional mitigation and recommendations.

8.3.2. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 03**.

KEY MESSAGES

- The geology and soils impact assessment were undertaken based on the fact that construction at the HPP site is well underway since 1980s, and that the soils are already largely disturbed.
- A pragmatic, constructive approach has thus been adopted to provide recommendations that can be readily implemented and will have a material impact moving forward.
- Impacts from construction activities during construction can be readily mitigated. However, care should be especially taken to enforce soil contamination from fuel storage, diesel engines and vehicular traffic by the contractors'
- The Atypical Zone (ATPZ) identified on the right bank, downstream of the dam, where spillway for discharge of water into the main stem of the river would need special attention and planning for measures, including but not limited to installation of monitoring system for any seismic activities and identification of areas needed for removing any debris that may block spillway in unlikely event of massive material rolldown near discharge location the spillway.
- The residual impacts related to soil loss inside and outside the inundation areas are technically and financially feasible and are moderate, through the soil reuse and restocking.
- Significant erosion and consequent sedimentation will be experienced within the area to be permanently and temporarily (seasonal fluctuations) inundated. Incorporation of soil conservation measures through the Watershed Management Plan will serve to reduce but not eliminate sedimentation from slopes and areas that are seasonally exposed by reservoir drawdown.
- The permanent and seasonal inundation areas and infrastructure and road areas referred to are shown in Figure 8-1. The infrastructure areas refer to the dam, the construction camps, quarries and resettlement sites both within and outside of the inundation zone.
- Conventional soil conservation methods – topsoil stripping, storage, replacement, revegetation-- will be implemented at newly disturbed land at new resettlement sites.

SUMMARY OF BASELINE CONDITIONS

8.3.3. A summary of Soils & Geology baseline conditions can be found in **Volume I, Chapter 7**. Further details on the baseline conditions can be found in **Volume II, Annex 03**.

8.3.4. The geology and soils impact assessment were undertaken based on the understanding that construction is well underway at the site and that the soils at the site are already largely disturbed. A pragmatic, constructive approach has thus been adopted to provide recommendations that can be readily implemented and will have a material impact moving forward. A WSP site survey was undertaken in September 2023 to determine the condition of the land, and if any identifiable contamination of soils.

8.3.5. Once the project is fully operational and the dam is full, water elevations will fluctuate significantly with seasonal changes. The seasonally barren slopes will be especially vulnerable to erosion and soil loss.

ASSESSMENT METHODOLOGY

Area of Influence

- Project Boundary at FSL 1,290 m inundation.

Valued Components

- Loss of Soil (**VC3-1**).

Impact Factors

- Impact Factor 1 (**IF3-1**) – Soil Loss in the permanent inundation zone.
- Impact Factor 2 (**IF3-2**) – Soil Loss in the infrastructure areas outside of the inundation zone.
- Impact Factor 3 (**IF3-3**) – Erosion and sedimentation in permanent and temporary inundation zone.
- Impact Factor 4 (**IF3-4**) – Erosion and sedimentation in the infrastructure areas outside of the inundation zone.
- Impact Factor 5 (**IF3-5**) – Change in Land Capability in the permanent and temporary inundation zone.
- Impact Factor 6 (**IF3-6**) – Change in land capability in the infrastructure areas outside of the inundation zone.

ASSESSMENT OF IMPACTS

8.3.6. Impacts considered in the construction phase include:

- Loss of soil – this includes both the actual loss of soil through erosion and excavation and the loss of access to and the use of soil due to areas of complete inundation and seasonal fluctuations.
- Erosion and sedimentation – this is a result of soil stripping, vehicle movement, vegetation clearance and overland flow from roads.
- Change in land capability – this is a result of permanent removal of soil and vegetation.
- Contamination – this would be caused by fuel storage construction vehicle refuelling and onsite spills.

8.3.7. Impacts considered in the operational phase include:

- Loss of soil – Inundation as dam fills and seasonal fluctuations due to reservoir drawback.
- Erosion and sedimentation - Erosion of soil from land cleared in advance of inundation, seasonal exposure of barren slopes due to reservoir drawdown in winter-spring.
- Contamination – fuel storage maintenance vehicle refuelling and spills.

Soil Loss

8.3.8. A major impact of development on soils is the loss of soil during the construction phase or phases of development. Failure to adequately strip soil from the reservoir area not yet inundated will result in a loss of this soil downstream. Failure to adequately strip and stockpile soil from proposed infrastructure and new road areas will result in a loss of this soil through sterilization, erosion and compaction.

8.3.9. The soils identified at the site are largely devoid of macrostructure (Arenosols, Cambisols and Leptosols), making soil loss through erosion and sedimentation from the infrastructure and road areas more likely.

8.3.10. Soil loss from the areas to be permanently and seasonally inundated is inevitable, therefore resulting in effects of **Moderate significance**.

Soil Compaction

8.3.11. Another impact of development on soils is compaction. Soil compaction occurs when soil particles are pressed together, reducing pore space between them. Heavily compacted soils contain few large pores, less total pore volume and, consequently, a greater density. Beyond a certain point, the bulk density of a soil is too high to be conducive to plant growth. Compacted soil has a reduced rate of both water infiltration and drainage. Some soil compaction will be inevitable in the context of the Project, and, while soils can be ripped at a later stage, they will never regain their original form, so this cannot be fully mitigated against. Ripping will improve seed retention and help to retain rainfall, however, the majority of the soil compaction occurs the first time that heavy vehicles or machinery are placed on the soil, so this impact is most important during the construction phase of the study. More clay-rich soils (the Ferralsols on site) are more vulnerable to compaction than sandier and siltier soils are (Arenosols, Cambisols and Leptosols on site).

8.3.12. The project site is not dominated by clay-rich soil, so compaction is less of an impact than it would otherwise be. This impact is not relevant to the area that will be inundated, resulting in effects of **Minor significance**.

Soil Erosion

8.3.13. Another of the main impacts of development on soil is the loss of soil through erosion. Soil erosion causes the loss of fertile topsoil and reduction of soil productivity and has serious impacts related to increased mobilization of sediments and delivery to rivers and dams. Eroded soil material leads to sediment concentrations in streams which affects water use and ecosystem health (Flugel et al., 2003). More clay-rich soils (the Ferrasols on site) are less vulnerable to erosion than sandier and siltier soils are (the Arenosols, Cambisols and Leptosols) making the project site very vulnerable to erosion. The main factors affecting the rate of soil erosion are precipitation, soil type, topography, land-use and land management. As highlighted, the precipitation in the lowlands is low but soils are silty or sandy and the topography is exceptionally steep. However, there will be relatively little new land disturbance as the construction footprint will not expand significantly.

8.3.14. Significant erosion and consequent sedimentation will be experienced within the area to be permanently and temporarily (seasonal fluctuations) inundated. This cannot be mitigated against resulting in effects of **Moderate significance** during construction reducing to **Minor** during operation**.**

8.3.15. Within the infrastructure areas soil stripping, clearing of vegetation, movement of vehicles and mobile plant and equipment, as well as earthworks is very likely to result in increased loose material being exposed and consequent erosion. Again, as the soils identified at the site are largely devoid of macrostructure (the Arenosols, Leptosols and Cambisols), they are highly vulnerable to erosion. As the site flanks the large Vakhsh River, the potential impact of sedimentation is linked to that of erosion and not easily reversible.

8.3.16. Any landslide that occurs in the ATPZ regardless of size, is expected to partially or completely dam the river. The height and slopes of the debris dam resulting from a slide will depend on the volume, material characteristics and velocity of the slide. But removal of this material will need to be expeditiously done, to prevent sediment being transported downriver causing degradation of water quality for users, including biota. If the material is not removed mechanically, when the landslide dam overtops and breaches, a sudden flood wave would be released that could impact the safety of Nurek Dam and other projects in the hydroelectric cascade downstream. These aspects will need to be dealt with in response to the final decision made regarding the handling of ATPZ following recommendations of, and in close coordination with the DSPOE.

Change in Land Capability

8.3.17. As highlighted, the land capability of the onsite soils varies significantly. The land capability of the shallow Leptosols and the sandy Arenosols is already low and unlikely to change significantly as a result of the project. The land capability of the loamy Cambisols and especially the more clay-rich Ferralsols is very likely to change. The movement of mobile plant / equipment is likely to result in compaction, disturbance and possible sterilization of soils and associated change in land capability. The degree of alteration of the site is very high and will be irreversible for the duration of the Project life (i.e., the impact will take place in the construction phase but will remain as long as the dam exists). Some land capability may be restored outside of the inundated area if the soils are correctly stripped during construction and reused in areas such as the new resettlement areas.

Contamination

8.3.18. As discussed within **Volume II, Annex 04**, potential contamination of soils was observed on-site across the Workshops / Garages, Transformers, Asphalt and Concrete batching plants, Storage of tanks / wastes, with sources/pathways from:

- Ground gas migration through services/buildings;
- Soil erosion/overland flow to nearby surface water features;
- Leaching of soil contamination into reservoir; and
- Leaching of soils to groundwater.

Table 8-6 Soils & Geology – Summary of Impacts – Construction Phase

8.3.19. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 03**.

Impact Factor	IF3-1 – Loss of arable soils in the permanent inundation zone	IF3-2 - Soil Loss in the infrastructure areas outside of the inundation zone	IF3-3 - Erosion and sedimentation in permanent and temporary inundation zone	IF3-4 - Erosion and sedimentation in the infrastructure areas outside of the inundation zone	IF3-5 - Change in Land Capability in the permanent and temporary inundation zone	IF3-6 – Change in land capability in the infrastructure areas outside of the inundation zone
Valued Component	**VC3-1 Loss of Soil**					
Sensitivity	Medium	Medium	Medium	Low	Medium	Medium
Type	Negative	Negative	Negative	Negative	Negative	Negative
Extent	Local	Local	Regional	Local	Local	Local
Duration	Permanent	Medium-term	Permanent	Medium-term	Permanent	Medium-term
Frequency	Constant	Periodic	Constant	Constant	Constant	Constant
Likelihood	Certain	Certain	Certain	Certain	Certain	Certain
Reversibility	Irreversible	Reversible	Irreversible	Reversible	Irreversible	Reversible
Magnitude	Medium	Medium	Large	Large	Medium	Medium
Significance	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Additional Mitigation?	Yes	Yes	No	Yes	No	Yes
Residual Significance	**Minor**	**Minor**	**Moderate**	**Minor**	**Moderate**	**Minor**

Table 8-7 Soils & Geology – Summary of Impacts – Operational Phase

8.3.20. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 03**.

Impact Factor	**IF3-1** – Loss of arable soils in the seasonal inundation (drawdown) zone	**IF3-2** - Soil Loss in the infrastructure areas outside of the inundation zone	**IF3-3** - Erosion and sedimentation in permanent and temporary inundation zone	**IF3-4** - Erosion and sedimentation in the infrastructure areas outside of the inundation zone	**IF3-5** - Change in Land Capability in the permanent and temporary inundation zone	**IF3-6** – Change in land capability in the infrastructure areas outside of the inundation zone
Valued Component	**VC3-1 Loss of Soil**					
Sensitivity	Medium	Medium	High	High	Medium	Medium
Type	Negative	Negative	Negative	Negative	Negative	Negative
Extent	Local	Local	Regional	Local	Local	Local
Duration	Permanent	Medium-term	Permanent	Medium-term	Permanent	Medium-term
Frequency	Periodic	Periodic	Constant	Constant	Constant	Constant
Likelihood	Certain	Certain	Certain	Certain	Certain	Certain
Reversibility	Irreversible	Reversible	Irreversible	Reversible	Irreversible	Reversible
Magnitude	Medium	Medium	Small	Small	Small	Small
Significance	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Additional Mitigation?	No	Yes	Yes	Yes	No	Yes
Residual Significance	**Moderate**	**Minor**	**Minor**	**Minor**	**Moderate**	**Minor**

MITIGATION AND RECOMMENDATIONS

Table 8-8 – Soils & Geology - Mitigation Measures and Recommendations

Valued Component	Overview of Mitigation Measure
VC3-1	**Soil Conservation** ▪ To be implemented by Rogun JSC within 3 months from the effective date. ▪ (Most new land disturbance will take place at new resettlement sites, with only limited expansion of HPP construction areas. These measures will be applied to all areas where land is to be cleared or otherwise disturbed: ▪ All new land-clearing and ground-disturbing activities should begin with demarcation of the area to the disturbed, which should be kept to an absolute minimum. ▪ All useable soil material should be stripped and stored for future reuse. ▪ Soil should be stored in stockpiles under 3m in height). ▪ Soil that will remain more than one season must be kept moist (which may not be easy in dry seasons) and covered or vegetated with native grasses to protect against erosion, discourage weeds and to maintain active soil microbes. ▪ Stored soil will be used to cover barren ground when construction is complete. ▪ Land-clearing by the Forestry Agency should be undertaken as close in time to reservoir inundation as is feasible, but will not require stripping and storage of soils. ▪ Immediately before inundation, formerly arable land that will be flooded should be made available to nearby communities (above the inundation zone) to recover topsoil for placement elsewhere.
VC3-1	**Preventing Erosion and Sedimentation** ▪ Limit earthworks and vehicle movement to demarcated paths and areas. ▪ New access and other roads should be designed to include gradients or surface treatment to limit erosion. ▪ Forestry Agency land-clearing should minimize the use of heavy equipment and maximize hand-cutting and -clearing. ▪ Forestry Agency land-clearing activities should minimize ground disturbance and should leave root systems intact. ▪ A Watershed Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of watershed in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ An Erosion Control Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of

Valued Component	Overview of Mitigation Measure
	erosion in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ Rogun JSC will develop and require Contractors to implement an Erosion Control Plan to manage stormwater and minimize erosion on the HPP construction site. ▪ DFZ will require Contractors to develop procedures to manage stormwater and control erosion on construction sites where topography and other conditions could lead to significant runoff and erosion.
VC3-1	**Preventing sedimentation downstream due to ATPZ** – in close coordination with DSPOE recommendations (Subject to final design solution). ▪ Identify locations for disposal of excess material from shaping of slope (and as a consequence surface drainage) in ATPZ; or Undertake assessment of areas through which realigned discharged tunnels will pass, if the area is not covered in the current Area of Influence. ▪ Seismic monitoring equipment should be installed as part of the dam operation plan. ▪ Areas for disposal of excessive soil should be identified for removal of blockage of spillway discharge.
VC3-1	**Implement a Contaminated Land Management Plan** ▪ A Contaminated Land Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of contaminated land in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ The plan will mitigate several risks currently identified on the Rogun HPP project. Where the risks cannot be mitigated through immediate action, the application of an updated Contaminated Land Management Plan will address residual risks through future quantitative risk assessment, remedial design and implementation. ▪ Immediate action for contaminated soils includes, but not limited to: ○ Types of materials approved to be deposited at each 'Dump Site' location shall be clearly stated and enforced. Regular inspections of the areas shall be undertaken, with facility to remove any out of specification materials. ○ Any abandoned or disused tank farms, shall be assessed for compliance against a common current standard, where installations do not and or cannot meet the required standard the tank farm and all its infrastructure shall be decommissioned and removed under a watching brief by a suitably experienced / qualified person, where soils and materials display visual and or olfactory evidence of

Valued Component	Overview of Mitigation Measure
	contamination these shall be removed and stockpiled, in a suitable laydown area, prior to treatment and or disposal; and where visual & olfactory evidence of gross contamination extends beyond a safe excavation depth and or where temporary works would need to be deployed, alternative intrusive investigation methods shall be sought. ○ Any operational tank farms on site shall implement and undertake annual integrity testing (also known as tightness testing) on both tanks and pipework), as a minimum. In the event of a failure the tank and or pipe run is to be taken out of commission. Due to the age of the plant and equipment, WSP do not recommend the equipment is repaired. In addition to undertaking weekly inventory reconciliation analysis, both retrospectively and continue to undertake the analysis until the facility is decommissioned. The records and analysis shall be reported regularly with any anomalies shall be flagged immediately to the Rogun HPP Environmental Management team. ○ Undertake a sitewide asbestos survey prior to WB Board approval, to identify structures where asbestos is and is potentially present. The survey findings will support the production of an Asbestos Register.
VC3-1	**Implement an Asbestos Management Plan** ▪ Undertake a sitewide asbestos survey prior to WB Board approval, to identify structures where asbestos is and is potentially present. The survey findings will support the production of an Asbestos Register. The Asbestos Register shall inform the development of an Asbestos Management Plan (AMP), which will state how AMP on the Rogun HPP project will be managed. The ACM must apply to all resettlement activities. ▪ An Asbestos Management Plan (AMP) will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of asbestos in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ AMP is to be developed in line with WB ESS, IFC EHS Guidelines and ADB Good Practice Guidance for the management and control of asbestos.

8.4 WATER / MINIMUM ENVIRONMENTAL FLOWS IMPACT ASSESSMENT

8.4.1. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 05** and **Annex 06**.

KEY MESSAGES

- The significant impact the Rogun Dam impoundment will have on the fluvial environment needs to be seen in the context of the Vakhsh River being a heavily modified water body (HMWB) on which the Rogun Dam is adding to a cascade of existing hydropower dams.
- Opportunities to improve the ecological and water quality status of other reaches of the Vakhsh water body will need to be identified to mitigate the impact on the fluvial environment and the loss of extensive areas of natural braided river channel.
- Discharges from the Rogun Dam (during both filling and full operation) will need to be carefully managed to maintain minimum environmental flows and adequate water supply to downstream users during dry years.
- The Rogun dam has been designed to store and convey the Probable Maximum Flood (PMF), improving the safety of the Nurek dam which is not able to convey the PMF.

SUMMARY OF BASELINE CONDITIONS

8.4.2. The baseline conditions were primarily established through a desk study of the previous Rogun Hydropower Project ESIA (Pöyry, 2014) and the Techno-Economic Assessment Study ('TEAS') technical reports (Coyne et Bellier, 2014). This existing information was updated with hydrometric and water quality data provided by the World Bank and the National Agency for Hydrometeorology of the Republic of Tajikistan.

8.4.3. Additional water quality sampling was undertaken by WSP on the river Vakhsh and its tributaries (at the dam construction site and upstream within the inundation zone) to corroborate the available water quality data.

8.4.4. A summary of baseline conditions, cover hydrogeology; geology; surface water quantity and quality; flood risk; geomorphology and sediment within **Volume I, Chapter 7** -with full supporting detail in **Volume II, Annex 04**.

SCOPE OF THE ASSESSMENT

8.4.5. The scope of the Assessment includes an assessment of the baseline conditions for the water environment in the environs of the Project and a qualitative assessment of the potential impact and recommended mitigation measures, where required. The scope of the assessment included the following:

- Water quantity for both water use and environmental flows.
- Flood risk to the local population and infrastructure.
- Water quality.
- Sediment transport.
- Geomorphology of the river channel.

- Groundwater - influenced by the impoundment of water in the valley.

Valued Components

Water

- River channels within the Phase 2 Rogan Dam reservoir inundation zone (during construction and reservoir filling) (**VC4-1**).
- Reach of the Vakhsh River located upstream of the dam and within the construction area (**VC4-2**).
- Reach of the Vakhsh River located downstream of the Rogun dam and upstream of the Nurek Reservoir (**VC4-3**).
- The Nurek reservoir (**VC4-4**).
- The river channel downstream of the Nurek Reservoir to its outfall in the Aral Sea, via the Amu Darya river(**VC4-5**).
- Groundwater regime upstream of the Rogun dam (**VC4-6**).

Minimum Environmental Flows

- Floodplain habitats (**VC5-1**).
- Flora (**VC5-2**).
- Fauna (**VC5-3**).
- Aquatic Ecology (**VC5-4**).
- Human Livelihoods (**VC5-5**).

Impact Factors

Water

- Impact Factor 1 (**IF4-1**) – Changes in Flow / Circulation in Natural Water Bodies.
- Impact Factor 2 (**IF4-2**) – Development of infrastructure.
- Impact Factor 3 (**IF4-3**) – Ground Disturbance and Removal of Natural Vegetation.
- Impact Factor 4 (**IF4-4**) – Changes in land use.
- Impact Factor 5 (**IF4-5**) – Contamination.

Minimum Environmental Flows

- Impact Factor 1 (**IF5-1**) - Changes in flow/circulation in natural water bodies due to seasonality.
- Impact Factor 2 (**IF5-2**) – Diversion of watercourses.
- Impact Factor 3 (**IF5-3**) – Dewatering of watercourses.
- Impact Factor 4 (**IF5-4**) – Modification of the characteristics of the channels.
- Impact Factor 5 (**IF5-5**) – Habitat loss and degradation.

ASSESSMENT OF IMPACTS

8.4.6. The impacts of the construction and operation of the Rogun dam on the existing fluvial regime and water resources have been assessed. The value components considered in the impact assessment include the affected river channels, the Nurek dam reservoir and the river channel downstream of the Nurek Reservoir to its eventual outfall into the Aral Sea, via the Amu Darya river. The impacts have been compared to both the existing baseline, in which the construction of the Rogun dam is underway and the HPP is operational, and a future fully operational baseline in which the reservoir has been filled to a level of 1,290 masl.

8.4.1. One of the most significant impacts the construction and operation of the Rogan Dam will have on the physical environment is the damming of the Vakhsh River to form a reservoir with a total surface area of 170 km^2, an overall length of approximately 70 km, and an impounded volume of 13.3 km^3. will result in an extensive and permanent modification to the existing fluvial environment. However, this HPP will form one of a cascade and therefore the significance must be seen in context with the rest of the water body which is highly modified. The loss of extensive existing braided river channels needs to be considered in light of the extensive presence of this morphology in the Vakhsh river basin. To mitigate this impact, it will be necessary to identify opportunities to improve the ecological and water quality status of other parts of the Vakhsh water body. This could be on river reaches upstream of the Rogun reservoir impoundment, or on the downstream river channel and hydropower cascade.

8.4.2. Studies to identify the required minimum environmental flows for the operation of reservoir have been undertaken. At present a steady flow of 10m^3/s flows through the dam to maintain the 17 km of the Vakhsh river downstream to Nurek reservoir. The minimum flow studies suggest a more natural approach to maintaining river flows downstream.

8.4.3. **Table 8-9** provides the minimum flows by month that should be provided downstream through the Rogun Dam to maintain a more naturalised hydrological regime important for maintaining Good Ecological Potential. These have been identified for drought years as well as average years. The estimate using the Tennant Method has been provided for comparative purposes only.

Table 8-9 – Water – Minimum flows to be provided downstream.

m^3/s	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Tennant (10%)	34	26	21	18	18	23	48	85	126	160	137	72
Minimum flow in Drought Years	102	76	64	55	53	51	68	90	122	152	156	136
Minimum flow in Average Years.	141	107	89	78	75	73	95	125	168	207	213	187

8.4.4. During the filling of the Rogan Dam reservoir Tajikistan will only use their average annual unused water allocation under Protocol 566 to fill the Rogun reservoir. During dry years this approach may result in constrained water supplies to downstream users. It is therefore necessary to manage the filling of the Rogun Dam so as not to adversely affect downstream water users during dry years using existing water resource management systems and processes. Implementing an online monitoring system for the Vakhsh Cascade which would be made available in real time to interested parties. The Rogun dam has been designed to store and convey the Probable Maximum Flood (PMF), improving the safety of the Nurek dam which is not able to convey the PMF.

8.4.5. Filling of the Rogan Dam reservoir will raise ground water levels over an extensive area, which will also vary in the vicinity of the reservoir with the annual variations in the reservoir water level. Ground water modelling and monitoring will be necessary to establish the positive and negative impacts of raised and variable ground water levels. Where there are negative impacts on the local population compensation will need to be provided.

8.4.6. During construction of the dam borrow pits downstream of the dam will contribute to the temporary sediment load reaching the Nurek Reservoir and the river channel downstream of the Rogun Dam. This will have a negligible impact on the sediment load in the Nurek reservoir given that the Rogan Dam will block sediment from the upstream catchment reaching the Nurek reservoir. Nevertheless, good practise measures are to be implemented for the borrow areas downstream of the dam through a Borrow Pit Management Plan compliant with IFC EHS guidelines.

8.4.7. The Rogun dam reservoir will flood sites of contaminated land within the construction area and across the impoundment area where there are current population centres. The resulting contaminates could enter the water column and pollute the resulting reservoir. Although the magnitude of the contamination in the impoundment area may be high the vast dilution potential of the Rogun reservoir will reduce the significance of the resulting pollution. Good management practices are to be established for possible contaminants during the construction phase, along with a programme of identifying and remediating areas of significant contamination within the impoundment area. Further details on the mitigation of contaminated land is covered under **Volume II, Annex 04**.

SUMMARY OF IMPACTS - WATER

Table 8-10 – Water - Summary of Impacts

Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 05.**

Impact Factors	Construction Phase													Operational Phase	
	IF4-1 - Changes in Flow / Circulation in Natural Water Bodies						IF4-2	IF4-4	IF4-5 - Contamination					IF4-1	
VC	**VC4-1**	**VC4-2**	**VC4-3**	**VC4-4**	**VC4-5**	**VC4-6**	**VC4-3**	**VC4-1**	**VC4-1**	**VC4-2**	**VC4-3**	**VC4-4**	**VC4-5**	**VC4-3**	**VC4-6**
Sensitivity	Medium	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low	Medium	Medium	Medium	Low	Low
Type	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Extent	Local	Local	Local	Local	Regional	Local	Local	Local	Local	Local	Local	Local	Regional	Local	Local
Duration	Long-Term	Short-Term	Long-Term	Short-Term	Short-Term	Long-Term	Short-Term	Long-Term	Medium-term	Medium-term	Medium-term	Medium-term	Medium-term	Long-term	Short-term
Frequency	Constant	Constant	Periodic	Periodic	Periodic	Constant	Continuous	Constant	Continuous	Continuous	Continuous	Continuous	Continuous	Periodic	Constant
Likelihood	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain
Reversibility	Irreversible	Irreversible	Reversable	Reversable	Reversable	Irreversible	Reversible	Irreversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Magnitude	Large	Large	Large	Large	Large	Medium	Medium	Medium	Medium	Large	Medium	Medium	Small	Large	Medium

Impact Factors	Construction Phase													Operational Phase	
	IF4-1 - Changes in Flow / Circulation in Natural Water Bodies						IF4-2	IF4-4	IF4-5 - Contamination					IF4-1	
Significance	Moderate	Moderate	Moderate	Major	Major	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Additional Mitigation?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Residual Significance	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**

SUMMARY OF IMPACTS – MINIMUM ENVIRONMENTAL FLOWS

Table 8-11 - Minimum Environmental Flows - Summary of Impacts

8.4.8. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 06**

IF	IF5-1		IF5-2		IF5-3		IF5-4		IF5-5		IF5-4	
VC	**VC5-1**	**VC5-4**	**VC5-1**	**VC5-4**	**VC5-1**	**VC5-4**	**VC5-1**	**VC5-4**	**VC5-1**	**VC5-4**	**VC5-1**	**VC5-4**
Sensitivity	High	Low	Medium	Medium	High	Medium	Medium	Medium	Medium	Low	Medium	Low
Type	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Extent	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local
Duration	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Permanent	Permanent	Short-term	Short-term
Frequency	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant
Likelihood	Likely	Likely	Unlikely	Likely	Likely	Likely	Likely	Likely	Certain	Certain	Likely	Likely
Reversibility	Irreversible	Irreversible	Irreversible	Reversible	Irreversible	Reversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Magnitude	Large	Medium	Small	Small	Medium	Medium	Large	Medium	Large	Large	Medium	Medium
Significance	Major	Moderate	Moderate	Moderate	Moderate	Moderate	Major	Moderate	Major	Moderate	Moderate	Moderate
Additional Mitigation?	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Residual Significance	**Major**	**Negligible**	**Negligible**	**Negligible**	**Major**	**Moderate**	**Major**	**Moderate**	**Moderate**	**Moderate**	**Minor**	**Minor**

MITIGATION AND RECOMMENDATIONS

Table 8-12 - Water & Minimum Environmental Flows - Mitigation & Recommendations

Valued Component	Mitigation Measure
VC5-1 VC5-2 VC5-3 VC5-4 VC5-5 VC6-1 VC6-4	**Pollution of reservoir from contamination within impoundment area** ▪ To be implemented by Rogun JSC, with inspections to be undertaken prior to WB Board approval, with approved cleanup plans up to 30 days after WB Board approval. ▪ Establish good management practices of possible contaminants during construction. Contaminants can become concentrated during low flow scenarios impacting on functionality. Sources of pollution and contamination during construction must be identified upfront and measures established to prevent any pollution into the river systems. Contaminants can become concentrated during low flow scenarios impacting on functionality. As detailed in **Volume I, Annex 04**, contamination mitigation measures for water treatment and runoff on site follows: ▪ Contractors shall direct runoff waters from drains and gullies from workshop areas through an interceptor prior to discharge into the river or to ground, allowing for the separation of free phase Light Non-Aqueous Phase Liquids (LNAPL) from water (significantly reducing the contaminant mass being lost to ground or surface water). ▪ Where workshops do not have a current drainage or gully system, the contractor shall ensure all runoff is contained, with all runoffs either being disposed/treated offsite, or onsite via interceptor (as a minimum). ▪ Additional treatment prior to discharge maybe necessary depending on the workshop activities and nature of any chemicals utilised. ▪ At 'general use' washout areas OJSC Rogun HPP shall establish an area where wash waters are contained and as a minimum undergo basic settlement prior to discharging to the river or reservoir. ▪ Advanced wash water treatment is likely not necessary due to the large dilution, however, if possible WSP would recommend a further assessment is undertaken to confirm. ▪ Where contractors 'wash out' within their own compounds or facilities, each contractor shall contain and treat any wash waters prior to discharge. As with the general 'wash out' area as a minimum any wash waters shall undergo basic settlement prior to discharge.
VC5-1 VC5-4	**Implement a Biodiversity Management Plan** ▪ Rogun JSC will oversee the implementation of a Biodiversity Management Plan to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of biodiversity in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. Ensure implementation of Good Practise measures through a Biodiversity Management Plan compliant with IFC EHS guidelines. ▪ The Biodiversity Management Plan will include, but not limited to:

Valued Component	Mitigation Measure
	• Flow management to maintain a minimum flow into the river system downstream to maintain baseline flows and conditions for ecosystems. • Offsetting practices to establish and promote impacted receptors to prevent irreversible processes impacting on relevant aquatic habitats due to long-term changes to the floodplain.
VC5-1 VC5-4	**Implement a Fisheries Management Plan** ▪ A Fisheries Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of fisheries in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ A Fisheries Management Plan provides direction for the management of fisheries resources, with the goal to protect species and genetic diversity as well as to optimize social, cultural and economic opportunities and values derived through the sustainable use of aquatic resources for both present and future generations. ▪ A plan encompasses the management of fish stocks, introduction of species and aquaculture as required. ▪ Ensure implementation of Good Practise measures through a Fisheries Management Plan compliant with IFC EHS guidelines.
VC5-1 VC5-4	**Implement a Watershed Management Plan** ▪ A Watershed Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of watershed in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ The Watershed Management Plan will include, but not limited to: ○ The management water discharges from the Rogun dam such that a minimum environmental flow is always provided. ○ Designs to cater for flooding cases and Probable Maximum Flood (PMF) conditions. ○ The reservoir filling procedure to maintain a minimum flow into the river system downstream so as not to maintain baseline flows and conditions. ○ Ensure implementation of Good Practise measures through a Watershed Management Plan compliant with IFC EHS guidelines.
VC5-1 VC5-4	**Implement a Sedimentation Management Plan** ▪ A Sedimentation Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of watershed in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months

Valued Component	Mitigation Measure
	of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors and the implementation of Good Practise measures through a Sedimentation Management Plan compliant with IFC EHS guidelines.
VC5-1 VC5-4	**Ongoing monitoring, surveys and measurement** ▪ Rogun JSC to implement from completion of Watershed Management Plan, with monitoring commencing after 30 days. ▪ This is to include all construction specific and operational monitoring, surveys and measurements to be conducted to: ▪ Provide adequate data for verification of environmental flows. ▪ Allow for adjustments to be made based on measured data. ▪ Update of management plans and procedures based on changing conditions as identified from measured and monitored data.
VC5-1 VC5-2 VC5-3 VC5-4 VC5-5	**Opportunities to improve the ecological and water quality status of the Vakhsh water body** ▪ Rogun JSC to implement from completion of Watershed Management Plan, with monitoring commencing after 30 days. ▪ Identify opportunities to improve the ecological and water quality status of other parts of the Vakhsh water body. This could be on river reaches upstream of the Rogun reservoir impoundment, or on the downstream river channel and hydropower cascade.
	Online Monitoring System for the Vakhsh Cascade ▪ Implement an online monitoring system for the Vakhsh Cascade which would be made available in real time to interested parties. ▪ Rogun JSC to implement from completion of Watershed Management Plan, with monitoring commencing after 30 days
	Groundwater Monitoring ▪ Undertake ground water modelling and monitoring to establish the positive and negative impacts of raised ground water levels. Include modelling to establish the effect an annual 30 m variation in the reservoir level will have on ground water levels. Provide compensation where there are negative impacts to the local population. ▪ Rogun JSC to implement from completion of Watershed Management Plan, with monitoring commencing after 30 days.
	Implement a Borrow Pit Management Plan ▪ A Borrow Pit Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of borrow pits in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ Ensure implementation of Good Practise measures in the borrow areas downstream of the Dam through a Borrow Pit Management Plan compliant with IFC EHS guidelines.

Valued Component	Mitigation Measure
	Survey the banks of the reservoir to establish instability risks ▪ Survey the banks of the reservoir to establish slopes at risk of instability due to varying water levels. Undertake intervention works to stabilise the slopes where possible. Further details on slope stability mitigation are covered under **Volume II, Annex 14** – Reservoir Slope Stability and **Volume I, Chapter 9.** ▪ To be undertaken by Rogun JSC with inspection prior to WB Board approval.

8.5 TRAFFIC & TRANSPORT IMPACT ASSESSMENT

8.5.1. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 07**.

KEY MESSAGES

- A single secure gate controls access to the site, so most construction traffic movements associated with the Project occur within the site area and therefore will not impact on the wider local road network. Less than 100 heavy vehicles are expected to pass through the gate on a daily basis, and they do not have to pass through Rogun town to reach or leave the site. Site traffic is much heavier, on the other hand, with hundreds of heavy and passenger vehicles transiting various areas.
- There are 80km of underground roads and 26km of surface roads on the site, with traffic managed by the contractor in control of the specific locations. A Project-wide security department is nominally responsible for enforcing traffic rules. A new Traffic Management Plan was recently approved for application by Lot 2 contractors'
- Two new roads will be constructed to replace roads that will be inundated. The International Highway and a bridge over the reservoir are receiving international financing and have been assessed in ESIAs prepared to the Lenders' standards.
- Once construction is complete in 2029, there will be only 6-7km of underground roads and a similar length of surface roads. There will be limited traffic flows for maintenance activities, and the impact of operational traffic will be negligible on the road network.

SUMMARY OF BASELINE CONDITIONS

8.5.2. A summary of Traffic & Transport baseline conditions can be found in **Volume I, Chapter 7**. Further details on the baseline conditions can be found in **Volume II, Annex 07**.

Area of Influence

Construction

- Road transport routes used by HPP and resettlement site construction traffic and 100m either side to reflect the presence of other road users, the general movement of pedestrians and the potential presence of social sensitivities such as hospitals, households, schools or places of worship.

Operation

- Road transport routes used by HPP operational traffic and 100m either side, as above.

ASSESSMENT METHODOLOGY

Valued Components

- Off-Site Road Network (**VC7-1**)
- On-Site Road Network (**VC7-2**)

Impact Factors

- Impact Factor 1 (**IF7-1**) – Impact of Construction Traffic

- Impact Factor 2 (**IF7-2**): Impact of Operational Traffic

ASSESSMENT OF IMPACTS

Construction Phase

8.5.3. It is likely that the Project will have a temporary, medium-term adverse impact of **Moderate significance** on the off-site road network. Permanent impacts will occur where roads need to close however it is noted that new access roads will be available for local communities.

8.5.4. Most HPP construction traffic movements occur within the Site area and therefore will not impact on the wider local road network (VC5-1). Construction workers are accommodated on site, in Rogun City, or in the local area. Busses carry workers to the gate, and those who do not live in Rogun town (approximately 300 in total) are bussed to their homes within 30km. Most workers live over 30km from the Project, and they travel to and from the site every 15 days in private cars or hire vans and busses.

8.5.5. The most significant number of heavy vehicles passing through the gate each day are 30-35 trucks that bring cement from Dushanbe (about 1000 tonnes per day) and return. Transporting turbines or other oversize loads (some large machinery and equipment) will require special vehicles and escort vehicles, but these will be one-time events that occur only infrequently.

Road Works

8.5.6. As noted, the number of heavy vehicles that pass through the gate on public roads is relatively low. As a result, the impact on local road condition is considered to be of **Minor significance**.

Accidents and Safety

8.5.7. Between October 2021 and September 2022, a total of 21 traffic accidents were reported with 6 injuries on the construction site. This increased to 55 traffic accidents with 9 people were injured between the same period in 2022 to 2023. A comprehensive Traffic Management Plan was introduced to segregate workers, ensure safe driving routes reduce incidents.

8.5.8. Again, due to the relatively low number of Project vehicles on public roads, and the implementation of the Traffic Management Plan on-site potential adverse impacts are expected to be of **Minor significance**.

Driver Delay

8.5.9. IEMA guidance states that driver delay is only likely to be significant where roads are already at, or reaching, capacity. The volume of traffic on the roads that serve the Project area are nowhere near capacity and Project traffic will add only minor traffic to that. Therefore, adverse impacts are likely to be of **Minor or Negligible significance**.

Non-motorised User Amenity

8.5.10. The impact on pedestrian amenity is likely to be most significant immediately outside the gate and the routes that workers take when they drive or walk to their residences. Although there is relatively little Project traffic in the town, there is some, and especially at day and night and when the 15-day shift changes. Adverse impacts could rise to **Moderate significance** but would normally be **Minor significance**.

Severance

8.5.11. In general, public roads will not experience severance except for the rare and occasional times that oversize loads are coming from Dushanbe, Nurek, or elsewhere. At these times, impacts relating to severance could be of Moderate significance, but for very short periods of time. Given the very light Project traffic on public roads, however, the overall significance should be **Minor** at nearly all other times. Impacts of **Moderate** significance will occur as a result of the Project given that there is an existing WeBuild Transport Management Plan (TMP).

Non-motorised User Delay

8.5.12. There is a very small area in which pedestrians and any other non-motorized users are affected by Project Traffic- from the Project gate into the small city of Rogun - and the limited amount of time there would be delay—during shift changes—delay would be negligible, amounting to a delay in crossing a street until traffic had passed. Since Rogun is well-populated with traffic lights, this becomes even less of an issue. This adverse impact is likely to be of **Negligible significance** from HPP traffic. It could be of minor significance in resettlement villages, but even then, construction will occupy very small areas and there are plentiful other pathways for non-motorized road users.

Operation Phase

8.5.13. Once fully operational, the Project will have reduced vehicular movement requirements, amounting to perhaps a few dozen per day on the site and even fewer outside.

8.5.14. The Project will have a beneficial impact through improved road networks—roads to resettlement villages will be relatively new, and the replacement roads (Associated Facilities) will also be in much better condition that the roads they will replace. This should lead to reduced accidents and driver delay.

8.5.15. For the villages on the left bank of Vakhsh, which in the past were largely only accessible via small, suspended bridges crossing the river, access will be greatly improved with new roads.

8.5.16. Overall, it is envisaged that impacts during operation will be of **Minor benefit.**

SUMMARY OF IMPACTS

Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 07.**

Table 8-13 – Traffic & Transport - Summary of Impacts

Impact Factor	IF7-1 - Impact of Construction Traffic		IF7-2 - Impact of Operational Traffic	
Valued Component	VC7-1	VC7-2	VC7-1	VC7-2
Sensitivity	Low to High	Low to Medium	Low to High	Low to Medium
Type	Negative	Negative	Negative	Negative
Extent	Local	Local	Local	Local
Duration	Medium-term	Medium-term	Long term	Long term
Frequency	Constant	Constant	Infrequent	Infrequent
Likelihood	Certain	Certain	Certain	Certain
Reversibility	Reversible	Reversible	Reversible	Reversible
Magnitude	Small / Beneficial	Small	Very Small / Beneficial	Very Small / Beneficial
Significance	Minor / Positive	Moderate	Negligible / Positive	Negligible
Additional Mitigation?	Yes	Yes	No	No
Residual Significance	Minor	Minor	Negligible	Negligible

MITIGATION AND RECOMMENDATIONS

Table 8-14 – Traffic & Transport - Mitigation Measures & Recommendations

Valued Component	Overview of Mitigation Measure
VC7-1 VC7-2	**Implementation of a Traffic Management Plan (TMP)** ▪ A Traffic Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of traffic in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ The plans/procedures will include such requirements as: ○ Route and traffic planning for turbines, transformers, and other oversize loads, to include escorts, signals, and other measures to minimize the effects on other traffic. Details of the proposed Project materials delivery routes. ○ Strict speed limits and speed control measures, including speed humps at the small settlement near Construction Camp 2. ○ Enforcement of one-way traffic ○ Workers transported only in vehicles with seat belts for all occupants that are of the 3-point configuration. ○ Drivers will receive special briefing from the PMC on rules of the road. ○ All vehicles used by the Project will be fit for purpose based on an assessment of usage and be maintained in safe working order in line with manufacturers' specifications, UN vehicle safety regulations and all applicable national legal requirements. This includes the repair of all minor defects that have an implication to safety, such as the presence of cracked glass windscreens, unlit bulbs, etc. All vehicles will also have a reverse alarm system installed that activates automatically. Regular checks will be made to all vehicles to ensure safety. ○ Drivers will be qualified for the class of vehicle they are authorized to operate, with licenses and driving records checked at least annually. Before any vehicle or equipment is put into operation at the beginning of a shift, the driver will complete a safety checklist (a checklist has been prepared by the ER, it will be reviewed and if necessary updated by JSC Rogun and/or PMC0. At a minimum, the driver will check tires, window glass, lights (including reverse lights and brake lights), reverse alarms (for trucks and heavy equipment), seat belts, horn, speedometer and other gauges, fire extinguisher, spill cleanup kit, etc. If any item is not in proper condition, the vehicle/equipment may not be moved and put in use until the item has been corrected or a supervisor has authorized (in writing) operation for a specified period of time before it has to be corrected, not to exceed two days. Drivers will not be penalized for trips not completed because of safety issues but may be penalized (including termination) for repeatedly operating a vehicle that does not pass the safety check. ○ Drivers/operators may not transport workers unless there are seated and using seat belts. Both drivers and workers may be penalized, including termination, for violating this requirement.

Valued Component	Overview of Mitigation Measure
	○ The TMP will include requirements for the security department and the HSE departments (contractors and PMC) will enforce traffic requirements on the site, and will be given authority to take action as authorized in the TMP—this will include warnings, suspension of driver authorizations, notices of noncompliance to employers, recommendations for terminate workers or drivers, etc.
VC7-1 **VC7-2**	**Road Safety Campaign** ▪ To be implemented by Rogun JSC, within 60 days of WB Board approval. ▪ In addition to the TMP, considered good practise mitigation, a road safety campaign should be implemented in local schools. The purpose of the road safety campaign is to raise general awareness of the risks associated with road crossings, discuss the Project's Road movements, and describe the extra caution that children need to take in relation to both road traffic, and also with the construction works that will be taking place across the regional area. ▪ During implementation of the road safety campaign, specific attention shall be given to vulnerable people, including any illiterate girls and women, so that they also are informed about the potential risks and impacts arising from road transportation. This may include, for example, women and children attending meetings in public spaces/buildings in villages, as well additional sessions in local schools. It is acknowledged that it will not be sufficient to just undertake activities in local schools as that may not reach all children resident in the villages as some may not attend school. Consequently, additional meetings will be held in the villages to target women and children that do not regularly attend school. ▪ Upgrade work may be undertaken on public roads by Project contractors' Permissions required may include local and national authority road permits and temporary traffic orders. ▪ For all upgrade / improvement works to the proposed transport route, the Occupational Health, and Safety Plan and TMP will be adhered to. A safety training programme will be in place to manage worker safety during works.
VC9-1 **VC9-2**	**Vehicle Identification** ▪ To be implemented by Rogun JSC, within 60 days of WB Board approval. ▪ All construction and operational vehicles should have unique identification number and contractor name at the front and rear of the vehicle. This will include a short unique identification number with the contractor's name. This applies to all EPC contractor and should be routinely monitored by the Project Management Consultant. ▪ The unique identification number and contractor name should be visible in all weather conditions. The number should be visible from at least 25 meters with the naked eye, and not exceed 5 characters in length. Reasonable measures should be implemented to ensure the number always remains visible, e.g., regular cleaning of the vehicle.

8.6 WASTE IMPACT ASSESSMENT

8.6.1. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 08**.

KEY MESSAGES

- At present, the Project is generating domestic, hazardous, construction and medical waste, in addition to industrial wastewater and sewage. There is limited municpal waste capacity for the Project, with majority of waste streams disposed in landfill sites locally and in Dushanbe.
- The current handling and disposal of refuse in some resettled communities may not be adequate, and improvements are required.
- While there are relevant waste management plans by contractors of varying requirements, a site-wide Waste Management Plan should be complied and implemented to align with IFC EHS guidelines.

SUMMARY OF BASELINE CONDITIONS

8.6.2. A summary of Waste baseline conditions can be found in **Volume I, Chapter 7**. Further details on the baseline conditions can be found in **Volume II, Annex 08**.

8.6.3. The current waste management system in Tajikistan relies heavily on landfilling and it faces several challenges such as lack of landfill space and limited recycling and composting measures. A site visit was undertaken in August and September 2023 to understand the current waste management practices on-site. Waste streams generated by contractors include domestic/general waste (food, plastics, metal etc), hazardous wastes (chemicals, used oil, batteries, etc) and medical waste.

- Domestic waste is disposed at Rogun municipal landfill by Rogun municipal services or at landfill in Vahdat by waste contractor PE Asoev.
- Hazardous waste is disposed at a waste site in Dushanbe as per agreement with contractor Yokubjon 2016 LLC or by Rogun municpal services at Rogun municipal landfill site although it was also noted that areas of oily waste and some dumping of potentially hazardous materials on site is occurring.
- Medical waste is incinerated at the Rogun Hospital incinerator which is constructed to international standards.
- Industrial wastewater or sewage goes to the WWTP plant into sedimentation ponds with oil-water separators and disposed into the surrounding environment. However, during site visits it has been noted that discharges of industrial wastewater is occurring overland without treatment.

Area of Influence

- 50 m around Project construction sites where waste is generated, stored or treated.
- 50m around municipal waste facilities used for disposal or treatment of construction waste.
- 50m around waste collection and storage facilities in resettled communities.

SCOPE OF THE ASSESSMENT

8.6.4. A site visit was undertaken in August and September 2023 to understand the current waste management practices on-site and the assessment focuses on impacts to waste management facilities and their ability to manage waste generation.

ASSESSMENT METHODOLOGY

Valued Components

- Waste disposal facilities for Project waste (including Rogun landfill, Vahdat landfill, Dushanbe waste disposal site) (**VC8-1**).
- Recycling facilities for Project waste (**VC8-2**).
- Waste sites for waste from resettled communities (**VC8-3**).

Impact Factors

- Impact Factor 1 (**IF8-1**) – Construction Waste Generation.
- Impact Factor 2 (**IF8-2**) – Operations Waste Generation.
- Impact Factor 3 (**IF8-3**) - Resettlement village waste.

ASSESSMENT OF IMPACTS

8.6.5. Waste generation during all phases of the Project has the potential to result in impacts to waste management receptors. Potential impacts may arise if hazardous waste is not properly stored on site prior to collection, during transport (if not properly contained), and at the ultimate disposal sites if these are not designed and operated to adequate standards. Inert wastes have the potential to cause local nuisance due to dust and litter from the handling of the materials themselves.

Refuse and Other Non-Hazardous Solid Wastes

8.6.6. Handling or disposal of general construction waste and refuse can give rise to a number of potential impacts including:

- Lighter fractions such as paper being blown by the wind potentially causing a litter nuisance over a wide area;
- Food waste attracting vermin and other disease carriers, or fauna, which can affect predator-prey relationships or cause other changes to ecosystems;
- Food waste creating nuisance due to odour as it degrades;
- Gaseous emissions, either direct or from burning of combustible items, can be potentially toxic and/or create nuisance due to odours; and
- Pollution of water courses/drinking water supplies – either direct from waste materials or from degradation products.

Hazardous Waste

8.6.7. Hazardous wastes present a range of potential environmental impacts which are often specific to the type of waste. The consequences are typically more serious, immediate and/or difficult to remedy than the impacts caused by non-hazardous wastes. Many hazardous wastes are potentially toxic to humans and animals and have the potential for causing serious pollution of land and water if not properly managed.

8.6.8. Some of the specific issues associated with the more common types of hazardous waste are as follows:

- Oily waste (lubricating, and hydraulic oils, oil-contaminated rags and PPE and oil/water mixtures), transformer oils containing PCBs, solvent wastes (including paints), other organic wastes and wastes containing heavy metals (e.g., fluorescent tubes – contain mercury, batteries), if not properly contained, can potentially cause pollution of groundwater and surface water courses potentially resulting in death of wildlife and rendering the water unsuitable for human consumption.

- Acids (e.g., from vehicle batteries) and alkalis (from some cleaning products and process chemicals) are highly corrosive in concentrated form and can potentially affect the pH of the receiving waters impacting biological processes potentially causing death of fish and plants.
- Chemicals such as herbicides can be toxic or have the potential for longer term impacts (carcinogenic or mutagenic) and can potentially impact flora and fauna beyond the target species contaminate surface water and groundwater water resources.
- Medical waste, from first aid facilities /clinics provided for the workforce, can contain a variety of potentially hazardous materials (Haz-mats) including syringes, soiled bandages (from treatment of minor injuries etc.) and possibly expired drugs. These wastes must be carefully managed to avoid transmission of infectious diseases, physical injury and release of potentially toxic substances.
- Existing structures have the potential to contain Asbestos Containing Materials (ACMs) which can be harmful to health, with the potential to cause cancers and other diseases, including mesothelioma and asbestosis when in a friable condition. These wastes must be carefully managed and disposed of safely.

Sewage and Industrial Effluents

8.6.9. Domestic sewage contains a variety of pathogens as well as having a high loading of organic pollutants, nutrients (nitrogen and phosphorous) and suspended solids. Discharge of untreated sewage can have a potential impact on receiving water bodies and the local environment – potentially causing serious health impacts to the local population and contamination of water supplies.

8.6.10. These potential impacts include:

- depletion of dissolved oxygen due to degradation of organic matter and/or suspended solids.
- aesthetic problems due to it unsightly appearance as well as odour.
- turbidity as a result of presence of suspended solids.
- eutrophication, an increase in nutrients which results in the proliferation of one species at the expense of another species, thereby causing an imbalance in the ecosystem. Algal blooms are typical examples of such impacts; and
- public health impacts – such as:
  - faecal contamination of drinking water supply (groundwater or surface water); and
  - disease transmission by insects, rodents or other possible disease carriers that may come into contact with food or drinking water.

VC8-1 - Waste disposal facilities for Project waste

8.6.11. The magnitude of impacts on waste management facilities during construction (IF8-1) is anticipated to be Medium as they currently do not meet international standards. Taking into consideration the medium receptor sensitivity, as the capacity of sites used by the project is limited, the Project is expected to result in **Moderate** adverse effects on waste management infrastructure, prior to mitigation. A new landfill is being designed for the Project and will be constructed within the Project boundary but outside the flooding zone. Previously dumped material will be disposed of in this facility. The landfill is being designed to meet international standards. Once this is completed effects are expected to reduce to **Negligible** Significance.

8.6.12. Taking into consideration the implementation of operational phase waste management plans (IF8-2), the magnitude of impacts on waste management facilities during operations are anticipated to be Very Small. Waste volumes generated once the Project is fully operational are not anticipated to impact on treatment or disposal of other waste arisings at the disposal sites. At this stage of the Project, selected waste sites may be licensed locally, however may not fully align with international standards. When combined with the medium receptor sensitivity as the waste sites are reaching capacity, the Project is expected to result in effects of **Negligible** on waste management, prior to mitigation.

VC8-2 - Recycling facilities for Project waste

8.6.13. The magnitude of impacts on waste management facilities during construction is anticipated to be Medium as the waste sites are reaching capacity and unlikely to meet international standards. Taking into consideration the High receptor sensitivity as there is shortage of recycling facilities nationally, the Project is expected to result in **Major** adverse effects on waste management infrastructure, reducing to **Minor** following mitigation.

8.6.14. Taking into consideration the implementation of operational phase waste management plans, the magnitude of impacts on recycling facilities during operations are anticipated to be Small. Waste volumes generated once the Project is fully operational are not anticipated to impact on treatment or disposal of other waste arisings at the disposal sites. At this stage of the Project, selected waste sites may be licensed locally, however may not fully align with international standards. When combined with the medium receptor sensitivity as by the operational phase it is expected that regional recycling facilities will improve. The Project is expected to result in effects of **Minor** adverse effects on waste management, prior to mitigation.

VC8-3 - Waste sites for waste from resettled communities

8.6.15. The description of the management of general waste in Darband suggests that current handling and disposal of refuse may not be adequate, and improvements are required. Incorrect handling or disposal of general waste and refuse can give rise to a number of potential impacts including:

- Lighter fractions such as paper being blown by the wind potentially causing a litter nuisance over a wide area;
- Food waste attracting vermin and other disease carriers, or fauna, which can affect predator-prey relationships or cause other changes to ecosystems;
- Food waste creating nuisance due to odour as it degrades;
- Gaseous emissions, either direct or from burning of combustible items, can be potentially toxic and/or create nuisance due to odours; and
- Pollution of water courses/drinking water supplies – either direct from waste materials or from degradation products.

The magnitude of impacts is anticipated to be Large as the informal waste disposal site is unlikely to meet national or international standards. Taking into consideration the High receptor sensitivity as there is limited municipal waste facilities, the Project is expected to result in **Major** adverse effects on resettled community waste management facilities, reducing to **Minor** following mitigation.

SUMMARY OF IMPACTS

8.6.16. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 08**

Table 8-15 – Waste - Summary of Impacts

Impact Factor	IF8-1 – Construction Waste Generation		IF8-2 – Operations Waste Generation		IF8-3 – Resettlement village waste
VC	**VC8-1**	**VC8-2**	**VC8-1**	**VC8-2**	**VC8-3**
Sensitivity	Medium	High	Medium	Medium	High
Type	Negative	Negative	Negative	Negative	Negative
Extent	Regional	Regional	Regional	Regional	Local
Duration	Medium-term	Medium-term	Long-term	Long-term	Long-term
Frequency	Constant	Constant	Periodic	Periodic	Constant
Likelihood	Certain	Certain	Likely	Likely	Certain
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible
Magnitude	Medium	Medium	Very Small	Small	Large
Significance	Moderate	Major	Minor	Minor	Major
Additional Mitigation?	Yes	Yes	Yes	Yes	Yes
Residual Significance	**Negligible**	**Minor**	**Negligible**	**Negligible**	**Minor**

Table 8-16 – Waste - Mitigation Measures & Recommendations

Valued Component	Overview of Waste Mitigation
VC8-1	**Implement a Waste and Wastewater Management Plan** ▪ A Waste and Wastewater Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of waste and wastewater in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors, and in alignment with IFC EHS requirements. ▪ Appropriate mitigation measures and procedures for the following are to be included in the Waste Management Plan: ○ Prevention of the uncontrolled dumping of waste on site and ensure all wastes are stored and disposed of appropriately. ○ Appropriate handling and disposal of oils or decommissioned equipment potentially containing PCBs. ○ Asbestos Management – a site-wide survey is to be undertaken to identify structures where asbestos is and is potentially present. The survey findings will support the production of an Asbestos Register, listing all the locations where ACM could be encountered. The Asbestos Register must inform the development of an Asbestos Management Plan, which will state how ACM on the Project site will be managed. The Asbestos Management Plan is to be developed in line with WB ESS, IFC EHS Guidelines and ADB Good Practice Guidance for the Management and Control of asbestos. Further information and recommendations related to asbestos disposal are discussed in **Volume II, Annex 08**. ○ Procedure for a survey of abandoned waste and equipment to be undertaken across the Project site (refer to **Volume II, Annex 08** for recommendations concerning abandoned fuel storage tanks). The survey is to be undertaken by a team of suitably qualified EHS personnel, and an inventory of all abandoned materials compiled. In line with IFC EHS Guidelines, re-use or recycling of equipment should be carried out, as appropriate. Materials / wastes for disposal are to be disposed appropriately in line with IFC EHS Guidelines. • Each Contractor is to provide a plan of all their current and past effluent arrangements to Rogun HPP to include into the Wastewater Management Plan. The Plan will be used to manage sewage and industrial wastewater across the Project site. Measures and procedures for the following are to be included: ○ Investigate the concrete washout water being discharged straight to environment. All discharged water is to comply with both national and IFC EHS water quality guidelines. Measures, in line with IFC EHS Guidelines, are to be implemented to ensure water quality limits are not exceeded. Such measures may potentially include transfer to settlement ponds and/or treatment in an upgraded on-site WWTP, prior to discharge. ○ Workshop areas - runoff waters from drains and gullies from workshop areas are to be passed through an interceptor to allow separation of free-phase LNAPLs from the water. Additional treatment may be necessary depending on the workshop activities and nature of chemicals

Valued Component	Overview of Waste Mitigation
	utilised. The water is to comply with national and IFC EHS Guideline water quality limits prior to discharge. Separated LNAPL is to be disposed of appropriately as hazardous waste. ○ Where workshops do not have a current drainage or gully system, all runoff is to be contained and then treated appropriately in a WWTP. Discharged water is to comply with both national and IFC EHS water quality guidelines. Additional treatment prior to discharge maybe necessary depending on the workshop activities and nature of any chemicals utilised.
VC8-1 **VC8-2**	**Investigate suitability of waste disposal and recycling facilities for construction-phase waste and development a Project-Wide Waste Strategy.** ▪ To be investigated by Rogun JSC, prior to WB Board approval and implemented by December 2024. ▪ The Waste Strategy shall: ○ Identify all types of waste being produced, volumes and current disposal routes and locations. ○ Identify current conditions for all facilities being used by the Project and whether they are compliant with ESS3 and WB EHS requirements for waste. This includes, but is not limited to, inert construction waste, timber, metal, plastics, chemicals, fuels and oils, WEEE, sanitary, medical, domestic, food and other hazardous and non-hazardous waste. ○ Identify current options for waste management using the Waste Hierarchy, including their capacity to receive the volumes of waste proposed. ○ Undertake a life-cycle analysis and assessment of alternatives to identify technically and financially feasible reduction measures. ○ Where new facilities or extensions of existing facilities are required, these shall be proposed, and an Environmental Basis of Design developed. ○ Through the Waste strategy process, where licensed facilities are not being operated to acceptable standards, the Project will minimize waste sent to such sites and consider alternative storage and disposal options, including the possibility of developing its own recovery or disposal facilities at the Project site or elsewhere. ○ All waste facilities are to comply with relevant national legislation and align with international standards and guidelines, including IFC EHS General Guidelines and IFC EHS Guidelines for Waste Management Facilities. **Investigate suitability of waste disposal and recycling facilities for operations-phase waste** ▪ To be investigated by Rogun JSC, prior to WB Board approval and implemented by December 2024.Prior to the development of waste management and wastewater management plans for operations, it is also recommended that as part of the Operational Readiness Plan to be

Valued Component	Overview of Waste Mitigation
	developed, that the Project ascertains the suitability of waste disposal and recycling facilities to be used during operations, to ensure that these facilities are able to operate to acceptable standards. ▪ Waste facilities are to comply with relevant national legislation and align with international standards and guidelines, including IFC EHS General Guidelines and IFC EHS Guidelines for Waste Management Facilities.
VC8-3	**Survey of waste facilities in resettled communities** To be implemented by Rogun JSC, with guidelines 30 days after WB Board approval. ▪ It is recommended that the Project, in conjunction with the DFZ and the Project Lenders, undertakes a detailed survey of the current waste facilities (for general household waste and sewage waste) in resettled communities, to ascertain their suitability. Where improvements are required, an action plan with assigned responsibilities and timeframes is to be put in place to address these. ▪ Plans for future resettlements should also be reviewed to ensure there will be adequate provision of suitable waste management infrastructure to these areas and communities. Waste collection and disposal facilities provided in resettled communities are to comply with relevant national legislation and align with international standards and guidelines, including IFC EHS General Guidelines and IFC EHS Guidelines for Waste Management Facilities.
VC8-1 **VC8-2** **VC8-3**	**Construction of a new Landfill or Incineration Plant** ▪ It is recommended the Project looks to develops new waste facilities in line with national legislation, and IFC EHS Guidelines for Waste Management Facilities. This should be investigated by Rogun JSC, prior to WB Board approval regardless of funding arrangements. ▪ This could include a new landfill site or incineration plant, or a combination of both.

8.7 BIODIVERSITY & ECOSYSTEM SERVICES IMPACT ASSESSMENT

8.7.1. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 09** and **Annex 10.**.

KEY MESSAGES

- The Project is located in an area where land has been significantly modified by agriculture and other human activities, and where the downstream Nurek HPP has interrupted longitudinal connectivity of the river and of migration fish and other aquatic species. The Project itself occupies and has affected over 10km^2 on both banks of the river. There will be no real expansion of land disturbance by construction except relatively small areas for new resettlement communities.
- The reservoir will flood a maximum of 170km^2 at FSL. Although there are a few terrestrial species of conservation concern (Red Book of Tajikistan) that occupy habitat that will be affected by flooding, habitat for these species is plentiful in the region and the country, and there is no threat to wider species populations over the wider area.
- Four protected areas are within 50km of the Project, but none will be affected by the Project.
- Aquatic biodiversity is limited due to high turbidity and variable flow. The conversion of riverine habitats to lacustrine will lead to changes in aquatic biodiversity, with positive effects for some aquatic species but losses to others, including species classified as Vulnerable by the RBT. Migratory birds and some mammals will also benefit to some extent.
- Filling of the reservoir will loss of several natural habitats that qualify as "natural habitat"[1] under World Bank ESS6, including several small patches of remnant Juniper Woodland and some areas of Floodplain Habitats in the braided channel of the river. There is no technically feasible way to avoid the impacts. As required by ESS6, no net loss of biodiversity will be ensured by implementation requirements in the Biodiversity Management Plan (BMP), Fisheries Management Plan (FMP), and No Net Loss Management Strategy.

SUMMARY OF BASELINE CONDITIONS

8.7.2. A summary of biodiversity baseline conditions can be found in **Volume I, Chapter 7**. Further details on biodiversity baseline conditions can be found in **Volume II, Annex 09**. Further details on ecosystem services baseline conditions can be found in **Volume II, Annex 10.**

8.7.3. WSP Biodiversity Surveys were undertaken in spring 2023 consisting of habitat, flora, fauna and aquatic surveys, with an additional survey effort is planned for autumn 2023 to further corroborate

[1] "Natural habitats 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 ecological functions and species composition." World Bank Environmental and Social Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources, paragraph 21.

findings and identify any seasonal variation in the biodiversity baseline that will require consideration within the Project mitigation plans.

8.7.4. There are no protected areas within the AoI, although there are four protected areas within 50 km of the Project. There is an increasing presence/extent of invasive species across the country, and within the region it is considered likely.

8.7.5. Tajikistan supports a hugely diverse floral assemblage, with over 9,700 species of plant recorded, of which over 1,100 are endemic. Given the legacy of human influence across the AoI, the floral assemblage has been greatly reduced.

8.7.6. Tajikistan supports over 80 species of mammals, one of which is endemic (the Bukhara or Pamir shrew Sorex buchariensis); and half of which have been designated a conservation status. Eight common/widespread species were recorded during field surveys, with two (least weasel *Mustela nivalis* and Eurasian otter *Lutra lutra*) being included within the Red Book of Tajikistan.

8.7.7. Tajikistan has 14 native amphibian species, two of which are endemic to the region. The desktop study recorded identified only two amphibian species within the Vakhsh River valley: green toad *Bufo viridis*; and lake frog *Rana ridibunda*.

8.7.8. A diverse reptile fauna is present across Tajikistan, with 46 species confirmed as being present, 22 of which are endemic to the region. Nine species were recorded during field surveys in 2023, and additional habitat suitability identified for four species. The vast majority of these are considered common and widespread, and not of any elevated conservation interest/status.

8.7.9. Tajikistan supports a diverse bird assemblage, with over 380 species having been recorded, four of which are regional endemic species.

8.7.10. Within the Vakhsh River valley, including the lakes of the Tigrovaya Balka Nature Reserve, 36 fish species are known to be present, with the upper reaches of the Vakhsh River having much lower species composition than the lower parts of the river. Based on the three sampling bouts that have taken place in 2011 and 2023, it has been determined that approximately 16 fish species occur within the Rogun Project AoI.

Area of Influence

Terrestrial Biodiversity

- Various AoI have been identified, although initially this extended to the edge of the Vakhsh catchment beyond the 1290m inundation zone.

Aquatic Biodiversity

- Vakhsh River upstream of the Nurek Reservoir to FSL 1290 m at Rogun, including tributaries directly impacted by the flood zone or resettlement.

SCOPE OF THE ASSESSMENT

8.7.11. This assessment has been undertaken in alignment with Environmental and Social Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6) and comprises a brief review of existing work undertaken in relation to the Project, followed by an assessment of updated information collected during 2023.

8.7.12. Additional studies are ongoing (to ensure seasonal variation in the biodiversity baseline is recorded and to also fill in baseline gaps for example to understand baseline conditions at new settlement areas), with these studies due for completion in October 2023. Findings form these surveys are not expected to materially change the findings of this assessment and will be presented in a standalone technical note upon their completion.

ASSESSMENT METHODOLOGY

Valued Components

- Floodplain habitat (**VC9-1**)
- Juniper woodland (**VC9-2**)
- Notable flora (**VC9-3**)
- Notable reptile species (**VC9-4**)
- Notable mammal species (**V9-5**)
- Migrating birds (**VC9-6**)
- Aquatic Biodiversity (fish) (**VC9-7**)
- Aquatic Ecology (general) (**VC9-8**)

Impact Factors

- **IF9-1** – Loss/degradation of habitat from flooding
- **IF9-2** – Increased human pressures (e.g. grazing, firewood collection, fishing, etc.)
- **IF9-3** – Encroachment / Introduction of invasive species
- **IF9-4** – Land-take – loss of important habitat/features
- **IF9-5** – Injury/killing of fauna as a result of construction activities
- **IF9-6** – Release of deleterious substances into the river
- **IF9-7** – Entrainment and Impingement of fish through the turbines
- **IF9-8** – Change in habitat composition
- **IF9-9** – Loss of tributaries and short-range migration

ASSESSMENT OF IMPACTS - BIODIVERSITY

Impact Factors

Construction Phase

8.7.13. For the purposes of this assessment, the construction phase comprises ongoing construction activities, i.e., construction required to complete the dam structure and other Project components, ongoing flooding zone clearance works, and construction of new settlements.

8.7.14. Predicted construction phase impacts will comprise the following:

- Land/vegetation clearance within the flooding zone
- Injury/killing of fauna as a result of construction activities
- Spread of alien/invasive species

Operational Phase

8.7.15. For the purposes of this assessment, the operational phase comprises the reservoir at maximum inundation level (i.e., 1290m).

8.7.16. Predicted operational phase impacts will comprise the following:

- Land-take – habitat loss within the flooding zone upon completion of construction activities and start of inundation;
- Change in habitat type as a result of a new reservoir within the landscape;
- Barrier effect (including fish migration) arising from new reservoir in the landscape;
- Displacement of fauna as a result of the new reservoir;
- Increased pressure on natural resources as a result of improved access;
- Entrainment and Impingement of fish through the turbines;
- Change in habitat from a lotic (river) to a lentic (lake) system, resulting in changes to flow, water depth, water temperature and subsequently species composition; and
- Loss of short-range fish migration.

VC9-1 Floodplain Habitats

Potential impacts to floodplain habitats during the operational phase are as follows:

- IF9-1 - Loss/degradation of habitat from flooding.

8.7.17. The floodplain habitat within the AoI is limited to the Vakhsh River channel and comprises three main extents. The floodplains at Komsomalabad and most of the floodplain extent upstream of the confluence of the Vakhsh and Obikhingou rivers have heavily modified as a result of ongoing human influence from settlements, cultivation/localised agriculture and widespread grazing use. An exception to this is a discrete floodplain area approximately 6km upstream of this confluence where it is likely that recent geomorphological changes have resulted in a 'new' floodplain area that has yet to experience any material human influence and therefore supports habitat that appears to be largely unmodified. It is therefore considered appropriate to classify this as Natural Habitat as per ESS6 at this stage; further survey work is being undertaken during September 2023, these results will be provided as a stand-alone annex.

8.7.18. Upon operation, the Project will result in the permanent and irreversible loss of this habitat type within the flooding zone footprint; this comprises 60ha and a relative loss of 100% of the habitat's occurrence within its EAAA. This is anticipated to occur around 2027 when 1185m inundation level is reached and represents a large impact magnitude that will result in an adverse effect that is **Major** and therefore Significant.

VC9-2 Juniper woodland

Potential impacts to juniper woodland during the construction phase are as follows:

- IF9-1 - Loss/degradation of habitat from flooding
- IF9-2 - Increased human pressures (e.g. grazing, firewood collection, fishing, etc.)
- IF9-3 - Encroachment / Introduction of invasive species

8.7.19. The woodland habitat within the AoI is restricted to remnant areas of juniper woodland on the left bank of the Vakhsh River that represent the last remaining fragments of a once common habitat in the landscape. This is a habitat that shows some signs of modification through grazing pressure and some tree loss but still retains of sufficient natural character (especially in terms of species diversity and composition) to be classified as Natural Habitat as per ESS6 at this stage.

8.7.20. The Project will result in the permanent and irreversible loss of approximately 185ha of habitat type within the flooding zone footprint (when also considering removal of trees across an assumed 25m buffer zone from the 1290m level); this totals a relative loss of approximately 65.3% of the habitat's occurrence within its EAAA. This is anticipated to occur between 2034-36, allowing for pre-flooding clearance and the anticipated maximum inundation level being reached in 2036 and represents a large impact magnitude that will result in an adverse effect that is **Major**. A no net loss/offsetting plan is being developed which will identify opportunities for protecting and enhancing existing areas following the mitigation hierarchy, and where required identify areas for no net loss. This reduces the effect to **Negligible** any may confer a positive effect once implemented.

VC9-5 Notable Mammals

8.7.21. Potential impacts to mammals during the operational phase are as follows:

- IF9-4 - Land-take - loss of important habitat/features; and
- IF9-8 – Change in habitat composition - – improved conditions for riparian mammals.

8.7.22. The VC mammal assemblage potentially at-risk during construction activities is limited to least weasel and Indian crested porcupine, with all other species unlikely to be resident within the flooding zone. The assessment here mirrors that described above for reptiles, although it is likely that given their inherent greater mobility, the impact to mammals may be even less. However, a precautionary approach is taken, and it is assumed and a permanent and irreversible impact that is small is still considered appropriate. This will result in an adverse effect that is **Minor** and Not Significant.

8.7.23. The change in habitat composition across the AoI will permanently benefit otters, that are known to be present within the Vakhsh River system. The reservoir will offer a more stable environment for foraging, and will also significantly increase the freshwater resource, meaning that the AoI will be able to support a greater number of otters. This represents a permanent **beneficial** impact.

VC9-6 Migratory Birds

Potential impacts to migratory birds during the operational phase are as follows:

- IF9-4 - Land-take - loss of important habitat/features; and
- IF9-8 - Change in habitat composition - improved conditions for aquatic/semi-aquatic birds.

8.7.24. The permanent change in habitat composition across the AoI has the potential to benefit some migratory (and resident) species by creating a significantly increased freshwater resource in the landscape. Fish-eating birds such as osprey, would likely make use of this resource for foraging, while migratory egrets, herons and duck species will likely also be attracted the reservoir. As with otters, the reservoir will offer a more stable environment for foraging, meaning that the AoI will be able to support a greater number of aquatic/semi-aquatic bird species. This represents an irreversible beneficial impact.

VC9-7 Aquatic Biodiversity (Fish)

8.7.25. Potential impacts to aquatic biodiversity (fish) during the operational phase are as follows:

- IF9-2 - Increased human pressures (e.g. grazing, firewood collection, fishing, etc.)
- IF9-3 - Encroachment / Introduction of invasive species
- IF9-6 - Release of deleterious substances into the river
- IF9-7 – Entrainment and Impingement of fish through the turbines
- IF9-8 - Change in habitat composition
- IF9-9 – Loss of tributaries and short-range migration

8.7.26. With the filling of the dam, the existing lotic (river) habitat will be transformed into a lentic (lake) system. By design, the construction of the Rogun HPP Project is to dam the Vakhsh River and fill the reservoir (flooding zone), making this a permeant change that is certain and irreversible. The magnitude of this impact ranges from beneficial to medium based on the species. Rheophilic fish species will be lost as the habitat changes to a deep-water habitat preferred by lacustrine species.

8.7.27. For certain species that favour open waters (pelagic), this change is viewed as **Positive**, while rheophilic species that favour fast flowing waters and shallow rocky areas will likely be displaced. As the Turkestan Catfish, a vulnerable species (RBT), that is predominant found in mountain rivers and streams under stones and rocks has been confirmed within the AoI, the adverse effect is considered to be Moderate and therefore Significant. The Turkestan Catfish population is considered stable and expected to occur in more than 3000 km of river and many more than 10 populations (Karimov, 2020).

8.7.28. Although fish migration up the tributaries will be limited as a result of the gradient, the lower portions of these inlets are considered to be important for fish as refuge areas off the main Vakhsh River channel, as they offer clear, cooler waters and are often used for spawning. The assessment of this impact also includes the tributaries downstream between Rogun and Nurek. The extent of the loss of tributaries and short-range migration as a result of the project will be limited to the Project AoI affected by the inundation and/or downstream fluctuations in flow (eFlow).

8.7.29. As the inundation is a certainty and the reservoir will be permanent, the magnitude of the loss of tributaries and associated short-term migration considered medium. With this in mind, the inundation effect of these habitats is likely to be **Moderate** and therefore **Significant** for fish.

VC9-8 - Aquatic Ecology (General)

8.7.30. Potential impacts to aquatic ecology during the operational phase are as follows:

- IF9-1 - Loss/degradation of habitat from flooding
- IF9-6 - Release of deleterious substances into the river
- IF9-8 - Change in habitat composition

8.7.31. As detailed above, the filling of the dam will result in a loss in lotic (river) habitat as the Vakhsh River will be transformed into a lentic (lake) system. By design, the construction of the Rogun HPP Project is to dam the Vakhsh River and fill the reservoir (flooding zone), making this a permeant change that is certain and irreversible.

8.7.32. The magnitude of this impact for aquatic ecology in the landscape is considered large and the the adverse effect is considered to be **Moderate** and therefore **Significant**, with approximately 100 km of river lost.

SUMMARY OF IMPACTS – BIODIVERSITY

8.7.33. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 09.**

Table 8-17 - Biodiversity – Summary of Impacts

Impact Factor	IF9-1 - Loss/degradation of habitat from flooding			IF9-2 - Increased human pressures	IF9-6 - Release of deleterious substances into the river	IF9-7 - Entrainment and Impingement of fish through the turbines	IF9-8 - Change in habitat composition				IF9-9 - Loss of tributaries and short-range migration
VC	**VC9-1**	**VC9-2**	**VC9-8**	**VC9-7**	**VC9-7**	**VC9-7**	**VC9-5**	**VC9-6**	**VC9-7**	**VC9-8**	**VC9-7**
	Floodplain habitat	Juniper woodland	Aquatic Ecology	Aquatic Biodiversity	Aquatic Biodiversity	Aquatic Biodiversity	Notable mammal species	Migratory Birds	Aquatic Biodiversity	Aquatic Ecology	Aquatic Ecology (Fish)
Sensitivity	Medium	Medium	Low	Medium	Medium	Medium	Low	Low	Medium	Low	Medium
Type	Negative	Negative	Negative	Negative	Negative	Negative	Positive	Positive	Positive or Negative	Positive or Negative	Negative
Extent	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent	Short-term Permanent	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent

Impact Factor	IF9-1 - Loss/degradation of habitat from flooding			IF9-2 - Increased human pressures	IF9-6 - Release of deleterious substances into the river	IF9-7 - Entrainment and Impingement of fish through the turbines	IF9-8 - Change in habitat composition				IF9-9 - Loss of tributaries and short-range migration
Frequency	Constant	Constant	Constant	Constant	Periodic	Constant	Constant	Constant	Constant	Periodic	Constant
Likelihood	Certain	Certain / Likely / Unlikely	Certain	Likely	Unlikely / Constant	Likely	Likely	Likely	Certain	Unlikely	Certain
Reversibility	Irreversible	Irreversible	Irreversible	Reversible	Reversible	Irreversible	Irreversible	Irreversible	Irreversible	Reversible	Irreversible
Magnitude	Large	Large	Large	Beneficial	Medium	Medium	Small	Small	Medium	Medium	Medium
Significance	Major	Major	Moderate	Positive	Moderate	Moderate	Positive	Positive	Positive / Moderate	Positive / Minor	Moderate
Additional Mitigation?	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
Residual Significance	**Negligible (potentially positive)**	**Negligible (potentially positive)**	**Moderate**	**Positive**	**Minor**	**Minor**	**Positive**	**Positive**	**Positive** **Moderate**	**Minor**	**Moderate**

SUMMARY OF IMPACTS – ECOSYSTEM SERVICES

Valued Components

- Wild plants (**VC10-1**)
- Trees used for memorials and shrines (**VC10-2**)
- Trees associated with local stories and taboo (**VC10-3**)
- Protected areas (**VC10-4**)
- Local healing and thermal waters (**VC10-5**)
- Croplands and orchards (**VC10-6**)
- Pastures (**VC10-7**)
- Remaining woody areas (**VC10-8**)
- Natural habitats (terrestrial, riparian floodplains, freshwater) (**VC10-9**)
- Floodplains (**VC10-10**)
- Freshwater streams (**VC10-11**)
- Species (**VC10-12**)

Impact Factors

Construction Phase

- **IF10-1 -** Land and vegetation clearance within the flooding zone;
- **IF10-2 -** Hunting of local wild mammals and birds, and fishing from the construction work force;
- **IF10-3 -** Reductions in water and air quality due to sediment release into the river system resulting from the depositing of construction and tunnelling waste into the river, release of contaminants into the river and localised water quality issues due to discharges from construction facilities, and release of dust and other air pollutants;
- **IF10-4** - Water abstraction for construction activities;
- **IF10-5** - Injury or killing of fauna as a result of construction activities;
- **IF10-6 -** Disturbance – including noise / vibration and visual disturbance; and
- **IF10-7 -** Introduction and spread of alien/invasive species.

Operational Phase

- **IF10-8 -** Flooded area resulting in habitat loss and change in habitat type (new reservoir within the landscape);
- **IF10-9 -** Water pollution arising from new reservoir by altering temperature balances, water chemistry and sedimentation; and
- **IF10-10 -** Barrier effect arising from new reservoir in the landscape.

8.7.34. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 10**.

8.7.35. No impact, apart from those mitigated through resettlement (as detailed in Annex 10), has been deemed of major significance because sensitivity was never rated higher than medium (i.e. the local community is not highly dependent on the ecosystem service).

Table 8-18 - Ecosystem Services - Summary of Impacts

Impact Factor	IF10-1 (Direct Impact)			All Construction IFs (Direct Impact)		IF10-8 (Direct Impact)	All Operational IFs (Direct Impact)			All Construction IFs (Indirect Impact)	IF10-9 (Indirect Impact)	
VC	VC10-1	VC10-2	VC10-3	VC10-12	VC10-1	VC10-2	VC10-3	VC10-11	VC10-12	VC10-9	VC10-9	VC10-5
Sensitivity	Medium	Medium	Medium	Low	Medium	Medium	Medium	Medium	Low	Medium	Medium	Medium
Type	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Extent	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local
Duration	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term
Frequency	Constant	Constant	Constant	Infrequent	Constant	Constant	Constant	Constant	Infrequent	Constant	Intermittent	Constant
Likelihood	Certain	Certain	Certain	Likely	Certain	Certain	Certain	Certain	Likely	Certain	Certain	Possible
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Magnitude	Medium	Large	Large	Medium	Medium	Large	Large	Medium	Medium	Medium	Medium	Medium
Significance	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Additional Mitigation?	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
Residual Significance	Moderate	Moderate	Moderate	Minor	Moderate	Moderate	Moderate	Moderate	Minor	Minor	Minor	Moderate

MITIGATION AND RECOMMENDATIONS

Table 8-19 – Biodiversity & Ecosystem Services - Mitigation Measures and Recommendations

Valued Component	Overview of Mitigation Measure
VC9-1 **VC9-2** **VC9-7** **VC9-8** **VC10-12**	**Develop and Implement the Biodiversity Management Plan** ▪ A Biodiversity Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of biodiversity in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ The Plan will require appointment of an Ecological Clerk of Works to support JSC Rogun and DFZ (see below). ▪ In order that the mitigation strategy is fully informed, it will support further survey effort, comprising a biodiversity walkover of areas of greatest biodiversity interest as follows: ○ Floodplain habitat. ○ Juniper woodland habitat. ○ General pre-construction biodiversity walkover of areas where vegetation clearance will be needed (including pre-clearance of the juniper woodland within the maximum inundation zone), Forestry Agency land-clearing in advance of pre-inundation land-clearing, and DFZ contractor land-clearing in advance of construction of new infrastructure as part of the resettlement program. ○ Walkover of areas outside the flooding zone to identify informal 'receptor' sites for the ad hoc translocation of notable flora/fauna; and ○ This walkover will be conducted at least three months prior to expected impacts, or in the spring breeding season within one month. ○ The Plan will require land-clearing as near in time to expected impacts, including inundation. ○ An appropriate monitoring programme will be a critical component in ensuring the ongoing success of mitigation described above. Monitoring requirements and methods shall be reviewed and updated periodically (e.g. on an annual basis) to ensure they are still fit for purpose. The overall monitoring commitment should be partnered with the Project's capacity building objective, with the Project identifying individuals to be increasingly involved on the Project's biodiversity monitoring, through a training and mentoring programme overseen and managed by the ECoW.
VC9-7 **VC9-8** **VC10-9** **VC10-12**	**Develop and Implement a Fisheries Management Plan** ▪ A Fisheries Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of fisheries

Valued Component	Overview of Mitigation Measure
	in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ The Fisheries Management Plan will provide direction for the management of fisheries resources in the Rogun reservoir and nearby Vakhsh River, with the goal to protect species and genetic diversity as well as to optimize social, cultural and economic opportunities and values derived through the sustainable use of aquatic resources for both present and future generations. Any monitoring and management of fish stocks and/or biodiversity required for the project based on agreed upon objectives for the Rogun Reservoir moving forward will be detailed within this Plan. ▪ The Plan will outline the quantity, frequency, timing, and quality of water and sediment flows necessary to sustain downstream aquatic habitats and biodiversity. Ensuring that sufficient water and the regulation thereof will help towards mitigating the impact to the downstream Vakhsh River between Rogun and Nurek.
VC9-1 **VC9-2**	**Implement an Offset Management Strategy** ▪ A live document that will consider the feasibility of various offsetting options before identifying viable options to go forward for further development. At this stage, other options under consideration include the following: ○ Restoration of damaged floodplain habitat elsewhere within the catchment (e.g. at the Tigrovaya Balka National Park). ○ Creation of new floodplain habitat upstream of the flooding zone. ○ Creation of new floodplain habitat in the depleted reach between the Project and the Nurek reservoir. ○ Other, out of kind, projects such as supporting wetland creation.
VC9-1 **VC9-2** **VC9-7** **VC9-8** **VC10-12**	**Ecological Clerk of Works** ▪ The Biodiversity Management Plan described above will require appointment of an Ecological Clerk of Works (ECoW) (or similar title) to provide biodiversity support in advance of and throughout project construction. The ECoW will have suitable qualifications for overseeing works that could affect terrestrial and aquatic biodiversity, and will be approved by the PMC. Project. Responsibilities will include, but will not be limited to: ▪ Periodically (no less than monthly) conducting walkovers of ongoing and near-future DFZ (Forestry Agency and construction contractor) land-clearing, in particular in locations where there is potential to harm wildlife and notable flora (most notably ground and vegetation clearance). ▪ Advising PMG concerning possible micro siting of works outside of the current Project site (i.e. for construction of any associated facilities that have yet to be built, such as transmission lines). This will serve to help avoid biodiversity sensitivities on the ground through minor tweaks in the location of works.

Valued Component	Overview of Mitigation Measure
	▪ Training Forestry Agency staff in identifying and removing animals (such as reptiles and amphibians) which may not be able to disperse quickly enough and would therefore be at risk of mortality and being alert to Least weasel. Staff will also be trained to move any such animals to nearby suitable habitat (as identified through pre-construction walkovers). ▪ Identifying invasive plant species in the area. Should any such species be identified then an Invasive Species Management Plan will be produced which will detail measures to be adopted to stop the spread of such species. ▪ Deliver a series of 'toolbox talks', including site inductions, to DFZ construction worker and supervisors to raise awareness of ecological issues. ▪ Identifying bat roosts in areas to be disturbed, and where these roosts cannot be avoided through micro siting of works, the ECoW will advise on an appropriate course of action to be taken to prevent loss of these roosts, where possible.

8.8 SOCIAL IMPACT ASSESSMENT

8.8.1. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 11**.

KEY MESSAGES

- During construction, the project will have significant social impacts related to local economies and employment (with a workforce at a maximum of 20,000+ people at the dam site), labor and working conditions (including workers' camps), community health, safety and security, land acquisition and resettlement (46,0000+ people are being resettled away from the dam impoundment area), community infrastructure, stakeholder engagement and grievance management and social inclusion, especially of vulnerable groups and women.
- During operation, some social risks will remain, especially those related to ongoing management of community health, safety and risk, labor and working conditions at the dam, stakeholder engagement and grievance management, social inclusion and follow-up to the resettlement process.
- Several social instruments are being prepared, in addition to the ESIA/ESMP. These include: a Stakeholder Engagement Plan, which sets out the process of consultation and grievance management, as well as recording key outcomes of ongoing consultations; a Resettlement and Livelihood Policy Framework which reports on the resettlement to date, as well as providing guidance for the preparation of subsequent Resettlement Action Plans; detailed Labor Management Procedures; and a Gender Action Plan, which consolidates key gender issues across the project activities.
- The Project provides real opportunities for enhanced social benefits, such as good labor practices, ongoing stakeholder engagement, improved community infrastructure for resettled people, benefit-sharing and enhanced social outcomes, including better socio-economic opportunities for women and vulnerable groups.

SUMMARY OF BASELINE CONDITIONS

Local Economy and Employment

8.8.2. It is estimated that at its peak there will be a total construction workforce of between 15-20,000 workers. Currently there are approximately 14,735 people working on the Project with 23% sourced from within 50km of the Project.

Labour and Working Conditions

8.8.3. Labour influx is associated with the migration of foreign workers into the Project area. Currently, the majority of Project workers are from Tajikistan, with expatriates, predominantly from India, Iran and Italy, comprising approximately 5.1% of the workforce.

8.8.4. Approximately 23% of the workers come from the area surrounding the Project (within 50km). All workers who are not Tajik nationals, and who do not already live locally, are being accommodated in the construction compounds, with provision of catering, recreational and healthcare facilities.

8.8.5. The large number of construction workers, and accommodation camps situated near local communities, means that there is a risk for strained relationships between workers and local residents, an increased risk of communicable diseases, and community disturbance (e.g. sexual exploitation and abuse/sexual harassment).

8.8.6. Women currently comprise 5.2% of the workforce, primarily undertaking domestic types of work such as cleaning, preparing food for workers and washing dishes. There are also a small number who work as nurses, engineers, or in administrative roles. The risk of SEA/SH within the workplace is substantial for women, due to a lack of employer obligation, gender sensitization, and institutional capacity.

Community Assets and Infrastructure

8.8.7. All community assets and infrastructure within the Flooding Zone will be lost as the reservoir is filled. Currently, facilities such as schools and religious meeting places provide opportunities for communities to gather and socialize and contribute to the social fabric of the existing settlements.

Community Health, Safety and Security

8.8.8. The Flooding Zone and buffer contains villages which includes residential properties, structures and agricultural land. Those communities in close proximity to the construction compounds and routes used to transport construction goods and materials are likely to experience specific impacts to their health, safety and security.

Inclusion, Vulnerabilities and Gender

8.8.9. Villages within the Flooding Zone are mainly traditional communities where men are the decision-makers. In some rural areas there are only primary schools and children must attend boarding schools for further education, returning to their parents at weekends. Many families do not want their daughters to leave the family for such a period of time so they do not continue their education after primary school, and they are left with basic literacy skills.

8.8.10. Therefore, women may be exposed to a series of impacts as they tend to have a limited education and are mainly housewives, agricultural workers, or involved in informal businesses. Household surveys show that many women are receiving a pension (approximately 25%), and a proportion have worked within the public sector (approximately 14%).

Land Acquisition and Resettlement

8.8.11. The Project will require the acquisition of, and provision of replacement, land and houses. Overall approximately 168km^2 of land will be acquired, and 69 entire villages (over 46,000 people) will be resettled. This land acquisition, and resulting resettlement, has the potential to affect the livelihoods of affected people and cause potential economic displacement. The acquisition of land will also cause the loss of access that current residents have to natural resources.

ASSESSMENT METHODOLOGY

Area of Influence

Construction

- Project Boundary at FSL 1,290 m inundation.
- Region of Republican Subordination.
- Existing and new communities of Rogun City, Nurobod, Faizobod, Dangara, Rasht, Tursunzoda, Rudaki, and other surrounding districts in the regions (Rayons).

Operation

- Project Boundary at FSL 1,290 m inundation.
- Region of Republican Subordination.
- Existing and New communities of Rogun City, Nurobod, Faizobod, Dangara, Rasht, Tursunzoda, Rudaki, and other surrounding districts in the regions (Rayons).

Valued Components

- Local Economy and Employment (**VC11-1**).

  There is a high level of sensitivity associated with local economy and employment due to the levels of poverty and employment in the local area.
- Labor Influx (**VC11-2**)
  - There is a medium level of sensitivity associated with labor influx due to the long-term duration of the construction of the Project and the impacts associated with workers from outside the local area.
- Gender Issues within Labor Working Conditions (**VC11-3**)
  - There is a high level of sensitivity associated with gender related issues within labor working conditions.
- Labor Management **(VC11-4)**
  - There is a high level of sensitivity associated with labor management due to evidence of poor working conditions.
- Occupational Safety (**VC11-5**)
  - There is a high level of sensitivity associated with occupational health and safety due to large scale of construction activities and the potential for a high rate of occurrences of accidents.
- Community Assets and Infrastructure (**VC11-6**)
  - There is a moderate level of sensitivity associated with community assets and infrastructure, although the loss is permanent, communal assets are being replaced with more improved assets and infrastructure.
- Community Health, Safety and Security (**VC11-7**)
  - There is a high level of sensitivity associated with the transport, excavation and ground works of the Project, which could lead to direct health and safety impacts within local communities.

Impact Factors

- **IF11-1** - Increase in local income due to employment expenditure.
- **IF11-2** - Impacts due to inadequate safeguards to protect workers from unfair, unsafe, or other adverse working conditions.
- **IF11-3** - Loss of current community assets and infrastructure. New resettlement to provide improved infrastructure.
- **IF11-4** - Potential noise and air pollution and reduced safety and security of local families and construction workers.
- **IF11-5** - Inclusion, vulnerabilities, and gender issues – risks for women including SEA/SH.

- **IF11-6** - Land acquisition and resettlement – acquisition & provision of replacement, land, and houses.

ASSESSMENT OF IMPACTS

Direct Effects - Construction

Local Economy and Employment

8.8.12. Induced employment is generated by workers employed by the Project spending money as individuals. During the construction period there will be an increase in local income generated as a result of employment expenditure.

8.8.13. Given the relatively high levels of poverty and employment in the surrounding Districts there is a high vulnerability of receptors, and the potential for the magnitude of impact to be Beneficial. Therefore, the effects associated with employment and improved local economy are considered to be **Positive**.

Labor and Working Conditions

Labor Influx

8.8.14. Typical labour influx related risks include the following:

- If construction workers do not speak Tajik or Russian, and are not familiar with the local culture, they may find it harder to fit into the local communities which could cause potential conflict;
- The long-term duration of construction activities (predicted to be ongoing until 2029) could exacerbate the related impacts of labour influx;
- If workers accommodation is located in close proximity to local residential households (if it is less the 100m) this could further contribute to strained relationships between the workers and local residents. It is understood that there is limited accommodation provided within Rogun City;
- The presence of a large number of construction workers, likely young males, could contribute to an increased risk of communicable diseases such as HIV/AIDS and other sexually transmitted diseases;
- The influx of a potentially migrant construction force to the Project area could lead to an increase in community disturbance (e.g. decrease in community cohesion, increase in crime and instability, incidences of gender-based violence);
- The labor influx could lead to increased pressure on local infrastructure and utilities (water electricity, gas);
- Local workers may feel threatened or disadvantaged as a result of labour influx and potentially overseas construction workers moving to the Project area. This could potentially lead to violence inside the construction areas and local conflicts; and
- Potential labor discrimination and harassment of foreign workers and/or women due to a lack of implementation of a Construction Workers' Code of Conduct.

8.8.15. As the Rogun HPP has been under construction and implementation for more than a decade, the PMG, JSC and Contractors have undertaken measures to:

  - Keep workers and their representatives informed about key developments about the dam;

- Promote understanding and tolerance between local communities and the workers, especially international workers;
- Maintain regular contacts with representatives from towns and communities near the dam;
- Facilitate the resolution of any disputes and grievances among the workers (local and international) and between the workers and local citizens; and
- Ensure that the labour influx does not tax existing infrastructure, such as water supply, sewerage and sanitation and electricity.

8.8.16. Both PMG and JSC report that there have been very few incidents of conflict or other adverse interactions between workers and the local communities, including the foreign workers who live in communities near the dam site.

8.8.17. It is not anticipated that there will be significant impacts on the existing community facilities and infrastructure provisions as the majority of services for workers are provided within the construction compounds.

8.8.18. Considering the Medium vulnerability of the receptor, and Medium magnitude of the impact, effects are considered as **Moderate** adverse (significant).

Gender

8.8.19. Tajik legislation prohibits women from working in heavy, underground and hazardous works (Article 216), and women who are pregnant or who have children under the age of three are prohibited from working overtime, on weekends or from taking business trips. It should be noted, however, that the workers have collective agreements which may allow for women to work in professions not permitted by law; in such cases, exceptions have been granted.

8.8.20. National legislation prohibits “sexual harassment and non-physical harassment in the workplace” (The Equality and Elimination of all Forms of Discrimination Act 2022, Article 6). However, the legislation does not properly define such harassment or set out mechanisms for ensuring accountability. Therefore, due to a lack of employer obligation, gender sensitization, institutional capacity and enforcement of a code of conduct, the risk of SEA/SH is substantial within the workplace for women. Considering the High vulnerability of females within the workforce, and the Large magnitude of impacts, effects are considered as **Major** adverse (significant).

Labor Management

8.8.21. The current work pattern for construction workers on site consists of 15 days on, and 15 days off, and day shifts are 12 hours with regular break, which is provided for in the Tajik Labor Code.

8.8.22. The Labor Management Audit found that a number of contractors have provided contracts with missing information (e.g., wages, working hours, and break and rest periods). There was also evidence found of shift workers doing overtime above their standard 12hr shift, which is prohibited by the Labor Code. However, these findings were not consistent across all contractors, many of whom were found to be compliant as part of the audit process.

8.8.23. The Labor Code (Article 208) also prohibits the employment of employees under the age of 18 for heavy, underground, and harmful or hazardous works. No evidence of child labor was found, and the age of all employees is verified using legal documents.

8.8.24. Workers are allowed to join labor unions and there is evidence of organized labor on site. A grievance mechanism, while basic, is also provided for workers to access.

8.8.25. Evidence of poor working conditions has been observed, though again this is not consistent across the Project, which included limited provision of drinking water, no soap or disinfectant in toilet cubicles for workers to wash their hands, poorly maintained toilet facilities and inadequate first aid and medical facilities for workers. There are also instances of sub-standard accommodation for workers, though this is not consistent across the whole Project. It should be noted that sub-standard accommodation is due to be replaced as construction compounds are moved through 2024-25.

8.8.26. Considering the High vulnerability of the receptor, and the Medium magnitude of impact, effects are considered as **Major** adverse significance.

Occupational Health and Safety

8.8.27. Common activities undertaken during construction can introduce high risks to the health and safety of the construction workforce, the main potential health and safety construction risks associated with the Project will be related to the following:

- Use of explosives for tunnelling;
- Working at height in the tunnels and dam;
- Working in confined spaces;
- Hot work, e.g. welding;
- Repetitive working and hard manual labor;
- Exposure to physical hazards from use of heavy equipment and machinery;
- Working with pressurized equipment;
- Excavation on steep, potentially unstable slopes;
- Trip and fall hazards;
- Exposure to noise and dust;
- Exposure to electrical hazards from the use of tools and machinery;
- Carrying heavy loads;
- Exposure to chemicals (e.g., paints, fuels, fresh concrete);
- Transportation within the Project tunnels;
- Working in both hot and cold conditions due to the climate extremes; and
- Risk of road traffic incidents.

8.8.28. In the absence of mitigation, due to the large scale of construction activities and the potential for a high rate of occurrences of accidents, receptors are considered to be of a High vulnerability. With a Medium magnitude of impact, effects are considered as **Major** adverse (significant).

Community Assets and Infrastructure

8.8.29. The allocation of new land for resettlement is done on a lottery basis, and it does not always mean neighbors are able to remain as neighbors in the new settlements. However, DFZ does make arrangements for those who want to remain with relatives or neighbors to maintain social networks and cohesion.

8.8.30. New settlements are anticipated to provide improved infrastructure in terms of new schools, healthcare facilities, sports and recreational facilities which affected people welcome. The Project will also provide more reliable electricity throughout the year.

8.8.31. Both household survey and focus group discussion (FGD) outcomes state that people are positive about the post-resettlement improvements, as they will benefit from better community assets and infrastructure. Effects are considered as **Positive**, despite the loss of existing infrastructure, which are reversible and manageable.

Community Health, Safety and Security

8.8.32. Community health, safety and security impacts will mainly affect the residential areas that are in close proximity to the construction compounds for the Project, and roads used to access these compounds. These residential areas will be highly sensitive to potential health, safety and security impacts during construction.

8.8.33. The following community health and safety impacts may be expected:

- Potential noise pollution associated with construction work activities i.e. blasting, truck movements, excavations, ground works;
- Potential air pollution, mainly dust resulting from groundwork and excavation, but also from vehicle movements;
- Reduced safety and security of local families, women and children resulting from potential labour influx and movement of overseas workers into the area and potential local conflict; and
- Reduced safety as a result of unauthorized access to construction works and equipment, obstruction of local access and road diversions, increased road traffic, including construction vehicles, and increased risk of road accidents.

8.8.34. Outcomes from FGDs and household surveys suggest there are poor road conditions that put community safety at risk, especially where high proportions of young children live. Households with caring responsibilities, people with disabilities, and elderly people may face restrictions on accessing some of their local community assets and infrastructure when in close proximity to construction activities.

8.8.35. The construction activities for the Project include excavation and ground works which, in addition to the risks from increase traffic, could lead to direct health and safety impacts within local communities. Therefore, due to a High sensitivity of the receptor, and a Small magnitude of impact, the potential effects are considered to be **Moderate** adverse (significant).

8.8.36. Impacts associated with use of security forces on affected communities are determined to be **Moderate to Low** as there is no evidence of issues raised during community engagement and FGD meetings. However, arm usage has been recorded due to military force engagement in the Project area.

Inclusion, Vulnerability and Gender

8.8.37. In order to assess the impacts of the Project on local women, FGDs were conducted with local women as part of this ESIA.

8.8.38. The key finding from the women-only FGD were as follows;

- The current socio-economic conditions of women participating in the FGDs varied greatly depending on the village they come from and how well serviced it is in terms of community infrastructure and services. Where community infrastructure was lacking, few women were in formal employment, girls were less likely to remain in education and female literacy rates are low. Where there are lots of facilities, higher rates of women are in employment in roles such as teachers, nurses and cleaners.
- Few women are employed on the Project, with participants citing the distance to the project and the 15 day shift pattern as barriers; husbands also do not want their wives to work in a male-dominated environment.
- Where women are heads of household, they are free to make decisions regarding resettlement. In all other cases, including where husbands working overseas, it is their husbands or parents who make decisions and manage assets.
- Participants were generally positive about the opportunities that they perceive come with resettlement particularly for employment, education, and improved community infrastructure.

8.8.39. Concerns were raised around the following;

- Compensation for resettlement, with some not yet having received it, and others worried about the valuation of their assets on the land (land itself is owned by the government and allocated to households to use for living and/or economic activities).
- Availability of water in their new residences.
- Assurance that their conditions (jobs, property and availability facilities) would be provided for.
- Whether women currently living with their parent would receive a land plot.
- Participants also raised concerns on behalf of the vulnerable women in their communities, such as those with disabilities, divorced women and widows who would need additional support during the resettlement (e.g., moving and construction new residences).
- Women also highlighted how they would prefer to be resettled alongside their existing neighbors and community.

8.8.40. Project specific vulnerable groups could be negatively affected if the resettlement and livelihood restoration planning does not include specialized livelihood measures and provide timely assistance to facilitate their physical relocation.

8.8.41. Considering the High vulnerability of receptors, and the Large magnitude of impact, the effects are anticipated to be **Major** adverse significance.

Land Acquisition and Resettlement

8.8.42. The Project resettlement requirements are described in the 2023 RLRF and 2017-2025 RAP2 (under preparation), together with details of the compensation and livelihood restoration measures. The potential Project impacts related to land acquisition are summarized as follows;

- Loss of all structures, including houses and businesses in 69 villages;
- Loss or restrictions on use of land and loss of livelihoods associated with this land, such as subsistence farming;

- Loss of common pastureland;
- Loss of crop lands and orchards;
- Loss of access to natural resources
- Loss of ethnographic and intangible cultural heritage
- Loss of public infrastructure, such as schools, roads and healthcare facilities; and
- Impact to business activities, including the loss of income in the period between business activities ceasing prior to resettlement, and activities returning to the point where they generate the previous level of income for business owners.

8.8.43. The project will result in the involuntary resettlement of about 47,000 people. Some 2000 were resettled under RAP 1. Under the ongoing 2017-2025 RAP 2, around 7,000 people have been resettled and another 8,500 are in the process of being resettled. While PAPs have been generally satisfied with replacement housing, land and community amenities (such as access to water supply, electricity, and social services), full livelihood restoration has been a challenge.

8.8.44. This is being addressed by RAP 2 and the second Livelihood Restoration Plan (LRP 2), currently under preparation, taking into account extensive consultations with the PAPs and support from several government programs. Various livelihood support programs are being provided by Ministry of Labor, Migration and Employment of Population (MoLMEP) and the Ministry of Agriculture (MoA), including skills training, job counselling, microloans. The RPF and RAP 2 will also examine and apprenticeships and community development activities.

8.8.45. Impacts on vulnerable groups including;

- Disabled people, e.g. those with physical or mental disabilities or chronic illnesses, who will require physical assistance if the village is to be relocated.
- Female-headed households (as well as women acting as de facto HoH while the HoH is absent, e.g. for labour migration), who may require additional assistance in building their new houses.
- Elderly people with no younger family members within their household, who may also require additional assistance in building their new houses.
- Young people (aged 24 or under) who may require additional assistance in finding a job in their new location.

8.8.45. The impacts on users of agricultural land will be dependent upon the availability of suitable productive replacement land, as well as the potential loss of crop and / or trees (depending on the time of year when resettlement occurs).

8.8.46. Women in the area often supplement their income with the informal sale of agricultural surplus. Only 14% of the women population in the sample stated to have an income source.

8.8.47. Where grazing land is available, PAPs are taking their animals with them to their new settlements, however land is not always available for this.

8.8.48. With a number of vulnerable groups identified (such as households headed by women, elderly, people with disabilities and their carers, etc) there is a High vulnerability of receptors and a Large magnitude of impacts. Therefore prior to mitigation, the effects associated with land acquisition and resettlement are considered as **Major** adverse (significant).

Direct Effects - Operation

Local Economy & Employment

8.8.49. The operation of the Project will create direct employment opportunities for local people. The Project currently employs 14,746 people due to the major construction works. The Construction period is assumed to last approximately 16 years and construction related jobs will gradually reduce over this period. After commissioning, the Rogun HPP JSC plans to employ about 800 people.

8.8.50. As construction ends and the transition to operation is complete, there are likely to be a significant reduction in the number of employees. These losses are likely to impact local communities to Rogun disproportionately since approximately 23% of workers comes from within 50km of the Project. There will be a need to retrench and reskill the construction workforce in order to replace the loss of income/livelihoods generated from the construction activities.

8.8.51. The operation phase will generate long-term employment opportunities mainly for HPP, environmental, health and safety, and monitoring activities. Given that women occupy only 5% of the construction workforce and are currently benefitting less from the employment opportunities, the Gender Action Plan includes measures to promote more employment opportunities for women in the water and renewable energy sector. Women economic empowerment is likely to improve in the region. The exact size of the workforce needed for operation is not determined at this stage.

8.8.52. The Project is expected to create long-term benefits for local communities and economic development for the region through the establishment of a benefit sharing mechanism. This mechanism will use funds from the HPP revenue to invest in the social, environmental and economic needs of the communities in the AoI and beyond. The reservoir is also expected to support eco-tourism opportunities after the reservoir is at full supply level. New skill-sets and job opportunities will be needed to support regional economic development. Enhanced job opportunities and improved skill-sets could lead to sustainable economic growth.

8.8.53. Due to the High vulnerability of the receptor, and Medium magnitude of impacts caused by the loss of construction jobs, the effects are considered as **Moderate** adverse (significant). While there could be benefits in the long term from the development of new sectors in the region, this will require extensive resources and time to develop fully.

Labour and Working Conditions

8.8.54. Employees of the operational Project are anticipated to experience similar working conditions to those currently provided (including similar shift patterns), however the workforce will be smaller in size, and primarily accommodated within Rogun and other local communities.

8.8.55. Due to the Medium vulnerability of the receptor, and Medium magnitude of impacts, the effects are considered as **Moderate** adverse significance before mitigation.

Community Assets and Infrastructure

8.8.56. FGD participants reported that living standards in the new settlements are better than in their previous locations in terms of infrastructure and employment. Participants raised the issue of availability of water in new settlements (in Faizobod and Darband (Nurobod)), but indicated that these issues had been resolved, or would be resolved before they move. Interviews with Jamoat representatives confirmed that upgrades to electricity and water infrastructure have been implemented in Faizobod and Tursunzoda.

8.8.57. Host communities are also benefiting from the improved public services and infrastructure by gaining more access to social services, such as improved medical facilities, schools, roads, cultural and recreational facilities.

8.8.58. Due to the High vulnerability of the receptor, and benefits that are already being realized, effects are considered as **Positive.**

Land Acquisition & Resettlement

8.8.59. While physical displacement activities are anticipated to be completed by the time the Project is operational, it is anticipated that economic displacement, and livelihood restoration activities will take longer to address.

8.8.60. Comments from the women-only FGD in communities due to be resettled identified that there was an expectation that the first 2-3 years in their new settlement might not be easy and will require some adaptation (rural to city living, pastoral to other employment). However, all groups of women anticipated that their new communities would offer more opportunities than were available to them in their existing settlements, resulting in a **Positive** effect.

Indirect Effects - Construction

Economy and Employment

8.8.61. Due to the size, scale and temporal length of the construction phase it is anticipated that there will be indirect opportunities created for employment, as workforce individuals create a greater demand for goods and services locally. This spending may support existing business, particularly in Rogun City, or support the establishment of new businesses.

8.8.62. Due to the Medium vulnerability of the receptor, and the anticipated beneficial impacts arising from the indirect employment, effects are considered as **Positive**.

Indirect Effects - Operation

Economy and Employment

8.8.63. In addition to direct employment provided by the operational Project, it is anticipated that the filled reservoir will lead to further beneficial indirect employment opportunities which are anticipated to arise in the newly created eco-tourism sector.

8.8.64. The local economy is expected to improve as a result of more employment, and diversity of economic opportunities, created both by the project operation and on the new reservoir, as well as through expenditure by visitors.

8.8.65. Due to the High vulnerability of the receptor, and the anticipated beneficial impacts arising from the indirect employment, effects are considered as **Positive**.

SUMMARY OF IMPACTS

8.8.66. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 11.**

Table 8-20 –Summary of Impacts – Social

Impact Factor	IF11-1 Increase in local income due to employment expenditure	IF11-2 Impacts due to inadequate safeguards to protect workers from unfair, unsafe, or other adverse working conditions				IF11-3 Loss of current community assets and infrastructure. New resettlement to provide improved infrastructure	IF11-4 Potential noise and air pollution and reduced safety and security of local families and construction workers.	IF11-5 Inclusion, vulnerabilities, and gender issues – risks for women including SEA/SH	IF11-6 Land acquisition and resettlement – acquisition & provision of replacement, land, and houses
Valued Component	**VC11-1** Local economy & employment	**VC11-2a** Labor influx	**VC11-2b** Gender	**VC11-2c** Labor Management	**VC11-2d** Occupational health and safety	**VC11-3** Community assets and infrastructure	**VC11-4** Community health, safety, and security	**VC11-5** Inclusion, vulnerabilities, and gender issues	**VC11-6** Land acquisition & resettlement
Sensitivity	High	Moderate	High	High	High	Moderate	High	High	High
Type	Positive	Negative	Negative	Negative	Negative	Positive	Negative	Negative	Negative
Extent	Regional	Local	Local	Local	Local	Regional	Transboundary	Local	Local
Duration	Medium-term	Medium-term	Medium-term	Medium-term	Medium-term	Long-term	Permanent	Long-term	Long-term
Frequency	Periodic	Constant	Constant	Periodic	Periodic	Constant	Infrequent	Infrequent	Constant

Impact Factor	IF11-1 Increase in local income due to employment expenditure	IF11-2 Impacts due to inadequate safeguards to protect workers from unfair, unsafe, or other adverse working conditions				IF11-3 Loss of current community assets and infrastructure. New resettlement to provide improved infrastructure	IF11-4 Potential noise and air pollution and reduced safety and security of local families and construction workers.	IF11-5 Inclusion, vulnerabilities, and gender issues – risks for women including SEA/SH	IF11-6 Land acquisition and resettlement – acquisition & provision of replacement, land, and houses
Likelihood	Likely	Likely	Likely	Likely	Likely	Likely	Likely/Unlikely	Likely	Certain
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Reversible/ Irreversible	Irreversible	Reversible	Irreversible
Magnitude	Beneficial	Medium	Large	Medium	Medium	Beneficial	Large	Large	Large
Significance	Positive	Moderate	Major	Major	Major	Positive	Major	Major	Major
Additional Mitigation?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Residual Significance	Positive	Minor	Minor	Minor	Minor	Positive	Major	Minor	Minor

MITIGATION AND RECOMMENDATIONS

Table 8-21 – Social – Mitigation and Recommendations

Valued Component	Overview of Mitigation Measure
VC11-1	**Local economy and employment** ▪ The contractor will be encouraged to employ local workers by providing preference to suitably qualified and experienced applicants from local communities. ▪ Develop and implement community benefit sharing program to improve regional economic development. ▪ Implement Gender Action Plan to improve socio-economic opportunities for women, this should be implemented by Rogun JSC by December 2024, or within 3 months of contract award.
VC11-2a VC11-2b VC11-2c VC11-2d	**Implement a Labor Management Plan** ▪ A Labor Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of labor in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors ▪ Measures will include, but not limited to: • Rogun JSC has documented their HR policy and procedures, ensuring they are in line with national legislation. Tendering processes will include policies on minimum working ages, normal working hours etc. A Labor Management Procedure will be developed and implemented, incorporating guidance on mental health, discrimination, employment contracts, and HR access. • Rogun JSC will ensure that the Project construction tendering process includes clauses and policies on minimum working age, normal working hours, freedom to collective bargaining, good working conditions, supply chain management, and measures to eradicate the risk of forced labour. • The Contractor(s) will develop and implement a Contractors Labour Management Procedures, as specified in the ESMP. • Project policies relating to non-discrimination, equal treatment, and equal pay for work of equal value in line with international standards will be implemented. • Development and implementation of a Construction Workers' Accommodation Management Plan which will include measures related to influx management and security.

Valued Component	Overview of Mitigation Measure
	• Elaboration of the Construction Workers' Code of Conduct (including policies on alcohol consumption and drug abuse, harassment and discrimination). • Workforce accommodation arrangements that house workers in separate and well-serviced self-contained facilities, as recommended in the Labour Audit required in the Labour Management Procedures, will continue to be utilized as much as possible. • Review and implement the applicable sections in the Workers' Accommodation Checklist. • Develop and provide awareness raising and training for workers and personnel in accordance with the Construction Workers Code of Conduct and other plans in the ESMP. • Rogun JSC will arrange independent audits and inspections of the construction sites and construction compounds every 6 months to ensure compliance with both national legislation and applicable ILO standards and recommendations. Living and working conditions will consistently meet international standards including safeguards to reduce GBV/SEA/SH risks to female employees and include regular monitoring and measures, such as adequate lighting around the roads and worker camps, well-lit lockable wash and toilet facilities, providing safe commuting transportation to and from work shifts and menstrual hygiene management facilities.
VC11-1	**Implement an Occupational, Health, Safety and Security Management Plan** ▪ An Occupational, Health, Safety and Security Management Plan Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of occupational, health, safety and security in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ Measures will include, but not limited to: • Two Community Liaison Officers (CLOs) will be appointed, one male and one female, to assist in SEP implementation and public consultations. • Provide private site security for the construction compounds and carry out screening and background checks on security guards hired. Provide SEA training to security workers as part of the Construction Workers' Code of Conduct in the Construction Management Plan. • Elaborate and implement the Health, Safety and Security Plan, which includes measure to ensure regular health checks of construction workers and the development of a policy for HIV/AIDS and other communicable diseases. • Measures will be implemented to reduce and mitigate effects associated with OHS risks. A Construction ESMP will be implemented and maintained, as well as a construction Emergency Response Plan (ERP).

Valued Component	Overview of Mitigation Measure
	• Consult with affected communities on suitable construction compound locations in accordance with environmental, social and economic criteria, as required in the ESMP and SEP. • The contractor will develop and implement a Community Health, Safety and Security Plan (CHSSP), which includes measures to protect local residents. Works are planned to be delivered safely, minimizing risks and disruption to road users, as well as the provision of temporary rehousing for areas with large adverse impacts. • The Contractor will ensure the works are planned to enable them to be delivered safely and, in a manner, which minimizes congestion, road safety risks and disruption for all road users, in accordance with the Construction Traffic Management Plan. • Provide temporary rehousing in areas in which large adverse impacts from noisy activities, and thus local nuisance / disturbance are expected, as described in Volume I, Chapter 8.4: Noise and Vibration. • Additional community health checks and monitoring of communicable diseases, awareness on prevention of diseases will be needed as part of CHSSP. • Ensure the public have access to the Project grievance mechanism so they can raise their concerns to the CLOs (as detailed in the SEP).
VC11-2	**Community Assets and Infrastructure** ▪ Undertake environmental assessments and precautionary safety measures during constructing communal infrastructure. ▪ Engage with communities to assess specific needs before designing and constructing communal infrastructure. ▪ Continue universal access application to best practice in all designs of communal assets and infrastructure.
VC11-2	**Implement a Gender Action Plan** ▪ A Gender Action Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans for management of gender in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors. ▪ Measures will include, but not limited to: • A gender-sensitive Code of Conduct (CoC) applicable to all workers will be implemented and widely communicated including as part of induction and refresher training.

<table>
<tr><th>Valued Component</th><th>Overview of Mitigation Measure</th></tr>
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Contractors will be contractually obligated to include provisions against GBV/SEA/SH, which will be stipulated within the CoC to be signed by all Project workers.
A gender-sensitive Grievance Redress Mechanism that allows for confidential submissions via a range of avenues will be implemented and well communicated including as part of induction and refresher training. Oversight will be established by an adequately experienced third party.
Appropriate and adequately trained staff will be employed to handle reports of misconduct including sensitive grievances. This includes engagement of a third-party expert gender consultant.
Participatory consultation processes will be implemented so that women’s voices, concerns and perceptions form part of project decision making, including in relation to resettlement, livelihood restoration, opportunities and concerns.
Additional compensation and assistance will be provided to vulnerable women (such as female heads of household) during resettlement processes.
During resettlement processes, women’s ownership rights will be recognized regardless of marital status as per international standards. Women’s security of tenure will be ensured for women on equal terms to men.
Explore opportunities to support service providers and facilities that seek to prevent and address GBV/SEA/SH in the project affected communities and generate positive outcomes and better gender equality for women.

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<tr><td>VC11-2</td><td>
Land Acquisition and Resettlement

Implement, monitor and report on the RAP measures from the completion of RAP2 Audit, including, but not limited to:

DFZ to establish a digitized database of all PAPs and PAHs, including vulnerable members.
Compensate all loss of assets, crops, fixed structures at full replacement cost
Conduct asset valuation for compensation 1 year before resettlement.
Adjust the final compensation value in line with yearly inflation if the transaction of the compensation is more than 1 year after final valuation.
Implement livelihood restoration measures in line with the RAP2 and LRP 2 approved by lenders.
Implement specialized measures for vulnerable groups as defined in the RLRF, RAPs and LRPs (i.e., additional compensation, assistance measures to cover vulnerable groups).
Ensure easy access to compensation payments for all PAPs through Amonatbank.
Regularly engage with PAPs to inform on the entitlements defined under the Guide for Land Acquisition and Compensation.

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Valued Component	Overview of Mitigation Measure
	• Collect, record, monitor, resolve and close-out grievances related to resettlement and livelihood restoration measures, in line with SEP provisions. • Appoint and train additional environmental, social, gender and engagement staff to implement RAPs and LRPs. • Follow and implement measures for employees of DFZ and its contractors defined in LMP, Code of Conduct, Gender Action plan. • Prepare monthly internal resettlement and livelihood monitoring reports and coordinate with other public agencies to collect relevant performance data. • Monitor progress on implementation of resettlement and livelihood measures against the defined monitoring indicators in RAPs and LRPs. • Engage third party RAP monitoring consultants for six-monthly external monitoring on resettlement and livelihood restoration. • Regularly publicize updates and information on resettlement process on national media, TV and other accessible community news sources. • Disclose external RAP monitoring reports both in-country in Tajik and in English/Russian on project website. • Undertake resettlement completion audits at the end of each RAP cycle.

8.9 GENDER IMPACT ASSESSMENT

8.9.1. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 12.**

KEY MESSAGES

- During construction, the project will have significant gender impacts. These relate to increased Gender-based Violence/Sexual Exploitation and Abuse/Sexual Harassment (GBV/SEA/SH) risks for women without a sensitive Grievance Redress Mechanism (GRM) and lack of referral pathways; lack of gender sensitive facilities (accommodation and transport) for women to work at the project site; weak management of health and safety consideration for women, unequal job opportunities coupled with biased recruitment policies (labour code that prohibits women from certain professions, social norms and caring responsibilities without kindergartens) and a livelihood restoration program that potentially leaves women and women-headed-households behind.
- During operation, these identified gender impacts/risks will remain, especially those related to GBV/SEA/SH, livelihood restoration for women and implementation of a strategic benefit sharing mechanism that delivers the economic dividends of the project to communities, including women and other vulnerable groups.
- Several social instruments are being prepared that also identify exclusion risks for women and propose mitigating measures in their respective domains. These include: (i) Stakeholder Engagement Plan, (ii) Resettlement Policy Framework and iii) Labour Management Procedures. Gender specific risks and mitigation actions identified across these instruments are consolidated through a Gender Action Plan (GAP) that summarises the project's overall commitment to manage gender-related risks and deliver benefits to women and girls. The GAP also identifies clear roles and responsibilities and budgetary allocation to deliver the gender actions committed by the project.
- Given the strategic significance of this landmark project, it provides several opportunities to enhance socio-economic benefits for Tajik women particularly by setting an example to effectively and sensitively handle GBV/SH/SEA complaints and referral pathways, by ensuring the livelihood restoration efforts include targeted interventions for women and by providing economic empowerment to women at the project site and in the resettled communities.

SUMMARY OF BASELINE CONDITIONS

8.9.2. Legislation of Tajikistan is fairly gender progressive, but there is still significant gap between the laws and their implementation and enforcement. The Committee for Women's and Family Affairs (Women's Committee) is the primary institution responsible for gender policy in Tajikistan, and its mandate focuses on measures to prevent violence against women and the provision of assistance to survivors of violence. The Women's Committee operates a network of regional information, consultation and crisis centres throughout the country.

8.9.3. In 2013, Tajikistan introduced the Law on the Prevention of Domestic Violence and the State Program for the Prevention of Domestic Violence 2014 – 2023 to attempt to reduce the level of domestic violence within the community and encourage victims to seek support. However, GBV remains prevalent in Tajikistan with spousal abuse reported to occur in approximately one third of marriages. For survivors of GBV, accessing social services can be challenging due to cultural stigmas and taboos and hard to access for women in rural Tajikistan as services are concentrated in urban areas. No current GBV projects are operating within the project area, although the UN's EU Spotlight Initiative, which aims to eliminate violence against women and girls, has been implemented in other districts close to Dushanbe. Social and cultural norms and traditional gender stereotypes that position women as homemakers remain persistent within Tajikistan, particularly in rural and remote areas. The participation of women in the labor force in Tajikistan is low, with approximately 69 percent of working age females not in paid employment in 2016 and the proportion of females in the total number of populations employed declining.

8.9.4. A high proportion of (mainly male) Tajiks work overseas and send remittances home. This substantially increases women's home-based responsibilities and impacts their ability to seek employment outside of the home. Rural women in Tajikistan are often faced with limited access to education, early marriages, family restrictions, restricted access to financial resources including credit and grants, limited land resources or restricted rights to land ownership, which hinder their employment opportunities. The primary occupation for most women in the regions is unpaid domestic work and childcare. Currently, most women employed on Rogun HPP are engaged in roles focused on cleaning, preparing food for workers and washing dishes as well as a small number of women nurses working on site and a few women who work in administrative roles within the HR Departments at the different contractor organizations.

ASSESSMENT OF IMPACTS

8.9.5. The project provides the potential for opportunities and benefits for women among project affected communities and nationally (including employment and skills development, improved living and socio-economic conditions and commitments delivered through benefit sharing investments). However, the project also has potential to exacerbate existing inequalities with adverse impacts for women (including unequal access to employment, increased GBV and SEA/SH risks etc).

8.9.6. Mitigation and management of impacts are considered within the context of a mitigation hierarchy consistent with the World Bank's ESF and described below:

- Anticipate and avoid risks and impacts;
- Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels;
- Once risks and impacts have been minimized or reduced, mitigate; and
- Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible.

8.9.7. Consideration has been given to both the SEA/SH risks that the project may introduce or exacerbate and the local capacity to prevent and respond to incidents of GBVH.

8.9.8. The gender related impacts have been evaluated and ranked based on the findings of the research undertaken for this report, including the desktop review of national and project relevant policies, plans and documents, observations from the field visit and the local survey, focus group discussions (FGDs) and key informant interviews.

8.9.9. It is important to note that risks and impacts will change over time and so need to be continuously monitored throughout the project lifecycle, including new and evolving impacts and the effectiveness of mitigation measures.

Table 8-22 – Construction Phase Gender-Related Risks and Impacts

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
Workers' accommodation and potential large influx of majority male workforce	The large influx of a majority male workforce presents an increased GBV/SEA/SH risk for women in the local community and project workforce.	While the workforce is largely segregated from the community with on-site accommodation, there is still potential for workers to interact with communities such as Rogun City. Changing social dynamics can increase DV risk. Potential for demand for sex work, but no evidence to date for this. Evidence to date does not suggest that a significant increase in GBV/SEA/SH has occurred.	**Major** (Considering the High vulnerability of females within the workforce and community, and the Large magnitude of impacts).	Gender-sensitive Code of Conduct applicable to all workers including mandatory workforce training on this and mandatory GBV/SEA/SH provisions in contracts. Grievance Redress Mechanisms in place and well communicated to the workforce and local community. Appropriate, segregated workforce accommodation. Actions should be investigated to support the increased capacity of community service providers to prevent and respond to GBV/SEA/SH.
Gender appropriate facilities and accommodation	Inadequate or inappropriate worker accommodation and facilities increases the vulnerability of women.	All workforce accommodation needs to meet international standards to manage GBV/SEA/SH risk and encourage women to seek employment opportunities at Rogun HPP. Safe transport needs to be in place for female employees.	**Major** (Considering the High vulnerability of females within the workforce, and the Large magnitude of impacts).	Improve living and working conditions for project workers to a level that meets international standards and includes safeguards to reduce GBV/SEA/SH risks to female employees. Implement women-only transport arrangements for female workers. Appropriate GRM in place.
Health and Safety for female employees	The work environment may present health and safety risks for female employees.	Work conditions that are not gender-sensitive may adversely impact female employees.	**Major** (Considering the High vulnerability of females within the workforce, and the Large magnitude of impacts).	Integrating gender-responsive H&S measures across the Project site, including adequate lighting around the roads and worker camps, well-lit lockable

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
				washing and toilet facilities, providing safe commuting transportation to and from work shifts and menstrual hygiene management facilities. Undertake gender-sensitive H&S assessments for each job/task and implement appropriate mitigation/control measures.
Internal capacity & gender mainstreaming	Lack of adequate policies, procedures, GRM or reporting mechanisms increases vulnerability of women working on the project due to limited capacity and tools to manage sensitive grievances.	Currently the project lacks adequate GRM, project wide Code of Conduct, adequate HR policies and internal capacity to manage SH/SEA risks and grievances.	**Major** (Considering the High vulnerability of females within the workforce, and the Large magnitude of impacts).	Implementation and promotion of sensitive GRM aligned with international standards and requirements, project wide CoC, workforce training on CoC and gender aspects. Project to be resourced with appropriately trained staff to manage gender aspects.
Recruitment bias	Poor quality policies and procedures presents a risk of discrimination and bias during recruitment processes.	This may disadvantage women and prevent them from having equal access to opportunities.	**Major** (Considering the High vulnerability of females within the community and workforce, and the Large magnitude of impacts).	Mandate policies of non-discrimination, equal treatment, and equal pay for work of equal value in line with national legislation and international standards. Staff training on policies.
Resettlement and livelihood restoration	Resettlement can potentially leave women at increased risk of GBV.	Increased pressure, potential changes in social dynamics and loss of social networks could expose women to higher levels of vulnerability including risk of DV. Women's newly created access to economic opportunities can present DV risk as social norms are disrupted. Women's real and perceived safety may be impacted if resettled into communities considered to be unsafe.	**Moderate** (Considering the High vulnerability of females within the community, and the Small magnitude of impacts).	Conduct resettlement processes in accordance with the Resettlement and Livelihood Restoration Framework, Resettlement Action Plan, and in line with national and international standards.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
				Effective GRM in place and promoted. Build internal capacity to address sensitive grievances and refer women appropriately.
	Resettlement can lead to increased vulnerability and disadvantage for female heads of household.	Specific needs and requirements for female HoH must be accounted for in the resettlement process.	**Moderate** (Considering the High vulnerability of females within the community, and the Small magnitude of impacts).	Additional compensation and assistance should be provided to vulnerable groups such as female headed households as per the RLRF. Livelihood restoration processes to consider female HoH. Inclusive consultation processes to capture needs of women. Support including transportation and construction for female headed households during resettlement. Communicate support available to impacted communities.
	Resettlement processes may place women at risk of losing assets or compensation where there is a lack of clear ownership or tenure.	Women can be placed at risk during displacement and resettlement where there is a lack of clear housing ownership and tenure security if women's rights are informal, for example if a divorce is not formalized or in the case of unregistered marriages.	Moderate (Considering the High vulnerability of females within the community, and the Small magnitude of impacts (assessed as 'Small' due to little evidence that this has emerged as an issue to date).	Compensation should be provided in the name of both spouses as per international and national standards. Security of tenure should be ensured for women on equal terms to men, as required by national law. Women's ownership rights will be recognized regardless of marital status as per

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
				international and national standards. Legal assistance to be provided in cases where ownership is not formalized.
	Resettlement processes may disproportionately and adversely impact women who rely on informal income generation activities.	FGDs show optimism among women around enhanced opportunities through resettlement and livelihood processes. However women are more likely to rely on informal income generation e.g. selling excess produce and homemade wares at markets and roadsides and their ability to do this may be disrupted. Women moving from rural to urban areas can be impacted by reduced opportunities for agricultural livelihoods and the need to gain additional income-generating skills. Women wishing to enter the workforce for the first time will also require special support and consideration. Many women PAPs do not have an income, leaving them vulnerable due to a lack of economic independence and agency which could be exacerbated if informal income generation is impacted. Women stressed a need for culturally acceptable jobs and kindergarten facilities to allow them to access new opportunities.	Moderate (Considering the High vulnerability of females within the community, and the Small magnitude of the impacts (assessed as Small due to limited evidence to date that women local to the project are overly reliant on informal income generation activities).	Compensation packages and additional support for vulnerable groups must be provided in accordance with the RPF . Continued consultation to understand impacts and perspectives of women related to livelihood restoration and enhancement measures. Ensure that kindergarten facilities are provided at resettlement sites. partnerships to PROVIDE training and employment opportunities for women affected by resettlement.
	Resettlement may adversely impact on the ability to undertake subsistence farming and therefore food security for women.	The majority of households within the project area practice some level of subsistence farming, relying on this for food and generating income from selling surplus, although for the majority this is not their main income stream. However household survey data shows a small proportion of women nominating subsistence farming as their primary source of income (0.7%).	Minor (Considering the High vulnerability of females within the community, and the Very Small magnitude of the impacts (assessed as Very Small due to limited evidence to date that women local to the project are overly reliant on subsistence farming for food security).	Understand reliance on subsistence farming for food through Census and Household Survey. Continued consultation with women to understand project impacts and inform livelihood restoration programs.
	Resettlement may adversely impact women by disrupting	Women are likely to be disproportionately impacted by infrastructure and service interruption as women are the	Moderate (Considering the High vulnerability of females within the community, and the Small	Understand use of and reliance on resources from Census and

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	access to resources or services and increasing the burden relating to unpaid and home-based work.	main users of utilities at home and largely responsible for childcare. Women express optimism about improved access to resources – such as water – in resettled communities. Previous observations have shown instances where schools, kindergartens and water infrastructure were not fully established when families resettled.	magnitude of impacts (Assessed as Small considering the likelihood with many resettled and host communities positive about the facilities available).	Household Survey and consultation. Plan for new communities appropriately including social infrastructure, particularly kindergartens and schools, and services needs and ensure fully operational prior to resettlement.
	Loss of social capital due to resettlement may increase women's vulnerability.	Social and other support networks – which women particularly often rely on - can be disrupted. HoH/HoF have a free choice between resettlement sites and FGD data suggests that some women have a strong influence on resettlement decisions, whilst others (particularly young women living with parents or in-laws) have limited voice.	Minor (Considering the High vulnerability of females within the community, and the Very Small magnitude of impacts (Assessed as Very Small due to the likelihood being low with efforts being made to relocate communities together / provide choice).	Equal and inclusive consultation processes to ensure that the concerns and needs of women are understood and accounted for and that women are empowered as far as possible to contribute to decisions about resettlement, in line with the RLRF and SEP.
	Resettlement and livelihood restoration processes may present competition for resources resulting in conflict that increases the vulnerability of women.	Current evidence suggests that host communities are not losing access to services or resources due to resettlement.	Minor to Positive (Considering the High vulnerability of females within the community, and the Very Small or Beneficial nature of impacts (Assessed as Very Small to Beneficial due to the likelihood being low with women in host communities positive about benefits relating to improved facilities, infrastructure and job opportunities)).	Well planned resettlement communities with adequate social infrastructure and services to avoid pressure or competition for these. Inclusive consultation processes with host communities including men and women.
	The process of splitting large households into smaller family units may impact women's position within the household dynamic,	During resettlement, large households containing multiple nuclear families are provided with an additional land plot for each family as an additional benefit. Current evidence from FGDs and household surveys suggest that this additional benefit is welcomed by PAPs. However, it is possible that, in individual cases, women	Minor to Positive (Considering the High vulnerability of females within the community, and the Very Small to Beneficial nature of impacts, given the evidence.	Implement and communicate effective GRM. Build internal capacity to address sensitive grievances and refer women appropriately.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	positively or negatively.	may become more isolated and vulnerable, particularly in DV situations.		
Equal access to project opportunities	National legislation (the Labor Code that prohibits women from certain professions) as well as social norms and traditions, care and home-based responsibilities or family pressures may lead to women having unequal access to opportunities to benefit from the project.	Legislation, social norms, home-based duties and poor policies and procedures. Unequal participation in consultation and decision-making processes mean that the views and interests of women are less likely to inform benefit sharing initiatives.	Major (Considering the High vulnerability of females within the community, and the Medium magnitude of impacts (Assessed as Medium due to the extent and duration of this impact)).	Skills development programs for women, leveraging partnerships. Awareness raising and normalizing of accessible opportunities for women. Clear and mandated policies and procedures relating to non-discrimination, equal treatment, equal pay for work of equal value and transparent recruitment opportunities. Establish safe and appropriate transportation for female workers. Availability of childcare such as kindergartens to enable women to seek employment. Continued consultation with women so that women's views are understood and incorporated and influence outcomes.
Decision-making	Factors including social and cultural norms, care responsibilities may result in women being excluded from or having a limited role in decision-making.	Male dominated decision making can mean women's views are not understood, including how they are impacted and their views on project benefits.	Moderate (Considering the High vulnerability of females within the community, and the Small magnitude of impacts (Assessed as Small due to few women expressing dissatisfaction with their lack of participation and the potential for mitigation measures to address this impact)).	Enable consultation with women using female facilitators, providing transport and childcare arrangements, considering access for women with disabilities and of different ages. Leverage Jamoats, village heads and women's councils to encourage inclusive male and

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
				female participation in decision-making.
Gender Referral Pathway	A lack of gender-related services and support leaves women more vulnerable to GBV/SEA/SH.	Nationally and locally there is a lack of services including shelters and a lack of awareness among survivors of their rights.	Major (Considering the High vulnerability of females within the community, and the Major magnitude of the impacts).	Map and understand referral pathways and services and support available to women including survivors of GBV/SEA/SH. Appropriate GRM and internal resourcing to address grievances and refer survivors. Explore opportunities to support and increase the capacity of local service providers.
Security personnel	The use of security personnel on the project can increase risks of SEA/SH.	As potential perpetrators, the use of security personnel can increase the risk of GBV/SEA/SH. The current lack of a gender-sensitive Code of Conduct exacerbates this risk. However, current evidence does not suggest this is serious concern.	Minor (Considering the High vulnerability of females within the community, and the Very Small magnitude of the impacts (Assessed Very Small due to a lack of evidence of any issues with security, the majority of which are reportedly military)).	Security personnel to be screened as appropriate. Security personnel to sign and be trained on project Code of Conduct that includes reference to GBV/SEA/SH. Security and safeguarding measures such as CCTV to be considered. Consider security staff of both genders.
Community Health and Safety	The large influx of a majority male workforce presents an increased risk of the spread of communicable disease including sexually transmitted diseases.	Women are at risk of being adversely impacted by the spread of communicable disease including Sexually Transmitted Diseases (STDs). Evidence from household surveys suggests a very small proportion of the community are concerned about this issue.	Moderate (Considering the High vulnerability of females within the community, and the Small magnitude of the impacts (Assessed Small due to current lack of evidence of increased spread of disease within the community)).	Women's access to health facilities and availability of education and testing regarding sexually transmitted diseases. Training and awareness for project workers to cover Sensitization on STDs/STIs/communicable diseases.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	Resettlement within new communities and environments can risk adverse health impacts including stress related impacts.	Moving to a new environment (e.g. from a rural to urban or peri-urban environment) and resettling can present risks of health impacts including physical and mental health impacts, including for women. This impact may be exacerbated for women who are vulnerable or disempowered in decision-making.	Minor (Considering the High vulnerability of females within the community, and the Very Small magnitude of the impacts (Assessed Very Small due to current evidence showing women overwhelmingly are positive and optimistic about resettlement)).	Ongoing consultation to understand women's concerns and needs. Awareness of GRM and health and psychological services. Increase awareness of policies and support available in relation to resettlement to avoid stress and anxiety caused by the unknown.
Economic empowerment	The project has the potential to present employment and economic empowerment opportunities for women seeking work or skills development.	The project – including resettlement and livelihood restoration - has the potential to offer a range of opportunities to increase women's labor market participation, and economic empowerment opportunities to women seeking these. FGD data supports the conclusion that many women in PACs wish to enter / remain in the workforce, and some in post-resettlement communities have already done so.	Positive (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	Equal opportunity policies in place and understood in line with national and international standards. Ongoing consultation to understand and develop desired opportunities for women, to deliver skills and training opportunities for women that align with community needs and employment opportunities. Benefits sharing mechanisms to be developed in equal consultation with women and men.
Community infrastructure and services	Resettled families may have access to better community infrastructure and services including education opportunities for girls.	The lives of resettled women and girls (and those in host communities) may benefit from improved access to services and community infrastructure through investments and commitments delivered as part of resettlement and livelihood restoration processes. These have the potential to ease burdens on the lives of women, reduce vulnerability or increase access to opportunities.	Positive (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	Well planned resettlement communities with appropriate infrastructure, services and facilities to meet needs of both men and women and enhance lives and livelihoods. School facilities and transport available to encourage girls' educational attainment.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
Gender mainstreaming	Gender mainstreaming measures implemented by the project can improve lives and livelihoods of women.	Gender mainstreaming measures can positively impact social norms and expectations in favour of gender equality.	Positive (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	Implement gender mainstreaming including gender-sensitive Code of Conducts, policies and procedures, GRMs and widespread accessible communication and awareness raising activities targeting project and community audiences. Explore opportunities to support local service providers and gender initiatives to enhance their impact in relation to improved gender equality.
Benefit sharing mechanisms	Investments and commitments made in benefit sharing can lead to positive outcomes and shared benefits for women.	Benefit sharing mechanisms can improve lives and livelihoods of communities impacted by the project including women. For example, through improved community infrastructure or services, energy infrastructure or jobs and training opportunities.	Positive (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	Implementation of a strategic benefits sharing strategy informed by community participation (including women).
Gender wage gap	The gender wage gap that exists in Tajikistan risks perpetuating gender inequality and discrimination.	This can increase women's vulnerability including economic dependence and impeding the economic empowerment of women.	Minor (Considering the High vulnerability of women in the community and workforce and the Very Small magnitude of impact (Assessed as Very Small due to a low likelihood in the context of the project which adheres to ILO conventions)).	Gender wage gap.
Electricity supply	Improved electricity supply and a reduction in energy poverty can positively impact the lives of women as domestic	Improved electricity supply leads to better living and socio-economic conditions and health outcomes for households across the country including the creation of jobs and economic stimulation. Women stand to benefit from these improved living conditions, especially considering that they	Positive (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	Electricity supply.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	tasks are made easier and health improved.	are often disproportionately adversely impacted by energy poverty.		
Gender wage gap	The gender wage gap that exists in Tajikistan risks perpetuating gender inequality and discrimination.	This can increase women's vulnerability including economic dependence and impeding the economic empowerment of women.	Minor (Considering the High vulnerability of women in the community and workforce and the Very Small magnitude of impact (Assessed as Very Small due to a low likelihood in the context of the project which adheres to ILO conventions)).	Gender wage gap.

Table 8-23 – Operational Phase Gender-Related Risks and Impacts

Key Aspect	Gender Related Risk / Impact	Description	Significance of Risk (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
GBV/SEA/SH	Changes to local populations and social fabric may enhance the vulnerability of women and girls including GBVH risks	Changes to local community profiles or an influx of visitors (for example through tourism) may present risks of GBV/SEA/SH to local women and girls.	TBD (More detailed context relating to operation phase required to assess this accurately).	Gender-sensitive GRM appropriate for operation phase. Inclusive consultation processes to understand and account for women's views on project impacts and mitigation measures. Gender-sensitive code of conduct applicable to all project workers employed for operation and maintenance phase. Training and regular refreshers on code of conduct for all O&M phase project workers.
Economic empowerment	Employment opportunities may benefit women.	Employment opportunities related to operation of the Rogun HPP or related industries such as eco-tourism may benefit women seeking economic empowerment.	Positive (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	Strategic skills development and training for women based on understanding of future demands during operation phase. Unbiased, non-discriminatory recruitment processes for operation phase jobs. Leverage partnerships to support skills development for women in relation to tourism and future needs and opportunities.

8.10 CULTURAL HERTIAGE IMPACT ASSESSMENT

8.10.1. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 13**.

KEY MESSAGES

- The cultural heritage baseline for the Project includes elements of physical heritage, incorporating palaeontological, archaeological and historic resources; and ethnographic heritage, which includes places of local cultural significance for Project Affected Communities (PAC), related intangible heritage, traditional practice and local knowledge.
- A programme of research and consultation has been completed in participation with both local cultural heritage experts and PAC to establish the current baseline conditions for the Project.
- The 2023 baseline update acknowledges that construction of the HPP has been underway since the 1980s. Several areas of proposed Project footprint are therefore already disturbed while several PAC are resettled, or in an active resettlement currently.
- The assessment of impacts in relation to cultural heritage is focused on two key aspects: cultural heritage resources that have been identified within the Project area that will be subject to preparatory works, resettlement and flooding (i.e., direct impacts); and cultural heritage resources within the perimeter of the reservoir that may be subject to secondary land slippage and/or alteration of landscape setting (i.e., indirect impacts).
- Impacts from ongoing construction activities and future operations can be readily mitigated through implementation of the measures detailed in the Cultural Heritage Management Plan (CHMP).
- The CHMP includes a requirement to evaluate, and potentially excavate and record / relocate, identified resources which will fall with the proposed flooding zone and near perimeter (landslip 'risk zone') while a Chance Find Procedure will proactively manage any accidently impacts to tangible resources that have not yet been identified.
- The CHMP also details the mitigation programme to manage anticipated impacts to intangible resources and cultural and sacred receptors, particularly where loss of access to existing cultural resources and / or relocation is predicted. These programmes will be completed in close consultation with PAC, DFZ and applicable stakeholders.
- Resources (archaeological and cultural) within the remainder of the proposed footprint will be presented as areas for avoidance and physical demarcation (with barriers) during all groundworks. Where necessary, ongoing monitoring programmes to ensure the effectiveness of this mitigation programme, will apply.
- Following the successful implementation of the CHMP, no residual impacts above minor significance in relation of cultural heritage are anticipated.

SUMMARY OF BASELINE CONDITIONS

8.10.2. The preparation of a comprehensive cultural heritage baseline was completed in three stages: a rapid desktop review of existing data, a targeted archaeological reconnaissance survey and a phase of community consultation and related survey specific to ethnographic cultural heritage. WSP's programme has been supported by experts at the A. Donish Institute in Dushanbe, who are also legally mandated (Chapter 3, Article 23, 2017) to carry out all cultural heritage survey within the Project zone.

8.10.3. The baseline cultural heritage surveys and consultations were completed by archaeology and ethnography expert teams at the A. Donish Institute in June and August – September 2023, identifying 45 archaeological, historic, and palaeontological resources and 36 cultural and sacred resources throughout the Project area.

Area of Influence

- A 1 km buffer around the Full Supply Level (FSL) and all Project components.
- This 1 km buffer is refined from a wider 20 km baseline buffer, which has allowed for a detailed appreciation of cultural heritage resources found within the wider area, to understand their rarity, historic association, and cultural context.

ASSESSMENT METHODOLOGY

Valued Components

7.1.2. To enable an analysis of potential Project-related impacts on cultural heritage, the full suite of resources, comprising archaeological, historic and palaeontological resources, natural features that embody cultural values and intangible forms of culture, as defined by ESS8, were considered as Valued Components (VCs) for the assessment. These are summarised below.

- Archaeological, Historic and Paleontological Resources (**VC13-1**) represents the ancient history of the Project area. Receptors include:
  - Isolated artefacts or groups of artefacts (pottery sherds, lithic debitage)
  - Evidence of past human activity (settlement areas, rock shelters, rock carvings)
  - Fortified sites and outposts (fortresses and watchtowers)
  - Historic buildings
  - Palaeontological resources (fossils)
- Cultural and Sacred Resources (**VC13-2**) represents tangible resources associated with ethnographic heritage of the Project area. Receptors include:
  - Sites of spiritual, religious significance or festivity (including mosques and shrines)
  - (Ancient) cemeteries and burial grounds
  - Sacred trees and other natural features of cultural importance (including spring sites, medicinal plants)
  - Central ‘magical greeting’ pillars found within many traditional houses
  - Cultural landscape
- Intangible Cultural Heritage Practice (**VC13-3**) represents local cultural activities and behaviours, with a number of unique practices recognised in the more isolated and historically remote village communities. Receptors include:
  - Storytelling and legends (unique cultural knowledge / oral history)
  - Practice of traditional medicine / healing (unique cultural knowledge)
  - Ritual and ceremony (associated with rites of passage, birth, marriage, death)

- Traditional craft activities (wool carpet weaving, carpentry painted with regional motifs, needlework and embroidery, iron-mongering, musicians making their own instruments and playing traditional music)
- Traditional construction techniques, including use of traditional clay hearths

Impact Factors

- Impact Factor **(IF13-1)** – Ground Disturbance Activities – Construction
- Impact Factor **(IF13-2)** – Emissions of Dust, Noise and Vibration – Construction
- Impact Factor **(IF13-3)** – Resettlement of PAP – Construction
- Impact Factor **(IF13-4)** – Presence of the Reservoir – Construction and Operation

Table 8-24 – VC versus IF matrix

VC vs IF	IF13-1 – Ground Disturbance Activities	IF13-2 – Emissions of Dust, Noise and Vibration	IF13-3 – Resettlement of PAP	IF13-4 – Presence of the Reservoir
Archaeological, Historic and Paleontological Resources (**VC13-1**)	✓	✓		✓
Cultural and Sacred Resources – (**VC13-2**)	✓	✓	✓	✓
Intangible Cultural Heritage Practice (**VC13-3**)			✓	✓

ASSESSMENT OF IMPACTS: CONSTRUCTION

VC13-1 – Archaeological, Historic and Palaeontological Resources

8.10.4. The construction phase of the Project is ongoing (the dam will be completed in approximately 2029). It will include a series of key activities related to the development of the hydropower dam and supporting infrastructure (access roads, tunnel portals and power transmission etc.). During this phase it is anticipated that all ground works, including levelling and grading, topsoil removal and other preparation activities have the potential to disturb both known and unknown resources throughout the Project footprint.

8.10.5. The introduction of heavy machinery (e.g., bulldozers, excavators, dump trucks, vibrating roller, crane and other equipment and machines) could result in the direct destruction of archaeological, historic and palaeontological sites through a change in the existing land surface, site's environmental context, and therefore, its material value. Construction activity may also result in ground compaction or vibration (e.g., as heavy equipment is transported).

8.10.6. Direct construction phase impacts are predicted to occur to 14 known receptors within the AoI, which incorporates the proposed Project footprint. These include the locations of fortresses, abandoned and historic settlements and structures and palaeontological resources (fossils). The direct disturbance and loss of these resources would result in an impact, prior to the implementation of appropriate mitigation (outlined in **Table 8-26**), that is permanent, irreversible and with the potential to occur locally - within multiple discrete locations throughout the proposed Project footprint. These impacts would be large in magnitude, upon individual resources which that are (on a worst-case basis) highly sensitive, resulting in a **major** significance.

8.10.7. Indirect impacts to seven archaeological and historical resources (fortresses) are also anticipated due to potential changes to their immediate environmental setting and due to their proximity to the maximum inundation zone. Indirect impacts of this nature would be temporary, related to the use of heavy machinery during the construction period, they would temporary, local and upon receptors of medium sensitivity. Pre-mitigation this would result in an impact of **moderate** significance.

VC13-2 – Cultural and Sacred Resources

8.10.8. The introduction of heavy machinery (e.g., bulldozers, excavators, dump trucks, vibrating roller, crane and other equipment and machines) could result in the direct destruction of cultural and sacred resources (burial grounds, ritual objects, sacred places etc.) through a change in the existing land surface and the direct destruction of the site's material value. Construction activity may also result in ground compaction or vibration (e.g., as heavy equipment is transported), affecting cemeteries and burial sites.

7.1.3. Direct construction phase impacts are predicted to occur to 32 known receptors within the AoI, which incorporates the proposed Project footprint. These include the locations of cemeteries, tombs, mosques and springs which are considered low to high in terms of cultural heritage value and sensitivity. The direct disturbance and loss of these resources would result in an impact, prior to mitigation, that is permanent, irreversible and with the potential to occur locally - within multiple discrete locations throughout the proposed Project footprint. These impacts would be high in magnitude, upon individual resources which that are (on a worst-case basis) **major** sensitivity.

8.10.9. Indirect construction phase impacts, to the local environmental setting, are predicted to occur to four known receptors within the AoI, which incorporates a 1 km buffer around all proposed Project footprint infrastructure. Without mitigation, there is potential for culturally sensitive materials to be re-deposited, damaged or destroyed following secondary landslips that may occur in the vicinity of the reservoir perimeter - as it gradually filled throughout the construction phase. Four resources within the immediate vicinity of the FSL are highlighted. On a conservative basis this impact is permanent, irreversible and with the potential to occur locally - within multiple discrete locations throughout the proposed Project footprint. These impacts would be high in magnitude, upon individual resources which that are (on a worst-case basis) highly sensitive. This would result in a **major** significance.

VC13-3 – Intangible Cultural Heritage Practice

8.10.10. Intangible cultural heritage is distinct and integral to the isolated, rural mountain communities within the Project AoI, incorporating traditional music, dance, food, crafts and ceremonial activities.

8.10.11. Selecting the severity of impacts from these activities is subjective, with change from the local cultural norm perceived as either potentially positive or negative. Anecdotal evidence gathered during informal consultations suggested that older generations feel more 'attachment' to their villages within the AoI, with younger generations excited to engage with the opportunities afforded by a more urbanized setting. In the context of the Project and prior to mitigation, potential a loss, deviation, or dilution of normal cultural behavior is considered a negative impact.

8.10.12. If impacts are to occur, they could be of unknown and, therefore, **major** significance, on a worst-case basis) and throughout the duration of construction. Societal changes are considered irreversible in the context of intangible cultural heritage.

ASSESSMENT OF IMPACTS: OPERATION

VC13-1 – Archaeological, Historic and Palaeontological Resources & VC13-2 – Cultural and Sacred Resources

8.10.13. This phase of the cultural heritage impact assessment is completed for the fully operational Project. This considers the reservoir to be flooded to the maximum extent (1,290 masl) in the year 2036. There is a continued risk, prior to the implementation of effective mitigation measures, that cultural heritage resources within the perimeter of the reservoir will be impacted by landslip.

8.10.14. Although this impact is expected to occur throughout the construction phase (as the reservoir is progressively filled), the FSL will vary seasonally, potentially triggering landslide movement which could affect cultural heritage resources. Any such landslide movement would likely occur close to the reservoir perimeter and be triggered by new erosion processes including changes in operational groundwater systems. The potential for archaeological, palaeontological or cultural features to be damaged as a result of landslide movement would depend on their proximity to the reservoir and the nature of the surrounding geology.

8.10.15. In the event of a large, rapid landslide movement, an impulse wave could be triggered within the reservoir that could inundate areas around the reservoir shoreline. Archaeological, palaeontological or cultural resources located close to the maximum inundation level (i.e., only slightly above 1,290 masl) are most likely to be affected by impulse waves.

8.10.16. On a worst-case basis, without the implementation of specific mitigation measures, there is potential for sensitive materials, of potential regional importance, to be re-deposited, damaged or destroyed following secondary landslips that may occur in the vicinity of the reservoir perimeter once it reaches FSL. Assuming their endurance throughout the construction phase, seven archaeological resources and four cultural and sacred resources, within the immediate vicinity of the MFL, are highlighted in this regard. These are situated within 1 km of the MFL and are particularly vulnerable to under-cutting and eventual slippage.

8.10.17. The extent of this indirect impact is difficult to quantify without further analysis of the archaeological resources in particular (beyond visual / surface inspection). On a conservative basis this impact is permanent, irreversible and with the potential to occur locally - within multiple discrete locations throughout the proposed Project footprint. These impacts would be high in magnitude, upon individual resources which that are (on a worst-case basis) highly sensitive. This would result in a major impact significance, pre-mitigation.

VC13-3 – Intangible Cultural Heritage Practice

8.10.18. Impacts to intangible cultural heritage, including local cultural landscape character, are predicted as the braided river valley / dispersed settlement character are incompatible with the presence of the operational reservoir, and as the resettlement of PAP is completed. The loss of access to specific (tangible) cultural and sacred resources is not assessed at operations phase, these are permanent impacts which are derived in the construction phase (associated with the current resettlement phase).

8.10.19. During the operations phase, the presence of the reservoir upon intangible cultural heritage practice is considered cumulatively for PAP. Selecting the severity of impacts from changes in cultural landscape character is currently poorly understood. It is recognized however, that although fundamentally the presence of the project will represent a major change – from an isolated, mountainous, braided river valley, the pace of change is very gradual. As consequence it is predicted that the 'shock' from impact is reduced and the opportunity for adaption and resilience in the face of change is high.

8.10.20. Resettlement of PAP will again be gradual and complete by 2032. Predicted deviations from the local cultural norm are perceived as either positive or negative and are also likely to vary by age group, with older generations likely to feel more 'attachment' to their villages within the AoI. In the context of the Project and prior to the implementation of specific, long-term, operations-specific mitigation, potential loss, deviation, or dilution of normal cultural behavior and experience is considered a negative impact.

8.10.21. If impacts are to occur, they could be of unknown and, therefore, high intensity (on a worst-case basis) and throughout the duration of construction. Societal changes are considered irreversible in the context of intangible cultural heritage and **major** in terms of impact severity (without mitigation).

8.10.22. Only moderate and major negative impacts and positive impacts prior to any mitigations are included in this chapter, the full impact assessment is presented in **Volume II, Annex 13.**

Table 8-25 – Cultural Heritage – Summary of Impacts

Impact Factor ** Worst Case*	Construction Phase									Operation Phase		
	IF13-1 - Ground Disturbance Activities		**IF13-2 -** Emissions of Dust, Noise & Vibration		**IF13-3 -** Resettlement of PAPs		**IF13-4 -** Presence of the Reservoir			**IF13-4 -** Presence of the Reservoir		
VCs	**VC13-1**	**VC13-2**	**VC13-1**	**VC13-2**	**VC13-2**	**VC13-3**	**VC13-1**	**VC13-2**	**VC13-3**	**VC13-1**	**VC13-2**	**VC13-3**
Sensitivity	High*	High	High*	High	High	High	High*	High	High	High*	High	High
Type	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Extent	Local	Local	Local	Local	Regional	Regional	Local	Local	Regional	Local	Local	Regional
Duration	Permanent	Permanent	Short-term	Short-term	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent
Frequency	Constant	Constant	Periodic	Periodic	Periodic	Periodic	Constant	Constant	Constant	Constant	Constant	Constant
Likelihood	Likely	Likely	Likely	Likely	Certain	Uncertain	Certain	Certain	Certain	Certain	Certain	Likely
Reversibility	Irreversible	Irreversible	Reversible	Reversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Magnitude	Large	Large	Small	Small	Large	Large	Large	Large	Large	Large	Large	Large
Significance	Major	Major	Moderate	Moderate	Major	Major	Major	Major	Major	Major	Major	Major
Additional Mitigation?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Residual Significance	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**

Table 8-26– Cultural Heritage Mitigation Measures & Recommendations

Valued Component	Overview of Mitigation Measure
VC13-1 **VC13-2** **VC13-3**	**Implement a Cultural Heritage Management Plan (CHMP)** ▪ This plan will be implemented by Rogun JSC by December 2024 (or within 3 months of contract award) for all EPC contractors and overseen by the Project Management Consultant. ▪ Avoidance • An “exclusion zone” (~25 m to account for the potential extent of sub-surface resources) around specific archaeological, historic and palaeontological resources. The Avoidance Plans will be incorporated into the CHMP and include all resources within the direct and indirect AoI and all resources (yet to be identified) within new-build resettlement sites. • Constraints mapping will be incorporated into the CHMP to facilitate the avoidance of sensitive cultural and sacred resources across the Project area. The construction phase avoidance plan will include all cultural and sacred resources currently identified within the AoI but outside the flooding zone and it will be updated as further resources are identified in participation with communities. ▪ Ongoing Engagement Programme • Where indirect environmental effects are predicted at cultural and sacred site receptors, additional cultural heritage mitigations will be recommended and detailed within the CHMP. This will include: – Plans for environmental screening (e.g., planting or additional noise barriers); – Plans for continued safe access to specific locations as necessary; – Plans for on-going consultation with village representatives yet to engaged by the cultural heritage experts in relation to cultural and sacred sites; and – Plans for continued, on-going consultation with site guardians / cultural leaders to monitor ongoing residual impacts and the effectiveness of proposed mitigations. • If the avoidance of cultural and sacred resources is not possible, as in the case of those identified within the proposed flooding zone, then relocation of the receptors may be the most appropriate form of mitigation, if at all possible. Alternatively, it may be considered more appropriate to move the receptor to a local museum where it can be easily accessed by local communities. Museums would provide opportunities to help manage equitable sharing of benefits of the Project while maintaining access to local cultural knowledge / associated artefacts.

Valued Component	Overview of Mitigation Measure
	• A Cemetery Relocation Best Practice Guide will be developed and implemented through the CHMP, in close consultation with local communities. It will outline the necessary steps that must be taken for burial and cemetery sites which cannot be avoided. The Cemetery Relocation guidelines will be compliant with Good International Industry Practices (GIIP). ▪ Archaeological and Palaeontological Minimisation • Archaeological evaluation comprising of a scheme of preliminary, shallow and targeted hand-dug test pits (e.g., 1 m x 1 m in size) through which the archaeological potential could be firmly established, and any further analysis undertaken (e.g., systematic excavation). • The location of palaeontological receptors recorded within the AoI will need to be verified and interpreted during the evaluation stage. This will require engagement with a palaeontological specialist, and, potentially, consultation with appropriate regional stakeholders to determine their significance. ▪ Chance Find Procedure (CFP) • Implementation of a Chance Find Procedure (CFP) is necessary to mitigate any accidental damage of both surface and sub-surface archaeological, historic and palaeontological resources, i.e., to provide a mechanism to address discoveries when a Cultural Heritage Expert is not present. • Continue ongoing engagement with non-governmental organizations (NGOs), such as the International Council on Monuments and Sites (ICOMOS) and UNESCO, and other stakeholders will be required throughout the construction phase. UNESCO's ongoing Silk Roads research program is of particular relevance, given the proximity of the flood zone to the Karategin sub-section of the ancient Silk Road route. ▪ Ethnographic Management • The CHMP will set out a strategy for maintaining community access to tangible sacred resources and facilitating respect for local intangible cultural heritage (traditions and taboos) to ensure that the negative socio-cultural effects are effectively mitigated. It may be necessary to demarcate areas to be avoided by noisy, dust inducing construction vehicles at certain times of the week/year to avoid disturbance of traditional ceremonial activities in proximity to construction routes, with regular platforms for community liaison recommended in this regard. In addition, this is will help to prevent any accidental loss of sensitive cultural assets throughout the construction phase (and beyond).
VC13-3	**Implement a Cultural Heritage Management Plan (CHMP)**

Valued Component	Overview of Mitigation Measure
	• This plan will be implemented by Rogun JSC by December 2024 (or within 3 months of contract award) for all EPC contractors and overseen by the Project Management Consultant. ▪ Awareness and Training Programme • Implementation of a Cultural Heritage awareness programme for specialist on-site staff (interacting with PAP), facilitating respect for local intangible cultural heritage, tradition and taboos will be incorporated in the CHMP as applicable for the constructions and operations phase (and throughout the remainder of the Project lifetime). It will include as a minimum: – Information on 'no go' areas to be avoided; – Relevant information on local cultural activities (e.g., rules governing certain places, or a schedule of seasonal ceremonies / festivities); – Information on local cultural sensitivities and acceptable behaviours; and – Any other pertinent issues to be discussed / prepared in participation with PAP. • The CHMP will also set out a strategy linking to the Project Livelihood and Restoration Programme (LRP). This programme would be specific to traditional crafts and skills, with the aim of ensuring that such intangible cultural heritage practice would not be completely lost as a result of the Project. The programme would be developed in close consultation with local communities and would be run from a central hub in each resettlement area, such as a museum. It may be appropriate to assign community cultural heritage 'champions' to organize courses and events. • Through careful management, and in consultation with local communities, it may be possible to create museums in each of the new built settlements under the guidance and management of professional museum experts. Museums like this would provide opportunities to help manage equitable sharing of benefits of the Project while maintaining access to local cultural knowledge / associated artefacts. This will need to be further explored as a model strategy for participatory management.
VC13-1 **VC13-2**	**Implement a Cultural Heritage Management Plan (CHMP)** ▪ This plan will be implemented by Rogun JSC by December 2024 (or within 3 months of contract award) for all EPC contractors and overseen by the Project Management Consultant. ▪ Upper Terrace Monitoring Program • A monitoring programme will need to be put in place to monitor ongoing slippage in the upper terraces of the valley and to assess the effectiveness of existing measures for ensuring slope stability (netting, gabions etc.). Slope stabilization techniques involving

Valued Component	Overview of Mitigation Measure
	excavation should be avoided to minimise the impact on archaeological, historic and palaeontological resources and cultural and sacred resources in the near perimeter.

8.11 LANDSCAPE & VISUAL IMPACT ASSESSMENT

KEY MESSAGES

- During construction, there is local landscape character and visual receptors amenity at a localised level only with moderate significance, such as the loss of some floodplain land, but mitigated with the implementation of a Landscaping and Planting Management Plan.
- Most of the construction activities are limited towards the dam site close to Rogun City. with some residents having direct views towards the project area. However, construction activities at the site have been ongoing since 2014.
- A Landscape and Planting Management Plan could be beneficial for improved visual amenity, where accessibility to the reservoir could be enhanced from footpaths and viewpoints.

SCOPE OF THE ASSESSMENT

8.11.1. The scope of the assessment included the following:

- Determining the existing situation (environmental baseline), analysing the existing landscape and visual context of the receiving environment and human receptors, within the defined study area.
- A brief desk-based review of the relevant guidance and planning policy context (where possible).
- A high-level review of local landscape character, including the existing site and features on the site.
- A high-level review of surrounding potential visual receptors located within the study area.
- Identification of the potential landscape and visual impacts associated with the Project during Construction and Operational phases.
- Identification of mitigation measures where the assessment identifies potentially significant effects.
- Description of the residual effects i.e., those effects upon the receiving environment that cannot be offset by proposed mitigation.

SUMMARY OF BASELINE CONDITIONS

8.11.2. This current baseline describes the existing landscape and visual character and context against the changes anticipated for the Project when the assessment was undertaken in July 2023.

8.11.3. The Project area is located in the Pamir Mountain range approximately 110 km east of Dushanbe on the Vakhsh river having an elevation that ranges between 1000 and 2000 m AOD. The river is intensively developed and accommodates five existing hydropower dams, of which the Project is the uppermost.

The landscape in the AoI is rural in character, with limited infrastructure. The local population are mostly involved in agricultural activities and cattle rearing for their livelihoods. The River Vakhsh cuts a V-shaped channel into the original U-shaped glacial valley, resulting in the river being framed by high mountains. A number of steep tributary streams join the river Vakhsh draining the adjoining hills. The landforms observed in the AoI include riverbeds, floodplains, river terraces, agricultural land on the floodplain, and predominantly steep sided mountain ranges.

Area of Influence

- The Area of Influence (AoI) for the purpose of this assessment is considered to be the maximum potential area over which significant impacts from the Project are likely to be experienced. For this assessment the AoI extends to 1 km from the Full Supply Level (FSL) of the reservoir (1290 m above mean sea level (amsl)).

ASSESSMENT METHODOLOGY

Valued Components

- Character Area: Vegetation (**VC15-1a**)
- Character Area: River and River Floodplain (**VC15-1b**)
- Character Area: Residential Settlements/ small scale agricultural land (**VC15-1c**)
- Visual Amenity: Residences on the North Bank edges (**VC15-2a**)
- Visual Amenity: Residences on the South Bank edges (**VC15-2b**)
- Visual Amenity: Workers (**VC15-2c**)
- Visual Amenity: Users of the highways (**VC15-2d**)

Impact Factors

- Impact Factor 1 (**IF15-1**) – Construction Activities
- Impact Factor 2 (**IF15-2**) – Operational Activities

ASSESSMENT OF IMPACTS

VC15-1 – Character Area

8.11.4. During construction phase, most of the landscape changes are confined to the dam site and its allied infrastructure, such as the construction camp, quarries, storage areas, and the associated noise and dust from construction traffic, working, and movement of people and plant. Approximately 1.3 km of the river reach has been blocked for construction of the dam. As a result, water has started to accumulate upstream of the dam site. The construction site covers an area of 20 sq. km.

8.11.5. Existing vegetation is limited and transient due to arable crop rotation, but some floodplain scrub/ grassland margins will also be permanently lost during construction. This effect would be direct, permanent and long-term.

8.11.6. Construction activities will have a direct effect on this character area close to the dam site due to proximity and physical loss of some floodplain land (as part of the Site is located within it). Construction activities would introduce potential additional noise, dust, wind-blown litter, construction vehicles and plant into the character area or its immediate setting. This effect would be direct, permanent and long-term but limited to the proximity of the dam site.

8.11.7. All the villages falling within the reservoir boundaries at FSL 1290 m amsl will be relocated by 2025. The village footprints will be cleared, and all material and building will be either shifted or demolished. Many of these villages have already been relocated. The residual effect would be moderate, direct, and permanent.

VC15-2 - Visual Amenity

8.11.8. Most of the construction activities are limited towards the dam site close to Rogun City. with some residents having direct views towards the project area. However, Construction activities have been ongoing for many years. Once the dam is constructed, most of the site will be inundated and views of construction removed.

8.11.9. Users of adjacent villages will have clear views of increasing water levels in the river due to the increasing height of the dam. Many of these villages have already been relocated and the remainder will have finished being relocated by 2032 depending on inundation.

8.11.10. Workers at the existing construction camp will be directly affected by the construction activities including noise, dust, traffic movement, plant and storage compounds. However, this will be seen in the context of the existing construction works and therefore these changes will be relatively characteristic.

8.11.11. Users of the existing highway will be directly affected by the required change in highways alignments. New alignments and bridges higher up the mountainside, will replace the submerged sections.

SUMMARY OF IMPACTS

Table 8-27 – Landscape and Visual - Summary of Impacts

Impact	IF15-1 – Construction Activities							IF15-2 – Operational Activities						
VC	**VC15-1a**	**VC15-1b**	**VC15-1c**	**VC15-2a**	**VC15-2b**	**VC15-2c**	**VC15-2d**	**VC15-1a**	**VC15-1b**	**VC15-1c**	**VC15-2a**	**VC15-2b**	**VC15-2c**	**VC15-2d**
Sensitivity	Low	Medium	Medium	High	Medium	Low	Low	Low	Medium	Medium	High	Medium	Low	Low
Type	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Positive	Positive	Negative	Positive
Extent	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local
Duration	Medium-term	Short-term	Short-term	Medium-term	Short-term	Medium-term	Medium-term	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent
Frequency	Periodic	Constant	Periodic	Constant	Constant	Constant	Periodic	Periodic	Constant	Periodic	Constant	Constant	Constant	Periodic
Likelihood	Certain	Certain	Certain	Certain	Certain	Certain	Likely	Certain	Certain	Certain	Certain	Certain	Likely	Likely
Reversibility	Reversible	Reversible	Irreversible	Reversible	Reversible	Reversible	Irreversible	Reversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Magnitude	Medium	Medium	Medium	Small	Small	Small	Medium	Medium	Medium	Small	Medium	Medium	Small	Small
Significance	**Minor**	**Moderate**	**Moderate**	**Moderate**	**Minor**	**Negligible**	**Minor**	**Moderate**	**Moderate**	**Minor**	**Positive**	**Positive**	**Negligible**	**Negligible**
Additional Mitigation?	No	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	No	Yes
Residual Significance	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**	**Negligible**	**Minor**	**Minor**	**Minor**	**Minor**	**Positive**	**Positive**	**Negligible**	**Positive**

MITIGATION AND RECOMMENDATIONS

8.11.12. Mitigation built into the design of the Project includes the following:

- Resettlement of villages to their preferred location;
- Removal/loss of natural and semi-natural habitat will be minimised throughout;
- All open excavations, hazardous materials, and plant machinery will be secured and made safe when not in use; and
- Minimise the use of artificial lighting on the site and where needed, use directional lighting.

Table 8-28- Landscape & Visual – Mitigation and Recommendations

Valued Component	Overview of Mitigation Measure(s)
VC15-1	**Soil Conservation** ▪ To be implemented by Rogun JSC from the effective date. ▪ (Most new land disturbance will take place at new resettlement sites, with only limited expansion of HPP construction areas. These measures will be applied to all areas where land is to be cleared or otherwise disturbed: ▪ All new land-clearing and ground-disturbing activities should begin with demarcation of the area to the disturbed, which should be kept to an absolute minimum. ▪ All useable soil material should be stripped and stored for future reuse. ▪ Soil should be stored in stockpiles under 3m in height). ▪ Soil that will remain more than one season must be kept moist (which may not be easy in dry seasons) and covered or vegetated with native grasses to protect against erosion, discourage weeds and to maintain active soil microbes. ▪ Stored soil will be used to cover barren ground when construction is complete. ▪ Land-clearing by the Forestry Agency should be undertaken as close in time to reservoir inundation as is feasible but will not require stripping and storage of soils. ▪ Immediately before inundation, formerly arable land that will be flooded should be made available to nearby communities (above the inundation zone) to recover topsoil for placement elsewhere.
VC15-1	**Preventing Erosion and Sedimentation**

Valued Component	Overview of Mitigation Measure(s)
	• Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces and soil stockpiles should be re-vegetated or stabilised as soon as is practically possible. • Areas potentially prone to landslides shall be vegetated where appropriate with native species.
VC15-1 VC15-2	**Implement a Landscaping and Planting Management Plan** ▪ A Landscape and Planting Management Plan will be developed by Rogun JSC to outline requirements. Within three months of the effective date, full details of the plan will be promulgated, with details for each Contractor. Each EPC Contractor will develop detailed plans in their respective areas and for their respective activities, to be approved by the Project Management Consultant within six months of the effective date for Lots 1 and 2 EPC Contractors, or by the time of mobilization for Lots 3A and 4 Contractors ▪ Character Area • Resettled areas near the reservoir shall be in keeping with the character of the area, and plots allowed for maintaining the traditional agricultural practises where appropriate. • A Landscaping and Planting Management Plan shall be developed to identify opportunities for screening of facilities where practicable typical of the natural vegetation of the area (prior to construction) to reduce impacts on the character of the area. • All planting should be undertaken in conjunction with a biodiversity specialist to identify opportunities for enhanced biodiversity gain (or no net loss). ▪ Improving Visual Amenity • A detailed Landscaping and Planting Management Plan shall be developed for the drawdown areas during operation for planting and opportunities to improve the visual amenity during these periods. • On the surrounding permanent roads and around the reservoir, Viewpoints shall be identified to enhance the visual amenity of the area. Where practicable areas for stopping shall be provided at these viewpoints. • The landscape plan shall identify opportunities for screening using vegetation and native species of negative views of facilities during operation. • Added enhancements in the landscape plan may consider access to safe areas of the reservoir (beaches, shallow margins etc) to improve accessibility to the reservoir, with circular footpaths etc and stopping points to enjoy the improved visual amenity

8.12 CONTAMINATED LAND

MITIGATION AND RECOMMENDATIONS

8.12.1. This is a summary of the mitigation and recommendations for Contaminated Land. The mitigation measures are listed throughout this Impact Assessment relevant to the technical aspects, but Table 8-29 will act as the full list for Contaminated Land (A04).

8.12.2. A number of actions and recommendations have been identified to reduce and where practicable mitigate widespread contamination from ongoing site works, or future activities, while assessing and addressing legacy contamination.

Table 8-29 Contaminated Land – Mitigation and Recommendations

Potential Source	Overview of Mitigation Measure(s)
Fuel Storage	▪ Each Contractor shall provide a detailed plan of all their current and past fuel storage and dispensing installations no matter how small the installation or how long the installation was in service. Rogun HPP shall compile the plans to produce a sitewide plan and inventory of all the fuel storage areas; ▪ An assessment of Russian standards utilised by a number of contractors shall be compared to the World Bank Group guidelines (referenced above). In the event 'Russian Standards' are below those set out in the World Bank Group Guidelines, WSP recommend a common standard is set for the Rogun HPP project, incorporating the above referenced guidelines. ▪ Irrespective of the whether the 'Russian Standards' are inadequate, a common standard shall be implemented for the Rogun HPP project, to allow for clearer inspections and auditing against a common standard.
Main Rogun Tank Farm (Construction Site 1)	▪ Implement and undertake annual integrity testing (also known as tightness testing) on both tanks and pipework), as a minimum. In the event of a failure the tank and or pipe run is to be taken out of commission. Due to the age of the plant and equipment, WSP do not recommend the equipment is repaired; ▪ Undertake weekly inventory reconciliation analysis, both retrospectively and continue to undertake the analysis until the facility is decommissioned. The records and analysis shall be reported regularly with any anomalies shall be flagged immediately to the Rogun HPP Environmental Management team; ▪ An assessment shall be undertaken to assess the appropriacy of local soil standards for TPH or whether Site Specific Assessment Criteria (SSAC) are required; and ▪ If possible, prioritise the installation of a new Rogun Tank farm in Construction Area 2, to allow the current tank farm to be decommissioned.
Abandoned Tank Farm	▪ The tank farm shall not be brought back into operation nor relocated within the Rogun HPP project. ▪ The tank farm and all its infrastructure shall be decommissioned and removed under a watching brief by a suitably experienced / qualified person, where soils and materials display visual and or olfactory evidence of contamination these shall be removed and stockpiled, in a suitable laydown area, prior to treatment and or disposal; and

	▪ Where visual & olfactory evidence of gross contamination extends beyond a safe excavation depth and or where temporary works would need to be deployed, alternative intrusive investigation methods shall be sought.
Disused Tank Farms	▪ Disused tank farms, shall be assessed for compliance against a common current standard, where installations do not and or cannot meet the required standard the tank farm and all its infrastructure shall be decommissioned and removed under a watching brief by a suitably experienced / qualified person, where soils and materials display visual and or olfactory evidence of contamination these shall be removed and stockpiled, in a suitable laydown area, prior to treatment and or disposal; and ▪ Where visual & olfactory evidence of gross contamination extends beyond a safe excavation depth and or where temporary works would need to be deployed, alternative intrusive investigation methods shall be sought.
Contractors Tanks and Tanks Farms	▪ All Contractor's fuel installations shall be assessed for compliance against a common current standard, where installations do not and or cannot meet the required standard the tank farm and all its infrastructure shall be decommissioned and removed under a watching brief by a suitably experienced / qualified person, where soils and materials display visual and or olfactory evidence of contamination these shall be removed and stockpiled, in a suitable laydown area, prior to treatment and or disposal; and ▪ Where visual & olfactory evidence of gross contamination extends beyond a safe excavation depth and or where temporary works would need to be deployed, alternative intrusive investigation methods shall be sought. ▪ Each Contractor shall implement and undertake annual integrity testing (also known as tightness testing) on both tanks and pipework), as a minimum. In the event of a failure the tank and or pipe run is to be taken out of commission; ▪ Undertake monthly inventory reconciliation analysis, both retrospectively and continue to undertake the analysis until the facility is decommissioned. The records and analysis shall be reported regularly with any anomalies shall be flagged immediately to the Rogun HPP Environmental Management team
Sewage	▪ Each Contractor shall provide a plan of all their current and past sewage arrangements no matter how small the installation or how long the installation was in service. Rogun HPP shall compile the plans to produce a sitewide plan of sewage arrangements across the project; and ▪ WSP recommend a common standard is set for the Rogun HPP project, incorporating the above referenced World Bank Group guidelines. **Construction Area 1** ▪ OJSC Rogun HPP Environmental Management need to better understand the sewage arrangements in Construction Area 1. WSP recommend the sewage systems schematics and plans are updated to reflect the current arrangements. ▪ Install correct septic tank design and maintenance measures to meet requirements (to avoid overflow and drainage to ground) and ensure regular collection with appropriate vehicles such as vacuum tankers. ▪ Ensure all sewage enters the sewage treatment system and is adequately treated prior to discharge avoiding any untreated septage being discharge to the surrounding environment;

	▪ Ensure treatment systems are controlled to include chemical alarms systems, shut off valves, appropriate storage of chemicals, training and implementation plan for accidental releases. ▪ An audit and inspection routine shall be developed for the treatment facility to include collection of samples to ensure compliance. **Contractors Compounds & Workshops** ▪ Sewage management within remaining areas including compounds / workshops shall be managed. In addition to sewage domestic wastewaters (laundry / kitchen) and industrial wastewaters shall be considered; ▪ If collected separately to sewage, control measures for domestic wastewater shall include avoiding discharge of hard-to-treat substances such as oils and grease. ▪ Measures for industrial wastewater shall include pre-treatment to removal any chemicals prior to the sewer to avoid any risks/hazards to the sewage and treatment system).
Wastewater Treatment and Run-off	**Workshops** ▪ Contractors shall direct runoff waters from drains and gullies from workshop areas through an interceptor prior to discharge into the river or to ground, allowing for the separation of free phase Light Non-Aqueous Phase Liquids (LNAPL) from water (significantly reducing the contaminant mass being lost to ground or surface water). ▪ Where workshops do not have a current drainage or gully system, the contractor shall ensure all runoff is contained, with all runoffs either being disposed/treated offsite, or onsite via interceptor(as a minimum). ▪ Additional treatment prior to discharge maybe necessary depending on the workshop activities and nature of any chemicals utilised. **Washout Areas** ▪ At ‘general use’ washout areas OJSC Rogun HPP shall establish an area where wash waters are contained and as a minimum undergo basic settlement prior to discharging to the river or reservoir. ▪ Advanced wash water treatment is likely not necessary due to the large dilution, however, if possible WSP would recommend a further assessment is undertaken to confirm; ▪ Where contractors ‘wash out’ within their own compounds or facilities, each contractor shall contain and treat any wash waters prior to discharge. As with the general ‘wash out’ area as a minimum any wash waters shall undergo basic settlement prior to discharge.
Landfills & Waste Management	▪ OJSC Rogun HPP shall provide clarity on the waste disposal arrangements on the Rogun HPP. Who is responsible for what waste stream; ▪ Where OJSC Rogun HPP are responsible for a waste stream, clear guidance on protocols and locations for how and where the waste can be deposited shall be circulated to all operators and contractors on the Rogun HPP project; and ▪ A ‘Quarantine Area’ shall be established and managed for problematic waste streams ‘such as unexpected wastes’ or where a suitable recovery or disposal facility cannot be established.

	Dump Sites ▪ The types of materials approved to be deposited at each location shall be clearly stated and enforced. Regular inspections of the areas shall be undertaken by OJCS Rogun HPP, with facility to remove any out of specification materials; and ▪ Where sites are closed for new deposits, the closure must be clearly communicated to the contractors' Access to closed sites shall be restricted and where practicable vehicular access physically impeded to avoid unsanctioned deposits. **Contractor Workshops** ▪ Each contractor / operator shall produce and provide OJCS Rogun HPP with a waste management plan, identifying the waste streams the contractor / operator produces, where the waste is stored and the disposal route for each waste stream; and ▪ OJSC Rogun HPP shall provide guidelines / standards on waste storage arrangements, including but not limit to; segregation secondary containment, maximum volumes to be stored and additional measures for sensitive locations.

8.13 TRANSBOUNDARY EFFECTS

WATER

8.13.1. During the filling of the Rogan Dam reservoir Tajikistan will only use their average annual unused water allocation under Protocol 566 to fill the Rogun reservoir. During dry years this approach may result in constrained water supplies to downstream users in riparian countries. It is therefore necessary to manage the filling of the Rogun Dam so as not to adversely affect downstream water users during dry years using existing water resource management systems and processes.

ENVIRONMENTAL FLOWS

8.13.2. The only significant transboundary effect for EFlows can come from the potential impacts to the streamflow of the Vakhsh River associated with the Nukus Declaration, Protocol 566 and the limits set by the Interstate Commission for Water Coordination (ICWC) in application of the Nukus Declaration. The latest agreements relevant to the operation of the Rogun hydropower project are presented under Chapter 2 of the Volume 1 of this ESIA. The Rogun HPP will be operated within the constraints of these agreements and so they inform the operational baseline for the project.

TERRESTRIAL BIODIVERSITY

8.13.3. No transboundary effects upon terrestrial biodiversity have been identified. The only receptor for which transboundary effects have been considered is migratory birds, who's conservation is often dependent upon suitable habitat/features being maintained across a number of countries. No significant adverse effects were identified for migrating birds and therefore transboundary effects are not considered any further.

AQUATIC BIODIVERSITY

8.13.4. No transboundary effects upon aquatic biodiversity have been identified. Regulated flows and longitudinal migration routes from the Amu Darya River and downstream countries has already been impacted by the five downstream dams. The construction of the Rogun HPP is therefore not expected to have any further adverse transboundary effects.

SOCIAL: COMMUNITY HEALTH, SAFETY AND SECURITY

8.13.5. Transboundary impacts could be experienced by communities downstream of the Project in the event of a failure of dam safety. While the Rogun dam has been designed to store and convey the Probable Maximum Flood (PMF), therefore improving the safety of the Nurek dam which is not able to convey the PMF, there is still the potential for impacts to downstream communities in close proximity to the Vakhsh cascade the event of an emergency.

8.13.6. Due to the High vulnerability of the receptor, and the anticipated negative impacts arising from an emergency situation cause by dam failure, effects are considered as Major adverse (significant) without mitigation.

CULTURAL HERITAGE

8.13.7. Based on the information gathered to date, there are no known resources within the AoI that are of international value or significance. There is one archaeological resource, the fortress of Imlok (RHHP-AR-13), located in the 20 km (baseline) buffer that is considered to be of very high sensitivity. This fortress, located on the outskirts of Nurobod, is of key importance for the Silk Roads route on the South Karategin section (and subject to international interest).

8.13.8. There is potential, in event of a dam failure or a landslide triggered impulse wave, that cultural heritage resources downstream of the Project and within the riparian countries could be submerged, damaged or destroyed. These impacts are further evaluated in **Volume I, Chapter 11** of this ESIA.

9. MAJOR HAZARDS

9.1. INTRODUCTION

9.1.1. This chapter provides a high-level assessment of likely significant effects of the Project on environmental and social receptors from the vulnerability of the Project to risks of relevant major accidents and/or disasters related to natural hazards or manmade hazards (hereafter referred to as Major Events).

9.1.2. The Chapter takes into consideration both external and internal factors, during the operation and construction phases, namely:

- The vulnerability of the Project to Major Events; and/or
- The Project's potential to cause Major Events.

9.1.3. Based on professional judgement, Major Events are occurrences or scenarios that have the potential to affect the Project causing immediate or delayed serious damage to one or more of the following:

- Human health
- Property
- Environment

9.1.4. This chapter has been completed in accordance with paragraph 15 of EU Directive 2014/52/EU and the Law of the Republic of Tajikistan on Ecological Expertise (news of Majlisi Oli of the Republic of Tajikistan 2003. № 4, art. 150, 2005, № 12, art. 638, 2007, № 7 art. 690).

9.1.5. This assessment is based on the information available within other relevant Volume II: Technical Annexes, such as Valued Components (VCs), likely significant effects and appropriate mitigation measures. This Chapter is intended to be read as part of the wider ESIA, with reference to the following Volume II: Technical Annexes:

- **Volume I, Chapter 10**: Climate Change and Greenhouse Gases
- **Volume II, Annex 01**: Air Quality.
- **Volume II, Annex 03**: Soils and Geology.
- **Volume II, Annex 05**: Water.
- **Volume II, Annex 09**: Biodiversity.
- **Volume II, Annex 11**: Social; and
- **Volume II, Annex 14**: Reservoir Slope Instability.

9.1.6. The potential Major Events to which the Project may be at risk of vulnerability during construction and operation phases considered in this chapter are listed in Table 9-1.

Table 9-1 - Major Event Categories and Types

Term	Type
Natural	▪ Geophysical ▪ Hydrological ▪ Climatological and Meteorological ▪ Space ▪ Biological
Technological or Manmade Hazards	▪ Societal ▪ Industrial and Urban Accidents ▪ Transport Accidents ▪ Pollution Accidents ▪ Utility Failures ▪ Malicious Attacks ▪ Engineering Accidents and Failures

9.1.7. This chapter describes the assessment methodology and the baseline conditions relevant to the assessment and a summary of the likely significant effects resulting from the vulnerability of the Project to Major Events.

9.1.8. Table 9-5 presents the Major Event categories and types and the justification for screening them in or out. Where appropriate, this chapter includes the further mitigation measures required to prevent, reduce or offset any significant adverse effects, the preparedness for and proposed response to emergencies, and the expected residual effects after these mitigation measures have been employed.

9.1.9. The definition of key terms used in this Chapter are provided in Table 9-2. These definitions have been developed by reference to the definitions used in EU and Tajik legislation and guidance relevant to major accidents or disasters as well as professional judgement based on knowledge and experience of similar projects in the context of the Project.

Table 9-2 - Key Terms

Term	Definition
(Natural) Disaster	In the context of the Project, a naturally occurring phenomenon such as an extreme weather event (for example storm, flood, temperature) or ground-related hazard events (for example subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a Major Accident as defined below.
External Influencing Factor	A factor which occurs beyond the Project that may present a risk to the Project, e.g. If an external disaster occurred (e.g. earthquake, Seveso site[1] major accident) it would increase the risk of serious damage to an environmental receptor associated with the Project.
Hazard	Anything with the potential to cause harm, including ill-health and injury, damage to property or the environment; or a combination of these.
Internal Influencing Factor	A factor which occurs within the Project that may present a risk to the Project itself.
(Major) Accident	In the context of the Project, an event that threatens immediate or delayed serious damage to human health, welfare or the environment, and requires the use of resources beyond those of the Applicant or its contractors to respond to the event. Serious damage includes the loss of life or permanent injury and/or permanent or long-lasting damage to an environmental receptor that cannot be restored through minor clean-up and restoration efforts. The significance of this effect takes into account the extent, severity and duration of harm and the sensitivity of the receptor.
Major Event	A Major Event is a low likelihood, high consequence event. This term is used to encompass both the term Major Accident and the term Natural Disaster.
Risk	The likelihood of an impact occurring combined with effect or consequence(s) of the impact on a receptor if it does occur.
Risk Event	An identified, unplanned event, which is considered relevant to the Project and has the potential to be a Major Accident or Disaster subject to assessment of its potential to result in a significant adverse effect on an environmental receptor.
Vulnerability	In the context of the EU Directive 2014/52/EU, the term refers to the 'exposure and resilience' of the Project to the risk of a major accident or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

[1] Seveso Sites are defined as industrial sites that, because of the presence of dangerous substances in sufficient quantities, are regulated under the Seveso III Directive (Directive 2012/18/EU).

9.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

9.2.1. The assessment has considered relevant legislation, policy and guidance which are summarised below.

INTERNATIONAL LEGISLATION

9.2.2. The applicable legislative framework covering the design, construction, operation of the Project is summarised as follows:

Paragraph 15 of EU Directive 2014/52/EU states:

> *"In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or natural disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment."*

NATIONAL LEGISLATION

9.2.3. The applicable legislative framework covering the design, construction and operation of the Project is listed as follows:

- Code No. 1329 of 23 July 2016 Labor Code of the Republic of Tajikistan.
- Law No. 721 of 28 June 2011 on Security.
- Law No. 518 of 1 October 2007 on the Peculiarities of Licensing Certain Types of Activities.
- Law No. 14 of 28 February 2004 on Industrial Safety of Hazardous Production Facilities (as amended 02/01/2020); and
- Law No. 666 of 29 December 2010 on Safety of the Hydraulic Structures (as amended 17/05/2018).

9.2.4. There is no published guidance for the application of the legal requirements to the assessment of Major Events. However, selected relevant guidance for risk assessment methodologies is summarised as follows:

- The International Standards Organization's ISO 31000: 2018 Risk Management.
- IEMA (2020) Major Accidents and Disasters in EIA: A Primer.
- IEMA (2016). EIA Quality Mark Article: Assessing Risks of Major Accidents / Disasters in EIA.

9.2.5. Additionally, the following international sources have been consulted to support the identification of potential Major Events.

- The International Federation of Red Cross & Red Crescent Societies (2008), Early Warning, Early Action. This guidance looks to other countries including those in warmer climates, thereby identifying risks that Tajikistan may encounter in the future in light of climate change and global warming.
- The International Disaster Database. This online source contains data covering over 22,000 mass disasters in the world since 1900 to the present day and aims to "rationalise decision

making for disaster preparedness, as well as provide an objective base for vulnerability assessment and priority setting".

9.3. ASSESSMENT METHODOLOGY

9.3.1. The assessment takes account of current and emerging GIIP for environmental assessment which also refers to other relevant documentation, including 'Early Warning, Early Action' and the International Disaster Database.

9.3.2. The assessment of Major Events has been achieved through a review of available documentation. The assessment does not involve assessment from 'first principles' (i.e., hazard identification studies and risk assessments), because it is recognised that existing legislation and health and safety requirements already identify risks and help to protect human beings and the environment.

9.3.3. The assessment presents any identified risks along with whether these are managed to be As Low As Reasonably Practicable (ALARP) or require further precautionary mitigation actions beyond those already integrated into the design and execution of the Project.

9.3.4. The study area for Major Events has been developed based on professional judgement as there is no specific regulatory guidance nor significant precedent or standardised methodology. The following factors and associated distances were adopted for setting the study area in order to capture internal and external influencing factors which may have high adverse consequences on the Project:

- Manmade features:
  - Airports and airfields within 13km;
  - Major Industrial Accident Risk facilities (i.e. hazardous facilities / Seveso establishments) within 3km;
  - Major Accident Hazard pipelines within 1km, such as dangerous gases, fuel and chemical pipeline systems;
  - Nuclear installations within 3km;
  - Fuel retail sites (including Liquified Natural Gas, Liquified Petroleum Gas) within 1km;
  - Rail infrastructure within 500m; and
  - Transmission (gas, electrical, oil/fuels) crossing the Project.
- Natural features with the potential to create risks within:
  - 3km (chiefly hydrological and geological, for example dam failure and seismic activity respectively); and
  - 1km (chiefly hydrological and geological, for example flood risk and unstable ground conditions respectively).

9.3.5. An initial long list of all possible Major Event types has been reviewed to rule out any potential Major Events that are considered highly unlikely to occur due to the location of the Project (e.g. Tsunamis, coastal flooding), based on information provided by the Project Team and use of information sources related to accidents and disasters. Those Major Events that could not be screened out, form the short list of Major Events which require further assessment.

9.3.6. The potential for identified relevant Major Events (the short list) to result in a significant adverse environmental effect has been evaluated using a risk-based approach. The approach has considered the environmental consequences of a Major Event, the likelihood of these consequences occurring, taking into account planned design and embedded mitigation, and the acceptability of the subsequent risk to the environment. The following process has been applied to each of the scoped in Major Event categories:

- Identifying risks;
- Screening these risks;
- Defining the impact;
- Assessing the likelihood; and
- Assessing the risk.

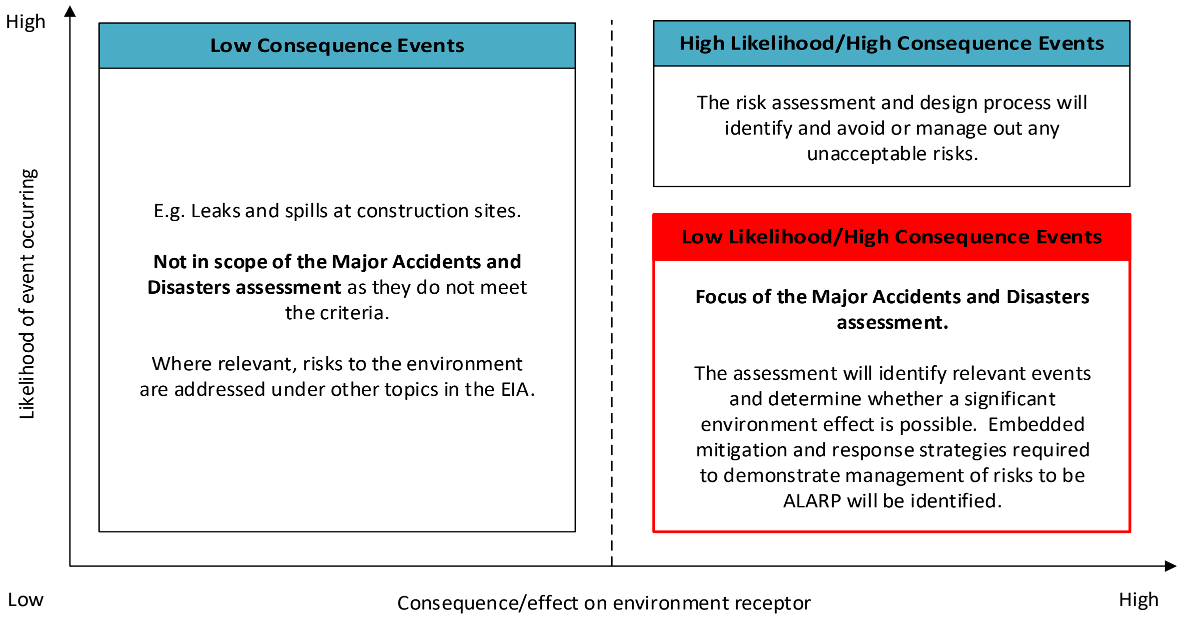
IDENTIFY RISKS

9.3.7. The Major Events considered in the assessment are rare events.

9.3.8. All low consequence events, whatever their likelihood, do not meet the definition of major accidents and disasters. For example, minor spills which may occur during construction, but would be limited in area and volume and temporary in nature, do not meet the definition of a major accident. Such minor events would be dealt with under the construction contractor's Environmental and Social Management Plan (ESMP) and do not fall within the scope of this assessment.

9.3.9. This assessment focuses on low likelihood, but potentially high consequence events as illustrated in Figure 9-1.

Figure 9-1 - Graphical Representation of Major Accidents and Disasters Consequence Significance



9.3.10. Low likelihood is defined for the purposes of this assessment, as: May occur during the lifetime of the Project, so no more than once in 10 years for the construction phase, and no more than once in 100 years for the operational phase.

9.3.11. This is an upper boundary for low likelihood. Very low likelihood events will also be included in the assessment, which may only occur at most once in every 1,000 years. Mitigation measures will reflect what is reasonable for such rare events, considering their potential consequence, within the guiding principle of risks being ALARP.

9.3.12. High consequence events are considered to lead to a significant adverse effect.

9.3.13. The risk identification process has used existing sources of information wherever possible. No additional risk assessments have been undertaken and the risk identification activity has focused on collating and reviewing the existing sources.

9.3.14. In order to identify whether a Risk Event has the potential to be a major event, which also has the potential to have a significant adverse effect on VC, a source, a pathway (between source and receptor) and a receptor (VC) need to be present. As such the assessment uses the following conceptual model:

- The source is the original cause of the hazard, which has the potential to cause harm;
- The pathway is the route by which the source can reach the receptor; and
- The receptor, which is the specific component of the environment that could be adversely affected, if the source reaches it.

9.3.15. Risk Events which do not have all three components have been screened out from the assessment.

SCREENING OF RISKS

9.3.16. The following screening process has been used to identify those Major Events which would require further consideration within the assessment:

- Is there a potential source, and/or pathway and/or receptor as defined above? If not, no further assessment required;
- Is there a relevant environmental receptor present in the locations where the Risk Event could occur, and a pathway whereby the source of harm can reach the receptor? If not, no further assessment required; and
- Does the potential impact on the environmental receptor meet the definition of a significant adverse effect? If not, no further assessment required.

9.3.17. For those Events which are not screened out during the three-step process, the following assessment methodology has been used. The assessment forms the basis for recommending additional mitigation measures, as appropriate, beyond those already integrated into the design and execution of the Project.

DEFINITION OF IMPACTS

9.3.18. Several mechanisms are in place to reduce the vulnerability of the Project to Major Events or mitigate significant effects on the environment should they occur. All measures to manage and reduce the risk of significant adverse effects occurring as a result of the vulnerability of the Project to

Major Events are considered to be primary mitigation measures for the purposes of the assessment. It has been assumed that:

- The design, installation, commissioning, operation and maintenance of plant, drainage systems, equipment, and machinery, including associated systems, will take into account GIIP.
- The construction stage(s) of the Project will be managed through the implementation of the Construction Phase Plan (prepared by the construction contractor(s)), an Environmental and Social Management Plan (ESMP) and an Environmental and Social Commitments Plan (ESCP).

9.3.19. This framework and the mitigation measures therein of relevance to the assessment are described in the **Volume 1 – Chapter 8** of this ESIA and the associated technical Annexes in Volume II of this ESIA.

9.3.20. A reasonable worst-case environmental impact(s) has been identified for each scoped-in Major Event. Impacts have been identified in consultation with relevant disciplines for each environmental factor assessed within this ESIA. The environmental impacts are identified through a qualitative process which seeks to answer the question 'could this event constitute a major accident or disaster in terms of the definitions provided' (refer to Table 9-2).

9.3.21. Where relevant, specific sensitive receptors around the Project are considered. The Risk Record presented in Section 9-7 records the outcome of this process.

RISK ASSESSMENT

9.3.22. The likelihood of the reasonable worst case environmental effect(s) occurring has been evaluated taking into account the following:

- The likelihood of the event occurring considering the measures already embedded into the design and execution of the Project; and
- The likelihood that an environmental receptor is affected by the event.

9.3.23. Likelihood assessments evaluate whether the effect (for example, loss of life) is a possible outcome of the event.

9.3.24. This evaluation refers to existing risk assessments as well as consultation with relevant discipline specialists.

9.3.25. The assessment of the risk has been carried out using a Major Events assessment tool, developed by WSP. Where likely significant adverse effects are identified, mitigation measures must be in place, commensurate with the likelihood of the event occurring. The assessment considers, in consultation with relevant disciplines, whether the risk to the environmental receptor is managed to be ALARP with the existing measures.

9.3.26. If gaps are identified, where the existing measures do not represent management of risks to an environmental receptor to be ALARP, then additional measures would be required. The Risk Record presented in Section 9-2 records the outcome of the assessment.

APPRAISE RISK MANAGEMENT OPTIONS

9.3.27. Risk management options fall into the following categories:

- Eliminate (or 'avoid') the risk, by adopting alternative processes in order to eliminate the source of the hazard, or remove the receptor;

- Reduce the risk by adapting proposed processes such that either the likelihood or the impact of the Risk Event can be reduced;
- Isolate the risk, by using physical measures to ensure that should the Risk Event occur, it can be effectively isolated such that there is no pathway;
- Control the risk, by ensuring that appropriate control measures are in place (for example emergency response) so that should a Risk Event occur, it can be controlled and managed appropriately. The mitigation hierarchy of repair and compensate any significant damage to environmental receptors may then apply following a control measure; and
- Exploit the risk if it presents potential benefits or new opportunities.

9.3.28. As safety risks will be required to be adequately addressed within the regulatory framework for the Project, it is not anticipated that significant residual effects, in terms of safety risks, will be identified as an output of the assessment.

SIGNIFICANCE CRITERIA

9.3.29. By definition, a Major Event would have a major adverse effect on human health, property or the environment. Accordingly, any risks that could result in a major event without suitable mitigation, management or regulatory controls in place will be assessed as significant.

ASSUMPTIONS AND LIMITATIONS

- The Project is being designed and its implementation guided by GIIP. These require infrastructure and systems to be designed so that risks to people and the environment are either eliminated or reduced to levels that are ALARP.
- The construction stage(s) of the Project will be managed through the implementation of the Construction Phase Plan (which will be prepared by the construction contractor(s) as required under the Regulation on Health and Safety in Construction Works (2003), an Environmental and Social Management Plan (ESMP) and an Environmental and Social Commitments Plan (ESCP).
- Environmental effects associated with unplanned events that do not meet the definition of a major event e.g. minor leaks and spills that may be contained within the construction sites are addressed in other relevant ESIA technical annexes, and measures in the Environmental and Social Management Plan (ESMP).
- It is recognised that there is an existing environmental and safety management framework for the hydropower plant (HPP) which will be expanded as the HPP reaches full capacity. It is presumed that this existing management framework aligns with good practice and complies with applicable regulatory requirements.
- The design, installation, commissioning, operation and maintenance of plant, drainage systems, equipment and machinery, including associated systems, will take into account Good Engineering Practice.

9.4. BASELINE CONDITIONS

9.4.1. Major Event risks relevant to the baseline in the absence of the Project include extreme weather events and associated flooding. Baseline conditions are described in detail in the relevant Technical Annexes in Volume II of this ESIA and summarised in **Volume 1 – Chapter 7** of this ESIA. Those aspects of most relevance to this assessment are summarised in Table 9-4.

9.4.2. In line with Paragraph 15 of EU Directive 2014/52/EU, the following VCs were considered in relation to Major Events:

- Members of the public and local communities;
- Infrastructure and the built environment;
- The natural environment, including ecosystems, land and soil quality, air quality, surface and groundwater resources and landscape;
- The historic environment, including archaeology and built heritage; and
- The interaction between the factors above.

9.4.3. The specific potential receptors of effects resulting from a major event are all reported in the relevant topic technical annex.

9.4.4. Receptors that have been excluded from the assessment, are set out in Table 9-3 below. Existing legislation which is in force in Tajikistan manages the vulnerability of those excluded receptors to Major Events. The applicable legislative drivers are identified in Table 9-3 below.

Table 9-3 - Excluded Receptors

Receptor	Applicable Legislative Driver and Justification for Exclusion
Employees of the Applicant and/or its suppliers, whether during construction, operation, or maintenance of the Project.	Employer's commitment and obligations to manage risks to employees are addressed in Code No. 1329 of 23 July 2016 Labor Code of the Republic of Tajikistan.
Members of the public who are wilfully trespassing, for example, a breach of the Project perimeter fencing.	Outside the occupier's legal requirements under the Law No. 721 of 28 June 2011 on Security.

9.4.5. The baseline features important to the Project are shown in Table 9-4.

Table 9-4 - Major Event Baseline Features

Feature	Type	Approximate Distance and Direction from Project
Vakhsh River valley	Receptor / Source	Adjacent
Vakhsh River	Receptor / Source	Adjacent
Vakhsh Fault	Source	Adjacent
Ionakhsh Fault	Source	Adjacent
Gulizindan Fault	Source	Adjacent
Pamir mountain ranges	Source	Adjacent
Nurek dam	Receptor	70km east

9.4.6. The specific potential receptors of effects resulting from a Major Event are all reported in the relevant technical annex.

9.5. MAJOR EVENT TYPES SCOPED IN OR OUT OF FURTHER ASSESSMENT

9.5.1. An initial review of the Major Event categories identified in the study area has been undertaken to inform the scoping process. This is summarised in Table 9-5 to show the potential vulnerability of the Project to the risk of each Major Event type. The phases are indicated in the table as “C” for Construction phase and “O” for Operational phase. For potential Major Events that have been screened out, justification has been provided to support this decision.

Table 9-5 - Elements Scoped In or Out of Further Assessment

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
Natural Hazards	Geophysical	Earthquakes	The Project is located within a seismically active zone. Tajikistan is classified as having a high earthquake risk (>20% chance of a potentially damaging earthquake in the next 50 years). Earthquakes regularly occur in Tajikistan mostly with magnitudes below 5.5 on the Richter scale. The strongest earthquakes recorded in the wider region were the Karatag earthquake of 1907 with a magnitude of 7.3 and the Khait earthquake in 1949 with a magnitude of 7.6. Damage was caused to the Project itself by an earthquake during construction in 1995. A number of tectonic faults are present in the region including the Gissar-Kokshal fault which passes approximately 10-15 km north of Dushanbe and the Illiak-Vakhsh fault crosses at approximately 20-25 km south of Dushanbe. The Site is framed by two regional third order faults: Ionakhsh upstream and Gulizindan downstream of the Site and a local fault (Fault No. 35) is located in the dam foundation. Construction: As part of the construction planning, a 3D seismicity study will be undertaken, and a comprehensive monitoring programme installed. Some seismic monitoring is currently in place in the existing area which will be updated and expanded in line with the outcomes of the proposed study. In the event of an earthquake being detected construction activities will cease during the earthquake. Potential risks from seismic events during construction will also be considered as part of the ESIA. Operation: The Project has been designed to withstand the probable maximum earthquake (Mw 6.9).	Yes C, O

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			Reservoir-Induced Seismicity (RIS) Scientists believe that large dams can trigger earthquakes in two ways: (1) by the added weight of a reservoir and (2) by the water that seeps into cracks underground or along a fault. Scientists believe that there are over 100 instances of dam reservoirs inducing earthquakes. The most recent case being the magnitude-7.9 Sichuan earthquake in China in May 2008, which some experts believe may have been induced by filling the Zipingpu Dam. To reduce the risk of reservoir-triggered seismic events, which is in general higher when filling is done quickly and stresses change more quickly, the Rogun reservoir would be filled slowly, over a period of 16 years; at that rate, the maximum reservoir-triggered earthquake would be relatively minor. The 2014 ESIA recommended that monitoring networks for strong-motion and micro seismic events were put in place before dam construction to further characterise background seismicity".	
Natural Hazards	Geophysical	Volcanic Activity	The Project is not in an active area, and it is highly unlikely that an ash cloud could significantly impact on any aspect of the Project.	No
Natural Hazards	Geophysical	Landslides & mudslides	Landslide risk is classified as high in Tajikistan. Approximately 36% of Tajikistan is at risk of landslides and mudslides; in 2006, about 13,000 people were affected by flooding and landslides. In Rogun area, landslide susceptibility is classified as high. This means that this area has high and intense periods of rainfall which can increase the risk of landslides and mudslides in conjunction with terrain slope, geology, soil, land cover and (potentially) earthquakes that make localized landslides a frequent hazard phenomenon. The region is prone to erosion which has been made worse by local deforestation caused by logging, agriculture and grazing. Oscillations in reservoir water levels may increase the risk of landslide and erosion. Investigations identified no large landslide blocks	Yes C, O

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			whose failure could cause damaging waves in the reservoir. However, it was recommended in the 2014 ESIA that preventive measures (e.g. monitoring, reforestation) should be implemented at settlements which are near these features to prevent significant adverse effects.	
Natural Hazards	Geophysical	Sinkholes	Along the left bank of the Vakhsh River there is evidence of intensive halide karst dissolution features. The resulting formation of sinkholes may initiate superficial landslides, leading to sinking of inhabited areas and causing damage to buildings, e.g., in Rogun city. As the mostly superficial sliding and creeping processes are expected to develop progressively during impounding the impact of impounding on dissolution and subsequent instabilities should be considered at the detailed design stage.	Yes C
Natural Hazards	Geophysical	Tsunamis	The Project is located inland, outside a tsunami risk zone.	No
Natural Hazards	Hydrological	Coastal Flooding	The Project is located inland, outside a coastal area.	No
Natural Hazards	Hydrological	Fluvial Flooding	The Amu Darya Basin is prone to natural hazards such as floods. In the Rogun area, river flood hazard is classified as very low. This means that there is a chance of less than 1% that potentially damaging and life-threatening river floods occur in the coming 10 years (return period of c. 1 in 1000 years). The Vakhsh river is a snow and glaciers melt influenced river. The high flows are related to the thaw season with main peaks in July and August. Discharge is not correlated to precipitation. Three major observed flood events of Vakhsh river at Tutkaul gauging station occurred in July 1953, July 1958 and July 1969. The Nurek HPP is not designed to handle the Probable Maximum Flood (PMF), and this places both the facility and downstream areas at some risk. The Rogun HPP is designed to withstand the PMF and its storage capacity	Yes C

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			and water regulation capability would allow flow control so as to protect Nurek and the downstream cascade. The mean annual flow in glacier fed rivers are predicted to increase until about 2080 and then decrease. The Project provides opportunity to mitigate adverse effects of climate change on downstream areas. Fluvial flooding has been scoped out during Operation as the Project is designed handle the PMF and will reduce potential flooding along the downstream cascade.	
Natural Hazards	Hydrological	Pluvial Flooding	Tajikistan's topography is mountainous; much of the country sits 3,000m above sea level and it has peaks over 7,000m in the Pamir and Alay ranges. The Fergana Valley to the north and the Kofarnihon and Vakhsh river valleys to the south are the lower elevation areas. This topography influences the country's hazardscape. Intense rainfall on steep terrain contributes to damaging floods and mudslides on a regular basis. The flood map of Dushanbe shows that there is very limited risk from surface water flooding in the city. Any flood risk is likely to come from the Varzob River which runs through the centre of the city, and the Kafirnigan River, which flows through the southern suburbs. In the Rogun area, urban flood hazard is classified as high. This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. The Project is located in a rural area and therefore the risk of surface water flooding is considered to be low and therefore this major event type has been scoped out.	No
Natural Hazards	Hydrological	Glacial Lake Outburst Flooding	Glacial Lake Outburst Flooding (GLOF) occurs where there is a release of meltwater from a naturally formed moraine of ide dam glacial lake. Causes of release can be through natural dam breach, especially in moraine dams	Yes C

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			which are typically weak in structure, or caused by landslides, earthquakes or avalanches. In addition, increased global warming is leading to rapid loss of ice resulting in the formation and/or expansion of glacial lakes, which when breached present a high risk to communities downstream. According to the Glacier Lake Outburst Flood Database V3.0 (uni-potsdam.de) 17 incidents between 1910 and 2015 have been recorded all of which occur in the Pamir region of Tajikistan. GLOF has been scoped out during Operation as the Rogun HPP is designed to withstand the PMF and its storage capacity and water regulation capability would allow flow control so as to protect Nurek and the downstream cascade.	
Natural Hazards	Hydrological	Groundwater Flooding	There are no records of groundwater flooding in the Project area.	No
Natural Hazards	Hydrological	Avalanches	The major reason for avalanches in Tajikistan is fresh snow formation. Large amounts of fresh snow not yet consolidated, are likely to be set in motion. In addition, the interface between fresh and old snow is rather unstable and tends to create sliding planes. Most avalanches in Tajikistan are observed in February and March. The occurrence of heavy snow and avalanches will likely increase considering the projections of increases in extreme precipitation and higher minimum daily temperatures.	Yes C, O
Natural Hazards	Climatological and Meteorological	Cyclones, hurricanes, typhoons, storms and gales	In the Rogun area, cyclone (also known as hurricane or typhoon) hazard is classified as very low. This means that there is less than a 1% chance of potentially-damaging cyclone-strength winds in the Project area in the next 10 years.	No
Natural Hazards	Climatological and Meteorological	Thunderstorms	This type of event could result in lightning strikes to temporary elevated structures during construction (e.g. tower cranes); however, the risk is no	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			different to other construction projects. Specific measures are therefore not considered to be required as part of the Project.	
Natural Hazards	Climatological and Meteorological	Wave Surges	The Project is located inland, and therefore is not subject to wave surges.	No
Natural Hazards	Climatological and Meteorological	Extreme temperatures: Heatwaves, Low (sub-zero) temperatures and heavy snow	The substantial projected increase in air temperatures as well as annual number of days where daily maximum temperature exceeds 25 °C, indicates that heat waves are more likely to occur and may last longer. In the Rogun area, extreme heat hazard is classified as low. This means that there is between a 5% and 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years. The Project area does experience heavy snowfall. The potential risks associated with this have been considered under the Avalanches event type above.	No
Natural Hazards	Climatological and Meteorological	Droughts	Tajikistan has historically experienced drought conditions. In the Central Asian country's Pyanj river basin, moderate droughts – which reduce crop yields by 20% - occur once every three to four years. Tajikistan's worst drought was in 2000 and affected about 3 million people (approximately half the country's population at that time). In the Rogun area, water scarcity is classified as very low or non-existent where droughts will occur much less than once every 1000 years.	No
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Solar Flares	Solar flare events are known to interrupt radio and other electronic communications. Records from solar storms in 1921, 1960 and 1967 describe widespread radio disruption and impacts on railway signalling and switching systems. There will be the use of electronic and electrical technology to control processes and plant, however this is protected, therefore the Project is	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			no more vulnerable than other similar systems operating on other hydropower plants. Further assessment in the ESIA is not required.	
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Solar Energetic Particles	Solar energetic particles which cause solar radiation storms, but only in outer space, so this major event type can be scoped out.	No
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Coronal Mass Ejections	Coronal mass ejections (CME) cause geomagnetic storms. The geomagnetic storm in 2003 caused the aviation sector to lose some GPS functions for a day, however there was no known significant impact on infrastructure.	No
Natural Hazards	Climatological and Meteorological	Fog	Fogs, lasting for more than 24 hours, with a visibility of 50 meters and less, are considered especially dangerous. However, it is a rare phenomenon in Tajikistan. Fogs start in November, reach their peak in December-January, and end in March. The exception is highland areas in the zones of cloud formation, where fogs are permanent. In most areas, total duration of fog does not exceed 50-70 hours a year. On the mountain passes, duration of fogs increases to 1,200 hours a year. Normally, fogs continue for 3-5 hours. In the period of 1961-1990, the number of days with fog increased by 20-50%. In the area of Khujand city, the number of days with fog increased by 80%. In the event of reduced visibility construction works would be temporarily suspended until visibility improved.	No
Natural Hazards	Climatological and Meteorological	Wildfires: Forest fire, Bush/brush pasture	Wildfire hazard is classified as high in Tajikistan which means that there is greater than a 50% chance of encountering weather that could support a significant wildfire that is likely to result in both life and property loss in any given year. However, in the project area forests are rare as most trees have been cut for firewood. The remaining forests are located in higher elevations, far above the reservoir Full Supply Level (FSL). Shrubs and bushes are found on the	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			slopes of the reservoir, but these are also decreasing as coverage since most are cleared to make way for cultivation. Therefore, wildfire is unlikely to be a risk in this location and has therefore been scoped out.	
Natural Hazards	Climatological and Meteorological	Poor Air Quality	Air quality in Tajikistan is generally poor and is at its worst during the late autumn and winter months due to the use of the coal-powered heating system. In 2022 the average PM2.5 concentration in Tajikistan was 9.2 times the WHO annual air quality guideline value. Construction: During the construction phase there will be an increase in dust emissions associated with the use of heavy construction traffic; compacted earth access roads; the operation of the crusher facilities and the associated open conveyors; unloading and loading of materials; the operation of the concrete batching plants, the operation of the borrow pits and the associated transport of the materials in open trucks. Road sprinkling is carried out in the construction site in order to suppress the dust emission. The impact on air quality during the construction stage is considered to be minor in the 2014 ESIA as the impact will be localised to the construction site and access roads and limited to the duration of construction. Operation: There will be an increase in diesel engine emissions originating from all mobile vehicles and fossil fuel combustion products from back-up generators. During the operational phase there will also be emissions of coarse particulate matter from exposed, dried sediments during periodic drawdown of the dammed waters for routine inspection and maintenance. **Volume II, Technical Annex 01: Air Quality** scopes out direct operational phase impacts from the assessment on the basis that operational impact will be minor and so are assessed as not significant. Indirect operational impacts	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			have been assessed as part of the Air Quality technical annex and are considered not significant.	
Natural Hazards	Biological	Disease epidemics: ▪ Viral ▪ Bacterial ▪ Parasitic ▪ Fungal ▪ Prion	The Project is located in a developed country where the population is in general good health. The most recent disease epidemics in Tajikistan was COVID-19, the first cases of which were identified in April 2020. Although no longer considered a global health emergency by The World Health Organisation, the vulnerability of the Project to a major event caused by COVID-19 during construction and operation should be mitigated by the occupational health and safety processes that are implemented by both the contractor and government rules and guidelines on the control of spread of COVID-19. The construction and use of the Project will not give rise to any disease epidemics. Risks from Weil's Disease (or leptospirosis) is considered to be of low likelihood, but not of high consequence as the last outbreak of leptospirosis in Tajikistan was recorded in April 2006 approximately 50km east of Dushanbe in the Mehrobod area of the Fayzobod district. It would be unlikely for any workers to contract Weil's as appropriate PPE will be worn and any risks managed in the ESMP.	No
Natural Hazards	Biological	Animal diseases: ▪ Zoonotic: • Avian influenza • West Nile virus • Rabies ▪ Non-zoonotic:	Animal diseases present in Tajikistan include: (1) Brucellosis is a zoonotic infection transmitted to humans from infected animals (cattle, sheep, goats, camels, pigs, or other animals) by ingestion of food products (such as unpasteurized dairy products) or by contact with tissue or fluids. Endemic areas for brucellosis include Central Asia. (2) Rabies – rabid dogs are commonly found in Tajikistan. (3) Crimean-Congo haemorrhagic fever (CCHF) is caused by infection with a tick-borne virus and is found in Eastern Europe, particularly in the former Soviet Union, throughout the Mediterranean, in northwestern	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
		• Foot and mouth • Swine fever	China, central Asia, southern Europe, Africa, the Middle East, and the Indian subcontinent. (4) Hantaviruses are viruses that can spread from animals to people that can cause serious disease in people. You can be infected with a hantavirus if you: breathe air or eat food contaminated with the urine, droppings, or saliva of infected rodents; or are bitten by an infected rodent, typically a mouse or a rat. Scoped out as the use of the Project is not going to be the source of any disease epidemics and spread would be controlled through containment of infected animals including prohibition of transportation.	
Natural Hazards	Biological	Plants	Project construction activities have the potential to introduce/facilitate the spread of non-native invasive plant species to sensitive habitats around the Project site resulting in the deterioration of these habitats. Standard control measures would be implemented by the appointed contractor during construction to handle and dispose of any diseased plants and/or injurious weeds and prevent their spread.	No
Technological or Manmade Hazards	Societal	Extensive public demonstrations which could lead to violence and loss of life	The Project is located in a developing country (according to the definition from the International Monetary Fund, Tajikistan is a developing country because of its lower economic performance.) that has steady population growth. International SOS reports that the central government of Tajikistan has extensive influence across the country, though the level of effective state control is lower in areas further from the capital Dushanbe, where the security environment is more volatile, notably in Gorno-Badakhshan Autonomous Oblast (GBAO). The Project is considered to be controversial and has led to contention between upstream Tajikistan and downstream Uzbekistan. In the past, tensions over the Rogun Dam have resulted in disruptions to economic activity and trade relations between the two countries.	Yes C

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
Technological or Manmade Hazards	Societal	Widespread damage to economies and societies	Tajikistan has direct borders with countries experiencing conflicts. The Project will not lead to widespread damage to societies and economies therefore this major event type has been scoped out.	No
Technological or Manmade Hazards	Societal	The need for large-scale multi-faceted humanitarian assistance	The Project will not lead to the requirement for large scale multi-faceted humanitarian assistance therefore this major event type has been scoped out.	No
Technological or Manmade Hazards	Societal	The hinderance or prevention of humanitarian assistance by political and military constraints	The Project will not lead to the requirement for large scale multi-faceted humanitarian assistance therefore this major event type has been scoped out.	No
Technological or Manmade Hazards	Societal	Significant security risks for humanitarian relief workers in some areas	The Project will not lead to significant security risks for humanitarian relief workers therefore this major event type has been scoped out.	No
Technological or Manmade Hazards	Societal	Famine	The Project is located in a developing country that produces some of its own crops and imports food. Tajikistan depends on imports to cover 75% of its food needs. Tajikistan also imports over 50% of its agricultural inputs such as: seeds, seedlings, animal breeds, fertilizers, and farm equipment. The World Food Program forecasted that by the end of 2022, 30% of Tajikistan's population would be classified as moderately food-insecure—up from 20% in 2021—while those acutely affected by food insecurity could more than double to reach 8.6%.	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			Famine is not relevant to the use of the Project and therefore has been scoped out.	
Technological or Manmade Hazards	Societal	Displaced population	There are 69 settlements within the future footprint of the Project, an estimated 43,643 people are to be resettled. The progressive filling of the reservoir has necessitated a staged programme of resettlement for villages and settlements within the reservoir area. This programme is conducted by the State Enterprise Directorate of the Flooding Area of the Rogun HPP. With construction and reservoir filing scheduled to take 16 years, the programme of resettlement has two phases, each with its own Resettlement Action Plan. The Aide Memoire of the Environmental and Social Panel of Experts (E&S PoE) stated that the Phase 1 Resettlement Action Plan (RAP) resettled 2,077 people of six villages within the construction footprint or would be flooded during early reservoir filling and was completed in 2017. The Phase 2 resettlement process is underway and is planned for completion in 2025. This major event type has been scoped out as there is a resettlement action plan in place for those settlements displaced by the Project and therefore does not require further consideration in the MA&D assessment.	No
Technological or Manmade Hazards	Industrial and urban accidents	Major accident hazard chemical sites	There are no Seveso sites within a 5km radius of the Project.	No
Technological or Manmade Hazards	Industrial and urban accidents	Major accident hazard pipelines	There are no major accident hazard pipelines within the Project study area.	No
Technological or Manmade Hazards	Industrial and urban accidents	Nuclear	Tajikistan currently has no operational nuclear reactors. There are strong radiation sources on Tajik territory as a result of Soviet-era industrial applications. In its 2012 Environmental Performance Review of Tajikistan, the United Nations Economic Commission for Europe announced that approximately 54.8 million tons of radioactive waste from Soviet-era uranium	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			mining activities (mostly process residue tailings) are housed in unsecured facilities – many of them near the large city of Khujand, approximately 170km north of the Project. The United Nations and the International Atomic Energy Agency have expressed concern over the detrimental impact of this unsecured waste on the environment and ecology of Tajikistan; in response, in July 2014, the leadership of Tajikistan adopted a national concept on the rehabilitation of uranium tailings during the ten-year period from 2014 to 2024. This major event type has been scoped out as there are no nuclear facilities within 5km of the Project.	
Technological or Manmade Hazards	Industrial and urban accidents	Fuel storage	There are no industrial activities (with the exception of the Rogun HPP construction site) in the three districts.	No
Technological or Manmade Hazards	Industrial and urban accidents	Dam breaches	Dam breaches in Tajikistan are rare, however. a breach of the temporary dam at the Sargazon reservoir occurred in 1986 due to a large mudflow resulting in the deaths of over 40 people. Overtopping of the temporary cofferdam at Rogun occurred in 1992. There are 5 hydropower dams in a cascade below the Project on the Vakhsh River. These include the Nurek HPP, located 70 km downstream from the Rogun HPP and, downstream of Nurek, the Baipaza, Sangtuda 1, Sangtuda 2 and Golovnaya Dams. Whilst the Rogun HPP is designed to withstand the PMF and its storage capacity and water regulation capability would allow flow control so as to protect Nurek and the downstream cascade, dam breach cannot be scoped out due to other causes. .	Yes
Technological or Manmade Hazards	Industrial and urban accidents	Mines and storage caverns	Tajikistan has large reserves of minerals including coal, gold and silver. The 2014 ESIA states that “No valuable mineral deposits within the area to be submerged”. There are no mining activities (with the exception of the Rogun HPP construction site) in the three districts.	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
Technological or Manmade Hazards	Industrial and urban accidents	Fires	Fires could be initiated by construction related activities which impact areas adjacent to the construction activities. During construction, standard control measures would be implemented by the appointed contractor to manage the risk of fire. There are no industrial activities (with the exception of the Rogun HPP construction site) in the three districts.	No
Technological or Manmade Hazards	Transport accidents	Road	According to the World Bank Group Global Road Safety Facility, Tajikistan reported 427 road traffic accident fatalities in 2016, the World Health Organisation (WHO) estimated that there were 1,577 fatalities in 2016 and the Global Burden of Disease (GBD) estimate it to be 648 fatalities. The WHO estimate of fatalities per 100,000 population for 2016 is 18.1. In 2016 it is estimated that there were 23,655 serious injuries resulting from road traffic accidents. During construction there will be an increase in heavy construction plant and equipment on the local road network which may increase the risk of accidents however, this will only be on a temporary basis.	No
Technological or Manmade Hazards	Transport accidents	Rail	There are no railways within the Project area.	No
Technological or Manmade Hazards	Transport accidents	Waterways	There are no navigable waterways within Tajikistan.	No
Technological or Manmade Hazards	Transport accidents	Aviation	The nearest airfields are Kulob International Airport which is approximately 96km to the south of the Project, Dushanbe International Airport which is approximately 110km west of the Project and Jirgatol Airport which is approximately 117km to the east of the Project.	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
Technological or Manmade Hazards	Pollution accidents	Air	Construction activities may cause dust emissions which may contribute to poor air quality albeit on a temporary basis. Use of fossil fuelled mobile plant and equipment during the construction phase. However, emissions from mobile plant and equipment covered under H&S and environmental legislation. The potential for this event has been considered in detail as part of the Environmental Impact Assessment process, and it is therefore not considered a requirement to evaluate this further.	No
Technological or Manmade Hazards	Pollution accidents	Land	**Volume II, Technical Annex 03: Soils and Geology** identifies that the contaminants associated with the construction and operation activities include hydrocarbon spills from diesel generators, refuelling bays, fuel tank farms, trucks and other equipment. **Volume II, Technical Annex 03** states that during all phases of the Project, soil contamination can and should be prevented, especially as these contaminants will quickly enter the Vakhsh River and Rogun Dam, and potentially groundwater resources. The August 2021 Rogun Environmental and Social Aspects review highlighted soil contamination at the Rogun tank farm as an existing issue. The review states that, over the years, fuel spills have led to widespread soil contamination at the tank farm and in other small areas of the site, and that this may have contaminated groundwater. The potential for pollution accidents to land has been considered in detail as part of the Environmental Impact Assessment process, and it is therefore not considered a requirement to evaluate this further.	No
Technological or Manmade Hazards	Pollution accidents	Water	During construction water quality may be impacted by: ▪ Increase in suspended solids from construction activities such as excavations or quarrying, or from increases in erosion due to earthworks and other related activities. This would increase the sediment and silt load downstream of any activities;	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			▪ Potential runoff from oils, lubricants, or other chemicals and substances associated with construction activities and vehicles used; ▪ Interaction of concrete with water may lead to changes in pH which could affect hydrogeochemical processes and/or aquatic life; ▪ Blasting work may result in the presence of nitrogen-species such as nitrate or nitrite from use of explosives, which may be toxic to aquatic life; and ▪ Potential of wastewater inputs to the catchment from construction camps and the workforce on site during construction. The change in environment from river to reservoir is notable, with potential impacts on the water quality. The 2023 updated ESIA recommends that continued water quality monitoring should be undertaken to identify any potential impacts. The assessment of water quality has been undertaken in the ESIA and further assessment in the major events section is not required.	
Technological or Manmade Hazards	Utilities failures	Electricity	Instances of electricity failure (also referred to as power loss or blackout) can be caused by a number of things, such as severe weather (e.g. very strong winds, lightning and flooding) which damage the distribution network. These tend of be mainly specific place, local (e.g. metropolitan area) and less frequently regional (e.g. North East) as a result of severe winter storms and consequent damage to the distribution overhead line network. Rogun HPP will significantly enhance supply security in Tajikistan by producing an average of 30% of domestic electricity demand between 2020 and 2050. The operation of the Rogun HPP will lead to a 1.8% and 3% per annum increase in the generation of electricity in Tajikistan, from a peak of about 3.8 GW in 2013 to a peak of more than 5.9 GW in 2031. The TEAS study, Transmission System (TEAS, Chapter 3.6, April 2014) concluded that the increase load to the transmission network will require the transmission	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			network to be upgraded however, this will be subject to a separate ESIA and is not considered further here. The Project is currently being powered by electricity generated by the two temporary turbine units. There are also back-up diesel generators should there be power failure.	
Technological or Manmade Hazards	Utilities failures	Gas	Underground and above-ground gas transmission pipelines are not present across the Project study area.	No
Technological or Manmade Hazards	Utilities failures	Water supply	Given that the Vakhsh river is a major tributary of the Amu Darya River, the operation of the Rogun hydropower plant needs to respect the regional water allocation agreements and practices. The operation of the Rogun HPP will be consistent with existing agreements for water allocation in the Vakhsh River. From 1992-2010, Tajikistan used approximately 83% of the water allocated annually by BVO Amu Darya. However, once the Rogun HPP is fully operational, the greater proportion of the water allocation will be utilized to fill the reservoir over an extended period (16 years) to ensure that the downstream hydropower plants are able to maintain intake velocities and the riparian countries receive their full allocation. The workers camps use water from the mains supply for cooking, washing etc. and bottled water for drinking. Some of the worker camps have a potable water treatment plant at the camp to ensure it meets required standards.	No
Technological or Manmade Hazards	Utilities failures	Sewage system	As part of the Project a domestic Wastewater Treatment Plant (WTP) with a full capacity of 700 m^3/day has been constructed but is not yet fully operational. A second WTP is under construction. On-site accommodation is provided in six workers' camps which are provided with sanitary facilities.	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
Technological or Manmade Hazards	Malicious attacks	Unexploded ordnance (UXO)	Tajikistan inherited an enormous stockpile of aging ammunition, including large-calibre ordnance and other explosives, following the collapse of the Soviet Union. Due to its porous borders with Afghanistan, large quantities of poorly secured small arms and light weapons and ammunition continue to present a real threat to national and regional security. Tajikistan also has extensive landmine contamination along its southern, western, and northern borders from both its civil war in the 1990s and earlier Soviet attempts to prevent border crossings by Afghan militants and narcotics traffickers. During its civil war fought from 1992 to 1997, Tajikistan's Central Rasht Valley region was heavily contaminated with landmines and UXO. The borders between Tajikistan and Uzbekistan and Afghanistan, including the Vakhsh and Rasht valleys, are laden with landmines and UXO. Tajikistan is successfully managing aging stockpiles of weapons and ammunition. The nation has also been adept at clearing landmines and other explosive hazards along its borders and within the central Rasht Valley region. To date and on the Rogun HPP construction site no UXO have been found to be present, however, there is the risk that landmines and/or other explosive hazards may be encountered during construction of any associated roads, bridges resettlement areas etc., as the Project is located within the Rasht Valley region,	Yes C
Technological or Manmade Hazards	Malicious attacks	Attacks: ▪ Chemical ▪ Biological ▪ Radiological ▪ Nuclear	Extremists remain interested in Chemical, Biological, Radiological and Nuclear (CBRN) materials, however alternative methods of attack such as employing firearms or conventional explosive devices remain far more likely. Historical use has been in closed densely occupied structures (underground, buildings) or targeted at specific individuals. The Project is unlikely to be a target for this type of event due to the low number of exposed targets.	No

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
Technological or Manmade Hazards	Malicious attacks	Transport systems	Potential systems would include (but are not limited to) railways, buses, passenger ferries, cargo vessels and aircraft. The Project is unlikely to be a target for this type of event due to the low number of exposed targets.	No
Technological or Manmade Hazards	Malicious attacks	Crowded places	The Project does not fall within the definition of a crowed place, i.e., pedestrian routes and other thoroughfares as well as sports arenas, retail outlets and entertainment spaces. The Project is unlikely to be a target for this type of event due to the low number of exposed targets.	No
Technological or Manmade Hazards	Malicious attacks	Cyber	Cyber-attacks occur almost constantly on key national and commercial electronic information, control systems and digital industries. Tajikistan is considered an attractive target for cyberattacks as its defences against such an attack are thought to be weak. Notwithstanding this, the Project is not considered to be more vulnerable to attack than similar infrastructure installed and running on other existing hydropower plants in Tajikistan.	No
Technological or Manmade Hazards	Malicious attacks	Infrastructure	According to the Ministry of Internal Affairs, there were two terrorist attacks and four attempted terrorist attacks in 2021. Authorities implicated the banned opposition Islamic Renaissance Party of Tajikistan and ISIS-affiliated groups in the planning of several attempted attacks. The Project would potentially be considered a high-profile attack.	Yes O
Technological or Manmade Hazards	Engineering accidents and failures	Bridge failure	A new bridge with a span of 786m will be constructed across the reservoir however as this road is part of the national and international road (Dushanbe) - Vakhdat - Jirgital - (Kyrgyzstan) it not considered as part of the Project.	Yes O

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
			However, the potential risks associated with bridge collapse will be considered as part of this ESIA.	
Technological or Manmade Hazards	Engineering accidents and failures	Flood defence failure	The study area associated with the Project does not benefit from flood defences or flood storage areas. The Vakhsh river has formed extensive floodplains in the wider sections of the valley. As part of the Project a number of diversion tunnels have been constructed to divert and discharge flood water from the construction area. Once completed, the upstream and downstream cofferdams will also provide protection during the construction phase. Following the completion of construction some of the tunnel spillways will remain available. In addition, surface spillways and middle level and high-level outlets will be constructed for use in the event of flooding. The design of the Project has been developed to include allowances for future climate change predictions that could result in flooding. The potential risk of breech events is considered in the Environmental Impact Assessment and therefore does not require further consideration in the assessment of major events.	No
Technological or Manmade Hazards	Engineering accidents and failures	Mast and tower collapse	There are no towers or masts in close proximity to the Project or being built as part of the Project.	No
Technological or Manmade Hazards	Engineering accidents and failures	Property or bridge demolition accidents	The Project involves demolition works. The risks of accidents occurring during these works would be taken into account by the appointed contractor and considered as part of their detailed methodology and risk assessments in advance of these works. Surveys would be undertaken prior to the demolition of properties and structures to confirm whether any potentially harmful substances (e.g. asbestos) are present, and to determine the risk to people.	Yes O

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In / Out	Scope In? Phase
Technological or Manmade Hazards	Engineering accidents and failures	Tunnel failure / fire	The Project involves the construction of tunnels including: ▪ Diversion tunnels have been excavated at the left bank, crossing the valley under the dam area and continuing at the right bank. The downstream part will be used as tailrace tunnels during operation. ▪ Six independent headrace tunnels and penstocks which will guide the water from the intakes to the powerhouse at the left bank. ▪ Several access tunnels to the powerhouse as well as transformer caverns, gate chambers etc.	Yes C, O

9.6. ASSESSMENT OF POTENTIAL MAJOR ACCIDENT EVENTS

9.6.1. The Long List in Table 9-5 above, presents all of the Major Event categories and types which have been considered as part of the assessment. Those Major Event types which could not be scoped out have been further assessed, the output of which is presented in Table 9-6 below. This table is a record of all potential Major Events considered as part of the assessment process.

Table 9-6 - Risk Record

Risk Record Entry No	Major Event Category	Risk Event Type	Section of the Project	Hazard Description	Applicable Phases (Construction, Operation, Maintenance) *	Risk Description	Hazard Sources and/or Pathways	Documentation in which the Event is/will be Addressed	Reasonable Worst Consequence if Event did Occur and Receptor(S)	Air Quality	Climate	People & Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape & Visual	Noise & Vibration	Transport	Material Resources	Road Drainage & Water	Mitigation	Could this Constitute a Major Accident or	Justification	Is this ALARP with Existing Mitigation?	Clarification
1	Geophysical;	Ground collapse	Rogun Dam construction area	Earthquake	C	The Project is located in a seismically active zone, an earthquake could cause a landslide / ground collapse.	The Project is located on/in close proximity to 3 fault lines.	CDM Risk Register Construction phase health and safety plan Seismic hazard assessments	Death / injury to construction workers and damage to onsite structures.			X			X						As part of the construction planning, seismic activity will be monitored and in the event of an earthquake being detected construction activities will cease during the earthquake.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction / maintenance workers.	N/A	Not identified as a potential major accident / disaster event.
2	Geophysical	Ground collapse	Rogun Dam construction area	Earthquake	C	The Project is located in a seismically active zone, an earthquake could cause the destruction of the worker camps.	The Project is located on / in close proximity to 3 fault lines.	CDM Risk Register Construction phase health and safety plan Seismic hazard assessment	Death / injury to construction workers and damage to onsite structures.			X			X						As part of the construction planning, seismic activity will be monitored and in the event of an earthquake being detected workers would be moved to a safe location.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction / maintenance workers.	N/A	Not identified as a potential major accident / disaster event.
3	Geophysical	Collapse / damage to structures	Rogun Dam	Earthquake	O, M	Failure of / damage (cracks in the wall) to the dam in the event of an earthquake leading to a large-scale loss of containment.	The Project is located on/in close proximity to 3 fault lines.	Emergency Plan Seismic hazard assessment Fault displacement assessment	Death / injury to members of the public.			X			X					X	Seismic hazard risk assessment including a Probabilistic Seismic Hazard Assessment and a Deterministic Seismic Hazard Assessment. 3D dynamic analysis modelling. Seismic stability analysis of slopes. The design has taken into consideration the conclusions from these assessments and the dam has been designed to withstand the probable maximum earthquake intensity of Mw 6.9.	Y	Could cause loss of life or permanent injury which requires ongoing disability support.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.

Risk Record Entry No	Major Event Category	Risk Event Type	Section of the Project	Hazard Description	Applicable Phases (Construction, Operation, Maintenance) *	Risk Description	Hazard Sources and/or Pathways	Documentation in which the Event is/will be Addressed	Reasonable Worst Consequence if Event did Occur and Receptor(S)	Air Quality	Climate	People & Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape & Visual	Noise & Vibration	Transport	Material Resources	Road Drainage & Water	Mitigation	Could this Constitute a Major Accident or	Justification	Is this ALARP with Existing Mitigation?	Clarification
4	Geophysical	Collapse / damage to structures	Rogun Dam	Earthquake	O, M	Landslide / International Highway Bridge collapse into the reservoir may cause impulse / bore-like waves leading to overtopping of the dam wall and flooding downstream	Slope / bridge failure leading to overtopping of the dam and flooding of the cascade.	Emergency Plan Landslide Risk Assessment	Death / injury to members of the public.			X	X		X					X	Dynamic slope stability analysis. Landslide risk assessment International Highway Bridge preventative maintenance inspection regime. The International Highway Bridge has been designed to withstand the probable maximum earthquake intensity.	Y	Could cause loss of life or permanent injury which requires ongoing disability support and/or damage to an environmental receptor.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.
5	Geophysical	Collapse / damage to structures	Hydropower plant	Earthquake	O, M	Loss of power due to damage to generating equipment.	Earthquake leading to damage to power generating equipment.	Emergency Plan Seismic hazard assessment	Nuisance only.			X									Back-up generator for the safe shut-down of the hydropower plant.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. Nuisance only.	N/A	Not identified as a potential major accident/disaster event.
6	Geophysical	Collapse / damage to structures	Hydropower plant	Earthquake	O, M	Damage to powerhouse and transformer caverns leading to injury of workers.	Earthquake leading to damage to the powerhouse and transformer caverns.	Emergency Plan Seismic hazard assessment	Death / injury to maintenance workers / operators and damage to onsite structures.			X			X						Seismic hazard risk assessment including a Probabilistic Seismic Hazard Assessment and a Deterministic Seismic Hazard Assessment. 3D dynamic analysis modelling. Seismic stability analysis of slopes. The design has taken into consideration the conclusions from these assessments and the Project has been designed to withstand the probable maximum earthquake intensity of Mw 6.9.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are operators / maintenance workers.	N/A	Not identified as a potential major accident / disaster event.
7	Geophysical	Collapse / damage to structures	Rogun Dam	Reservoir induced seismicity	C, O, M	Earthquake leading to damage / failure of the dam wall resulting in a large-scale loss	Impoundment and / or filling of the reservoir causing an earthquake.	Dam Safety Panel of Experts Report Emergency Plan	Death / injury to members of the public.			X	X		X					X	Seismic hazard risk assessment including a Probabilistic Seismic Hazard Assessment and a Deterministic Seismic Hazard Assessment. 3D dynamic analysis modelling.	Y	Could cause loss of life or permanent injury which requires ongoing disability support and/or damage to an	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.

Risk Record Entry No	Major Event Category	Risk Event Type	Section of the Project	Hazard Description	Applicable Phases (Construction, Operation, Maintenance) *	Risk Description	Hazard Sources and/or Pathways	Documentation in which the Event is/will be Addressed	Reasonable Worst Consequence if Event did Occur and Receptor(S)	Air Quality	Climate	People & Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape & Visual	Noise & Vibration	Transport	Material Resources	Road Drainage & Water	Mitigation	Could this Constitute a Major Accident or	Justification	Is this ALARP with Existing Mitigation?	Clarification
						of containment event.		Seismic hazard assessment CDM Risk Register Construction Phase Health and Safety Plan													Seismic stability analysis of slopes. Continuous seismic monitoring. Lake water level monitoring. The reservoir will be filled slowly over a period of 16 years.		environmental receptor.		
8	Geophysical	Harm to people	Rogun Dam construction area	Landslide & mudslide	C	Rockfall into the construction area may cause death and/or injury to workers.	Slope failure.	CDM Risk Register Construction Phase Health and Safety Plan	Death / injury to construction workers and damage to onsite structures.			X			X						Dynamic slope stability analysis. Landslide risk assessment.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction workers.	N/A	Not identified as a potential major accident / disaster event.
9	Geophysical	Harm to people	Rogun Dam	Landslide & mudslide	O, M	Landslide into the reservoir may cause impulse / bore-like waves leading to overtopping of the dam wall and flooding downstream.	Slope failure leading to overtopping of the dam and flooding of the cascade.	Emergency Plan Landslide Risk Assessment	Death / injury to members of the public.			X	X		X					X	Dynamic slope stability analysis. Landslide risk assessment.	Y	Could cause loss of life or permanent injury which requires ongoing disability support and/or damage to an environmental receptor.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.
10	Geophysical	Ground collapse	Rogun Dam	Oscillations in reservoir water levels increase the risk of landslide and erosion	O, M	Erosion of mountain sides with resultant landslide into the reservoir causing impulse / bore-like waves leading to overtopping of the dam wall and flooding downstream.	Slope failure leading to overtopping of the dam and flooding of the cascade.	Emergency Plan Landslide Risk Assessment	Death / injury to members of the public.			X	X		X					X	Dynamic slope stability analysis. Landslide risk assessment	Y	Could cause loss of life or permanent injury which requires ongoing disability support and/or damage to an environmental receptor.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.
11	Geophysical	Ground collapse	Rogun Dam	Superficial landslides as a result of the formation of sinkholes in the halide karst.	C, O, M	Impounding results in the formation of sinkholes and the initiation of superficial landslides	Superficial landslides causing damage to buildings.	Emergency Plan Landslide Risk Assessment	Damage to property.			X			X						Dynamic slope stability analysis. Landslide risk assessment	N	Unlikely to lead to fatality or long-term harm/disability.	N/A	Not identified as a potential major accident / disaster event.

Risk Record Entry No	Major Event Category	Risk Event Type	Section of the Project	Hazard Description	Applicable Phases (Construction, Operation, Maintenance) *	Risk Description	Hazard Sources and/or Pathways	Documentation in which the Event is/will be Addressed	Reasonable Worst Consequence if Event did Occur and Receptor(S)	Air Quality	Climate	People & Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape & Visual	Noise & Vibration	Transport	Material Resources	Road Drainage & Water	Mitigation	Could this Constitute a Major Accident or	Justification	Is this ALARP with Existing Mitigation?	Clarification
						causing damage to buildings (e.g. Rogun City).																			
12	Societal	Harm to people	Rogun Dam construction area	Extensive public demonstrations due to controversy associated with the Project.	C	Injury / loss of life to those people involved in public demonstrations.	Violence associated with public demonstrations.	Security Management Plan. Construction Phase Plan. Community Health and Safety Management Plan.	Minor injury to member of the public.			X									Implementation of the actions identified in the Security Management Plan and the Construction Phase Plan. Training of site security, to include managing potentially hostile situations.	N	Unlikely to lead to fatality or long-term harm / disability.	N/A	Not identified as a potential major accident / disaster event.
13	Industrial and Urban Accidents	Collapse / damage to structures	Rogun Dam	Breach or overtopping of the Rogun Dam	C, O, M	Large scale loss of containment resulting in: damage to the hydropower dams in the cascade below Rogun Dam; injury / loss of life to local populations; and impacts on aquatic and ecological receptors.	Failure of the / damage to the dam wall leading to the loss of containment of the reservoir.	Emergency Plan	Death / injury to members of the public.			X	X							X	Hazard identification studies and risk assessments identifying appropriate mitigation measures. Designed to appropriate standards.	Y	Could cause loss of life or permanent injury which requires ongoing disability support and / or damage to an environmental receptor.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.
14	Malicious attacks	Fire and / or explosion or release of harmful gas	Rogun Dam construction area	Presence of unexploded ordnance (UXO).	C	Striking UXO resulting in an explosion.	Encountering UXO during construction activities.	CDM Risk Register Construction Phase Health and Safety Plan UXO Risk Assessment	Fire and / or explosion affects site infrastructure and / or construction workers in the immediate area with possible death and / or injury.			X			X						Construction Emergency Response Plan. Construction Health and Safety Management Plan. UXO risk assessment.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction workers.	N/A	Not identified as a potential major accident/ disaster event.

Risk Record Entry No	Major Event Category	Risk Event Type	Section of the Project	Hazard Description	Applicable Phases (Construction, Operation, Maintenance) *	Risk Description	Hazard Sources and/or Pathways	Documentation in which the Event is/will be Addressed	Reasonable Worst Consequence if Event did Occur and Receptor(S)	Air Quality	Climate	People & Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape & Visual	Noise & Vibration	Transport	Material Resources	Road Drainage & Water	Mitigation	Could this Constitute a Major Accident or	Justification	Is this ALARP with Existing Mitigation?	Clarification
15	Malicious attacks	Collapse / damage to structures	Rogun Dam	Targeted malicious attack.	O, M	Failure of / damage (cracks in the wall) to the dam leading to a large-scale loss of containment.	Presence of the dam.	Emergency Plan Security Management Plan Security vulnerability assessment National risk register	Death / injury to members of the public.			X	X							X	A security management plan will be developed which considers the potential for malicious attacks including aerial attacks.	Y	Could cause loss of life or permanent injury which requires ongoing disability support and/or damage to an environmental receptor.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.
16	Engineering accidents and failures	Fire and / or explosion or release of harmful material	Rogun Dam construction area	Demolition of buildings / structures.	C	Release of asbestos / other hazardous material during demolition of buildings / structures.	Airbourne dust particles containing hazardous materials.	CDM Risk Register Construction Phase Health and Safety Plan Demolition Management Plan Hazardous materials survey and management plan	Death / injury to construction workers.	X		X	X								Buildings will be surveyed prior to demolition works to identify the presence of any hazardous materials. Implementation of a demolition management plan. Removal of any hazardous materials will be undertaken by a competent contractor with the appropriate qualifications / accreditation.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction workers.	N/A	Not identified as a potential major accident / disaster event.
17	Engineering accidents and failures	Tunnel collapse.	Rogun Dam construction area and Rogun Dam	Collapse of tunnel.	C, O, M	Collapse of tunnels on to workers while being used for access / egress to the construction site and the powerhouse.	Failure of the / damage to the tunnel leading to collapse on workers.	Planned inspection and maintenance assessment	Death / injury to construction / maintenance / operational workers.			X									Tunnels have been designed to appropriate standards. Preventative maintenance regime - tunnels will be regularly inspected to ensure they remain fit for purpose.	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction / maintenance / operational workers.	N/A	Not identified as a potential major accident / disaster event.
18	Engineering accidents and failures	Tunnel collapse.	Rogun Dam	Collapse of tunnel.	O, M	Collapse of tunnel preventing the diversion of water from the reservoir potentially leading to overtopping of the dam wall.	Failure / blockage of the tunnel preventing the diversion of water from the reservoir leading to water overtopping the dam wall.	Planned inspection and maintenance assessment Emergency plan	Death / injury to members of the public.			X	X							X	Tunnels have been designed to appropriate standards. Preventative maintenance regime - tunnels will be regularly inspected and cleared of sediment / debris to ensure they remain fit for purpose.	Y	Could cause loss of life or permanent injury which requires ongoing disability support and / or damage to an environmental receptor.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.

Risk Record Entry No	Major Event Category	Risk Event Type	Section of the Project	Hazard Description	Applicable Phases (Construction, Operation, Maintenance) *	Risk Description	Hazard Sources and/or Pathways	Documentation in which the Event is/will be Addressed	Reasonable Worst Consequence if Event did Occur and Receptor(S)	Air Quality	Climate	People & Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape & Visual	Noise & Vibration	Transport	Material Resources	Road Drainage & Water	Mitigation	Could this Constitute a Major Accident or	Justification	Is this ALARP with Existing Mitigation?	Clarification
19			Rogun Dam construction area	Collapse / damage to residential properties.	C	Vibration from heavy construction traffic causing damage to residential properties potentially leading to collapse of dwelling.	Heavy construction traffic in close proximity to residential dwellings causing damage to properties.	CDM Risk Register Construction Phase Health and Safety Plan	Death / injury to members of the public.			X						X			Where possible, heavy construction traffic will be routed along roads which do not pass residential properties. Regular planned property inspection regime for potentially affected properties.	Y	Could cause loss of life or permanent injury which requires ongoing disability support and / or damage to property.	Y	Considered to be ALARP if all mitigation measures outlined are correctly implemented.

9.6.2. The following section presents a summary of the identified Risk Events, during construction and operation phases, which have been considered taking into account any relevant management measures in place prior to the assessment.

CONSTRUCTION PHASE

9.6.3. Major Events to which the Project may be vulnerable during the construction phase are summarized in Table 9-7 below, which lists those Risk Events whose impact on an environmental receptor has the potential to be a major event as defined in Table 9-2. All considered events are set out in Table 9-6.

Table 9-7 - Potential Major Accident and / or Disaster Events during Construction Grouped by High Level Risk Event

Risk Record Entry Number	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event did Occur
7	Earthquake leading to damage / failure of the dam wall resulting in a large-scale loss of containment event.	Collapse / damage to structures.	Death/injury to members of the public.
13	Breach or overtopping of the Rogun Dam from flooding during construction.	Collapse or damage to structures.	Death/injury to members of the public.
19	Vibration from heavy construction traffic causing damage to residential properties potentially leading to collapse of dwelling.	Collapse / damage to residential properties.	Death / injury to members of the public.

9.6.4. Based on the assumptions and mitigation measures put forward in other relevant technical annexes, it is considered that the identified potential major accident(s) and/or disaster(s) events above would all be managed to be ALARP.

OPERATION PHASE

9.6.5. Major Events to which the Project may be vulnerable during the operational phase are summarized in Table 9-8 below, which lists those Risk Events whose impact on an environmental receptor has the potential to be a major event in section in Table 9-2. All considered events are set out in Table 9-6.

Table 9-8 - Potential Major Accident and / or Disaster Events during Operation Grouped by High Level Risk Event

Risk Record Entry Number	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event did Occur
3	Failure of / damage (cracks in the wall) to the dam in the event of an earthquake leading to a large-scale loss of containment.	Collapse / damage to structures.	Death/injury to members of the public.
4	Landslide/mudslide/GLOF into the reservoir may cause impulse / bore-like waves leading to overtopping of the dam wall and flooding downstream.	Collapse / damage to structures.	Death/injury to members of the public.
7	Earthquake leading to damage / failure of the dam wall resulting in a large-scale loss of containment event.	Collapse / damage to structures.	Death/injury to members of the public.
9	Landslide into the reservoir may cause impulse / bore-like waves leading to overtopping of the dam wall and flooding downstream.	Harm to people.	Death/injury to members of the public.
10	Erosion of mountain sides with resultant landslide into the reservoir causing impulse / bore-like waves leading to overtopping of the dam wall and flooding downstream.	Ground collapse.	Death/injury to members of the public.
13	Large-scale loss of containment resulting in damage to the hydropower dams in the cascade below Rogun Dam; injury / loss of life to local populations; and impacts on aquatic and ecological receptors.	Collapse / damage to structures.	Death/injury to members of the public.
15	Failure of / damage (cracks in the wall) to the dam leading to a large-scale loss of containment.	Collapse / damage to structures.	Death/injury to members of the public.
18	Collapse of tunnel preventing the diversion of water from the reservoir potentially leading to overtopping of the dam wall.	Tunnel collapse.	Death/injury to members of the public.

9.6.6. Based on the assumptions and mitigation measures put forward in other relevant technical annexes, it is considered that the identified potential major accident(s) and/or disaster(s) events above would all be managed to be ALARP.

9.7. TRANSBOUNDARY IMPACTS

9.7.1. The assessment of Major Events intrinsically considers possible transboundary impacts. The assessment has considered the potential consequences associated with the failure or over-topping of the dam which are the two main Risk Events identified that could lead to transboundary impacts. The Emergency response plan for Cascade Failure defines the process for warning and evacuation should the event occur.

9.8. SUMMARY

9.8.1. For the potential Major Events identified, the assessment concluded there is no likely requirement for further mitigation measures, as based on the information currently available in other relevant ESIA topic chapters / annexes, it is deemed that the risks are anticipated to be ALARP.

10 CLIMATE RESILIENCE

10.1 INTRODUCTION

10.1.1. This Chapter considers climate change in two ways; an assessment of the Project's vulnerability to the physical risks of climate change and an assessment of the risks from transitioning to a lower-carbon economy.

10.1.2. A Climate Risk and Vulnerability Assessment (CRVA) has assessed the physical risks of climate change and the potential impacts on Rogun Hydropower Plant (HPP) (the Project) during its lifetime. The CRVA considered the vulnerability of the Project to climate variables identified in the future baseline, assessed the impacts with consideration to the design adaptation measures which improve the resilience of the Project to the impacts of climate change.

10.1.3. Transition risks in the context of climate change arise during the transition to a lower carbon economy. The changes required to facilitate the transition will give rise to a range of risks including policy and market changes, technological advances and reputational risks around higher emitting operations and a lack of resilience to climate impacts and future climate projections.

10.2 CLIMATE RISK AND VULNERABILITY ASSESSMENT

10.2.1. The scope of the CRVA is to assess physical climate change impacts on the current, partially constructed, Project (existing and proposed assets), across its future operational lifetime (up to and including the 2090s). Hydropower generation is sensitive to weather, particularly weather events that impact on hydrological conditions such as precipitation and temperature, and it is imperative that climate change is considered in the planning and management of the Project[1].

STANDARDS AND GUIDELINES

10.2.2. World Bank Environmental & Social Standards (ESS) - ESS1 Assessment and Management of Environmental and Social Risks and Impacts sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing (IPF), in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs). The ESS1 guidance note states that – "the environmental and social assessment will consider potentially significant project related transboundary and global risks and impacts, such as impacts from effluents and emissions, increased use or contamination of international waterways, emissions of short- and long-lived climate pollutants, climate change mitigation, adaptation and resilience issues, and impacts on threatened or depleted migratory species and their habitats".

10.2.3. The European Investment Bank (EIB) Standard 5 – Climate Change (EIB5) sets out the requirement for projects to assess, manage and monitor project-related physical climate risks. The standard aims

[1] World Bank (2020). Climate Change in Tajikistan (Online). Available from: https://zoinet.org/wp-content/uploads/2018/01/TJK-climate-summary-en.pdf (Accessed: July 2023).

for the CRVA to build resilience and adaptive capacity in response to current and future climate change-induced impacts.

10.2.4. The CRVA aligns with the EU Taxonomy 'Do No Significant Harm' (DNSH) principle to climate change adaptation objectives for investment decisions. This regulation sets out the definition of sustainable investment by applying good governance practice and ensuring the principle of DNSH for both environmental and social objectives. The CRVA methodology aligns to DNSH.

10.2.5. EIB Climate Strategy[2] sets out EIB's commitment to building resilience to climate change through use of CRVAs.

10.2.6. IEMA EIA Guide to Climate Change Resilience and Adaptation sets out how to address climate change resilience in environmental impact assessments[3]. This has been adapted for use as guidance for international ESIAs.

10.2.7. The International Hydropower Association (IHA) have produced a Climate Resilience Guide for the Hydropower Sector[4] which has been used to identify and assess climate change risks and suggest adaptation measures for the Project.

EXISTING ASSESSMENT

Environmental and Social Impact Assessment, 2014

10.2.8. Volume I Main Report of the 2014 Environmental and Social Impact Assessment (ESIA) provided sectoral studies of the Project, of which climate data was reported as part of the study on the physical environment. Section 7 of the 2014 ESIA focussed on the effects of the Project on the local climate, in addition to how the changes in water availability with climate change may affect the operation of the Hydropower Plant (HPP). Section 20 developed the climate projections for the project area, indicating the importance of snow and glacier melting on future water resources and flooding and mudflows. The hydrological and glaciological projections as part of this section assess the impact of the disappearance of glaciers and the water balance of the basins. It also assesses the impact of the Project on the local climate, and environment due to climate change, such as downstream sedimentation. The assessment concluded that there are no significant adverse climate change risk affecting the operation of Rogun HPP in terms of water availability.

10.2.9. The ESIA did not include detailed studies on changes to hydrology from climate change, including Glacial Lake Outburst Floods (GLOF), changes in flows due to local glacier retreat or expansion, changes in sedimentation, or other effects of climate change (e.g., increasing temperatures) that would increase the risk to the operation of Rogun HPP.

10.2.10. An assessment of climate change and its effects on Rogun HPP was excluded from the Volume II technical annexes.

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[2] European Investment Bank (EIB) (2020) Climate Strategy (Online). Available from: https://www.eib.org/attachments/strategies/eib_climate_strategy_en.pdf (Accessed on: July 2023)

[3] IEMA (2020) EIA Guide to Climate Change Resilience and Adaptation. Available at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020

[4] IHA (2019) Hydropower Sector Climate Resilience Guide (Online). Available at: https://assets-global.website-files.com/5f749e4b9399c80b5e421384/5fa7e38ce92a9c6b44e63414_hydropower_sector_climate_resilience_guide.pdf (Accessed: June 2023)

Techno-economic assessment study, 2014

10.2.11. Chapter 5 of the Techno-Economic Assessment Study (TEAS) is a comprehensive review of the existing climate documentation to assess the quality of the data, review the inflows assessment, estimate flood return periods and Maximum Probability Flood, and review the existing climate change projections.

10.2.12. The study analysed trends in precipitation and temperature but concluded that a critical review of climate change models is required to reduce the uncertainties inherent in downscaled climate change projections, to allow for the level of accuracy required when designing HPPs. It is currently not accurate to understand the local impact of climate change on Rogun HPP, and therefore derived climate adaptation measures would be inappropriate. However, the study reiterates that adaptation must be incorporated into the planning of Rogun HPP. The study suggests that even a robust and conservative design should allow some flexibility to be resilient to drastic climatic changes. Adaptive capacity could be built in the form of monitoring systems e.g., early warning systems to improve preparedness to extreme phenomena.

Environmental and Social Panel of Experts, 2014

10.2.13. Recommendations from the Environmental and Social Panel of Experts (ESPoE) include that coverage of climate change and adaptation needs to be improved, using the EIB Standard 5 as a guide.

Review of Environmental and Social Aspects of Rogun Hydropower Plant, 2021

10.2.14. This review concluded that the Environmental and Social assessment should consider the impacts of climate change such as climate change adaptation and resilience issues. It is also recommended that the structural design should take into account climate change considerations.

Dam Safety Panel of Experts, Second Report, 2023

10.2.15. Recommendations from the Dam Safety Panel of Experts (PoE) suggests that the TEAS Climate change impacts and risk assessments should be updated. This includes factoring in climate change into Reservoir Operation Simulation Studies and flood assessments.

Environmental and Social Panel of Experts, Second Report 2023

10.2.16. The second report from the ESPoE reiterates that resilience, vulnerability, and adaptation need to be addressed in line with both World Bank and EIB guidelines.

CLIMATE AND HYDROLOGY STUDIES

10.2.17. It is noted that further studies around climate and hydrology to support the planning of the Rogun HPP will be undertaken. This includes climate change impact assessment and adaptation studies, including hydrology, sedimentation modelling and management, and flood-wave hazard such as GLOFs and landslides.

10.2.18. At the time of writing, these studies have not been commissioned and therefore the outcomes from these studies have not informed this assessment. The outcomes will inform the future climate change adaptation management of the Project.

BASELINE – CURRENT CONDITIONS

Current Baseline

10.2.19. Tajikistan is the smallest country in Central Asia; 93% of its territory is mountainous regions and 6% is occupied by glaciers. Tajikistan is located in the temperate continental climate zone and with moderate climate variables typical of Central Asia. Climate variability is linked with its geological sub-state, which includes coastal, plain areas and mountains. Tajikistan is prone to natural disasters; typically avalanches in winter, flash floods in the spring, and high temperatures and dust storms in the summer[5].

10.2.20. The glaciers are important in regulating the climate whilst retaining water and controlling flows6. Climate change impacts are already observed in Tajikistan, with 20 billion cubic metres of ice volume within glaciers already lost during the 20th century (about 2.5%), likely to be accelerated by increasing temperatures. It is estimated that total glacial area will decline by up to 20% within the next 30-40 years, depleting water resources and increasing the risk of mudflows and floods[7].

10.2.21. The climate change data below focuses on trends in precipitation, temperature, sea level rise, wind and the impacts on land across the operational design life. Detailed hydrological data and trends affecting the operation of the Project can be found in Annex A05: Water.

10.2.22. Information on the current climate (current baseline) of Tajikistan has been obtained from the World Bank Climate Change Knowledge Portal[8]. Region of Republican Subordination (referred to as Tadzhikistan Territories in the World Bank Climate Change Knowledge Portal) is located across central and west Tajikistan, in which the Project is located. Baseline climate information for the sub-region of Region of Republican Subordination is presented as representative of the climate of the Project.

Temperature

10.2.23. The temperatures experienced across Tajikistan are dictated by the mountainous terrains. Average monthly temperatures in Region of Republican Subordination are slightly warmer in comparison to the rest of Tajikistan as presented in **Figure 10-1**. The coldest month is January, with July and August being the warmest months.

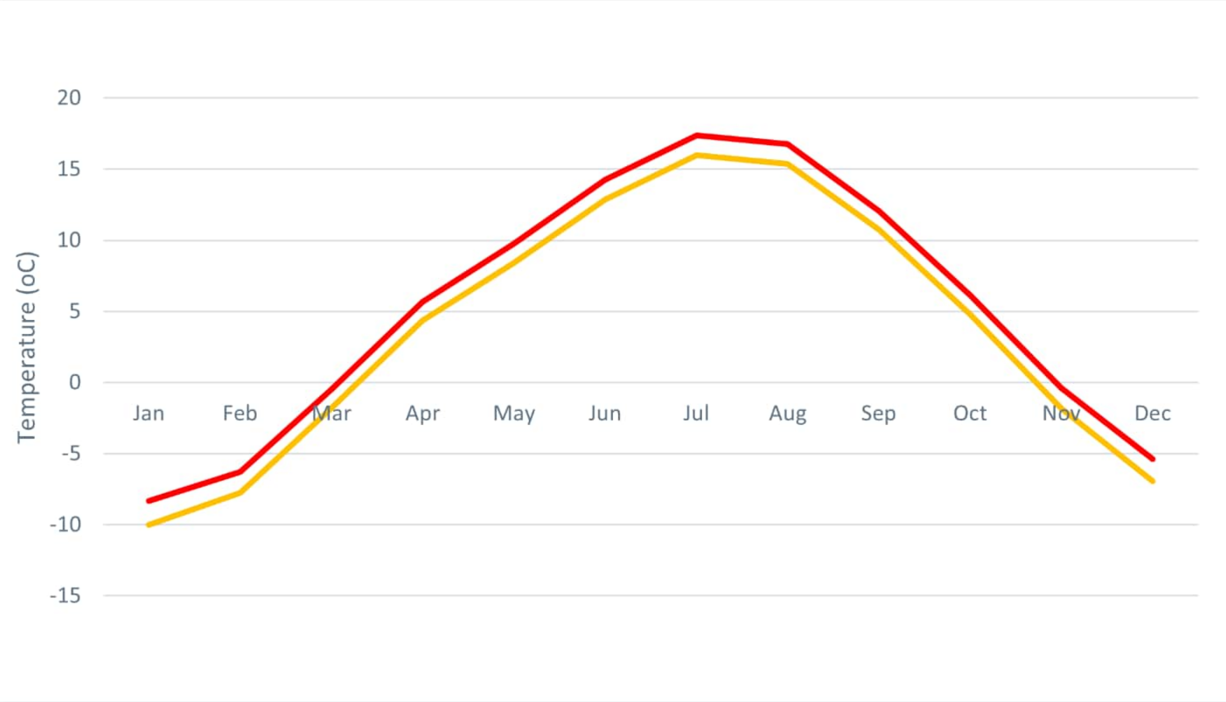
[5] World Bank (2020). Climate Change in Tajikistan (Online). Available from: https://zoinet.org/wp-content/uploads/2018/01/TJK-climate-summary-en.pdf (Accessed: July 2023).

[6] UNDP (n.d.) Tajikistan Climate Change Adaptation. Available at: https://www.adaptation-undp.org/explore/central-asia/tajikistan (Accessed: June 2023)

[7] Global Support Programme (n.d.) Supporting Tajikistan to advance their NAP process. Available at: https://www.globalsupportprogramme.org/projects/supporting-tajikistan-advance-their-nap-process (Accessed: June 2023)

[8] World Bank (2020). Climate Change Knowledge Portal. Available at: https://climateknowledgeportal.worldbank.org/

Figure 10-1 - Average Monthly Temperature for Region of Republican Subordination (red) and Tajikistan (orange) (1991-2021)



10.2.24. Temperature records spanning 1901-2021 indicate that there have been increases in the annual average temperature of Region of Republican Subordination (**Table 10-1**), consistent with climate projections. **Table 10-1** shows that from 1991-2021, the average annual temperature in Region of Republican Subordination has been approximately 0.7°C higher than the average for 1961-1990. 2016 was the warmest year since 1900 in Tajikistan with an average temperature of 4.53°C, closely followed by 2021 with an average annual temperature of 4.52°C.

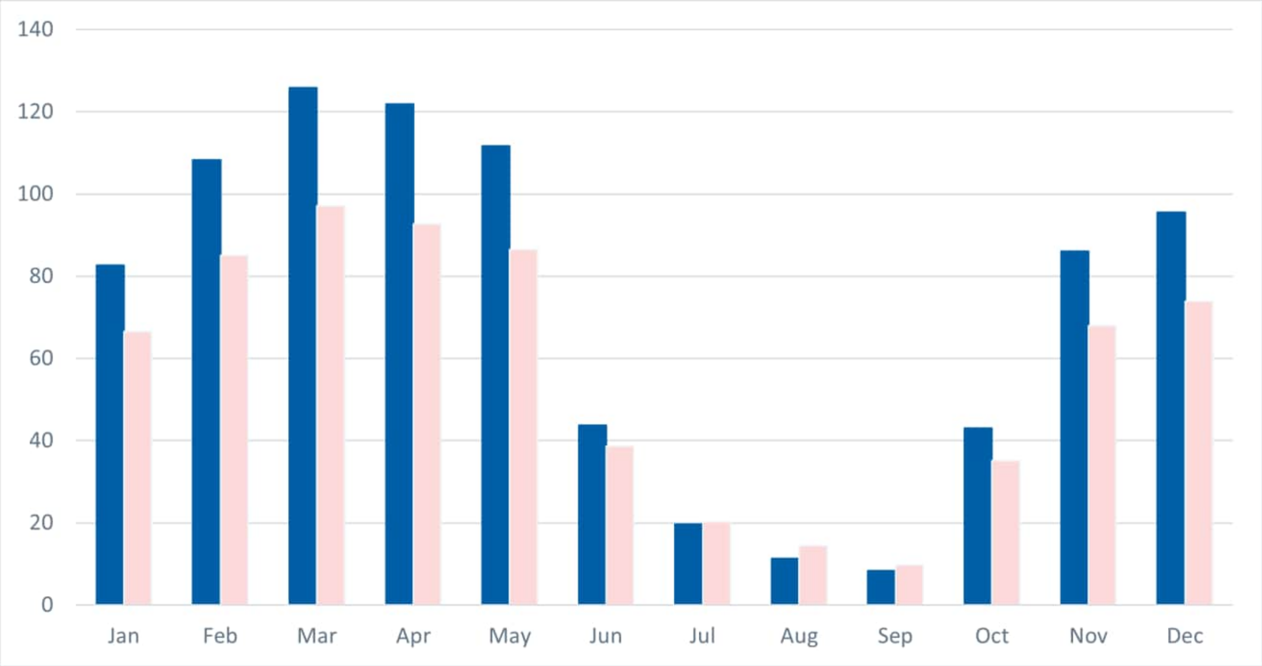
Table 10-1 – Region of Republican Subordination Annual Average Temperature (1901-2021)

Year	Average Annual Temperature (°C)
1901-1930	2.7
1931-1960	2.7
1961-1990	3.1
1991-2021	3.8

Precipitation

10.2.25. Average monthly precipitation in Region of Republican Subordination is generally higher in comparison to the rest of Tajikistan as presented in **Figure 10-2**. The wettest month is March, with July, August and September being the driest months.

Figure 10-2 - Average Monthly Precipitation for Region of Republican Subordination (blue) and Tajikistan (pink) (1991-2021)



10.2.26. Precipitation records spanning 1901-2021 indicate that there have been increases in the annual average precipitation of Region of Republican Subordination (shown in **Table 10-2**). **Table 10-2** shows that from 1991-2021, the average annual precipitation in Region of Republican Subordination has been approximately 55mm higher than the average for 1961-1990.

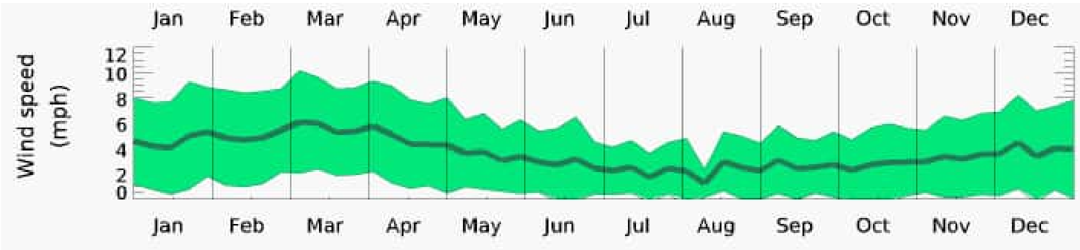
Table 10-2 – Region of Republican Subordination Annual Average Precipitation from 1901-2021

Year	Average Annual Precipitation (mm)
1901-1930	740.5
1931-1960	764.4
1961-1990	793.3
1991-2021	848.3

WIND

10.2.27. Wind speed data (which is being affected by the energy levels being affected by a warmer climate) is not available from the World Bank Climate Change Knowledge Portal. However, Meteoblue presents observed climate data for the Region of Republican Subordination region[9] (Meteoblue, 2020). Data obtained approximately 72km away from Project site shown in **Figure 10-3**. Wind speeds are typically lowest in July and August, and highest in March.

Figure 10-3 - Average Monthly Wind Speed (mph) for Region of Republican Subordination 2022



10.2.28. Dust storms are common in Tajikistan due to the aridity of the region situated in the 'global dust belt'. Dust storms are typical between April and November however are primarily associated with lowland areas[10].

Solid Mass

10.2.29. Mudflow and landslides within mountainous and foothill regions are unpredictable and result from melting glaciers leading to flash floods or glacier lake outburst floods (GLOF). Avalanches are where large amounts of uncompacted fresh snow are set into motion. Most avalanches are observed in February and March.

Future Baseline (Climate Projections)

10.2.30. Climate projections have been derived from the World Bank Climate Change Knowledge Portal for the Project area[11]. Projections have been presented for Region of Republican Subordination. Projections have been provided for SSP2-4.5 (middle of the road, equivalent to 2-degree warming) and SSP5-8.5 (fossil fuel development, equivalent to a 4-degree warming), the latter has been used to provide a 'worst case' scenario[12] against which to assess the resilience of the Project. This follows the precautionary principle. The projections have been assessed for the 2030s, 2050s and 2090s (20-year periods) using CMIP6 data.

10.2.31. As stated in **Section 0**, further studies will be undertaken to support climate change impact studies, including the impacts of the future climate to glaciers in the region, using climate change data from the glacial regions.

[9] Meteoblue (2020). Climate observed Cernavoda. Available at: https://www.meteoblue.com/en/weather/historyclimate/climateobserved/roghun_tajikistan_1220701

[10] Abdullaev, S. F., and Sokolik, I. N. (2019). Main Characteristics of Dust Storm sand Their Radiative Impacts: With a Focus on Tajikistan. Journal of Atmospheric Science Research Volume 02(02). (Accessed on: July 2023).

[11] World Bank (2020c). Tajikistan Climate Data – Projections. Available at: https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections

[12] It is acknowledged that climate modelling can produce scenarios against greater degrees of warming, the SSP5-8.5 projections represent a scenario which is commonly available and accepted to represent a 'worst case' in the context of Environmental and Social Impact Assessments.

Temperature

10.2.32. The projected change in seasonal temperature for Region of Republican Subordination for the 2030s, 2050s and 2090s under SSP2-4.5 and SSP5-8.5, compared to the baseline of 1995-2014 is presented in **Table 10-3**. For SSP2-4.5 this shows an increase in temperature in the range of 1.01°C (2030s winter) to 3.13°C (2090s summer) for the 50% percentile 'central estimate' (taken as the median value of predicted change). For SSP5-8.5 this shows an increase in temperature in the range of 1.24°C (2030s summer) to 6.10°C (2090s summer).

10.2.33. The projections for temperature rise are greatest in summer. During winter, air temperatures are also expected to increase, though with less intensity.

Table 10-3 - Region of Republican Subordination Projected Change in Season Temperature (°C) under SSP2 and SSP5 for the 2030s, 2050s and 2090s (baseline period 1995-2014)

Year		SSP2-4.2	SSP5-8.5
2030s	Summer	+1.15	+1.24
	Winter	+1.01	+1.37
2050s	Summer	+1.87	+2.54
	Winter	+1.92	+2.54
2090s	Summer	+3.13	+6.10
	Winter	+2.99	+5.66

10.2.34. As well as an increase in average temperatures, projections indicate an increase in extreme temperatures (i.e., the temperature experienced during heatwaves). Table 10-4 shows the mean maximum of daily maximum temperature for summer and winter in each of future time slices relative to the reference period (1995-2014) for Region of Republican Subordination. **Table 10-4** shows that the hottest day in the 2090s period is projected to be 40.2°C, 6°C degrees hotter than the hottest day in 1995-2014.

10.2.35. Periods of extreme temperature can increase the risk of fire outbreak, with high temperatures, low humidity and dry conditions conducive to fire weather[13] (Jones et al., 2020).

[13] Jones et al., (2020) Climate Change Increases the Risk of Wildfires. Available at: https://tyndall.ac.uk/working-papers/climate-change-increases-the-risk-of-wildfires/

Table 10-4 - Region of Republican Subordination Projected Mean Maximum of Daily Max-Temperature (°C) under SSP2 and SSP5 for the 2030s, 2050s and 2090s (baseline period 1995-2014)

Year		SSP2-4.2	SSP5-8.5
Baseline period	Summer	34.2	34.2
	Winter	10.0	10.0
2030s	Summer	35.2	35.4
	Winter	11.3	11.4
2050s	Summer	36.1	36.6
	Winter	12.1	12.6
2090s	Summer	37.2	40.2
	Winter	13.4	15.9

Precipitation

10.2.36. An increase in annual precipitation is predicted in Region of Republican Subordination for all time periods and scenarios. This is due to winter precipitation increases far outweighing summer precipitation decreases. The projected change in annual precipitation for Region of Republican Subordination for the 2030s, 2050s and 2090s under SSP2-4.5 and SSP5-8.5 compared to the baseline of 1995-2014 for the 50th percentile is presented in **Table 10-5**. This shows an increase in annual precipitation in the range of 4.3mm to 61.2mm.

Table 10-5 - Region of Republican Subordination Projected Change in Annual Precipitation (mm) under SSP2 and SSP5 for the 2030s, 2050s and 2090s (baseline period 1995-2014)

Year	SSP2-4.2	SSP5-8.5
2030s	+17.4	+4.3
2050s	+28.0	+26.8
2090s	+39.5	+61.2

10.2.37. It is anticipated that there will be seasonal changes as more precipitation will fall as rain and less as snow which will increase annual and inter-annual variability. These changes may lead to greater average flow volumes and greater variability.

10.2.38. As the country's mountain glaciers melt at increasing rates, in the short to medium term this could lead to excess waterflows and cause severe flooding and associated hazards such as landslides and mudslides. This will occur for several decades whilst the glaciers deplete. In the longer term, reduced glaciers are likely to reduce the regularity of waterflows, where annual flow volumes will decrease due to extensive glacier recession and may result in the drying of some watersheds.

Wind

10.2.39. There is low confidence in the accuracy of the results from existing models of future wind conditions under climate change. The site of the Project is identified as having a 'very low' storm hazard risk[14].

10.2.40. The retreat of glaciers can increase the incidence of dust storms however these are concentrated within the lowland areas.

Solid Mass

10.2.41. Projected increases in extreme precipitation events combined with warm spells could increase avalanching and landslides with climate change (World Bank, 2021a, 2021b).

SCOPING

10.2.42. The CRVA methodology aligns to EIB Standard 5 and the Do No Significant Harm (DNSH) framework criteria. As such, a scoping assessment is not required here. The methodology ensures a proportionate assessment with a focus on key climate change risks. This is undertaken through a screening process (Step 1) which identifies only relevant climate hazards impacting the project, and a vulnerability assessment (Step 3) to bring forward only those receptors (project assets) considered vulnerable to the climate change trends for further assessment as part of the CRVA.

ASSESSMENT METHODOLOGY

10.2.43. The assessment of climate risk and vulnerability follows the criteria for climate change adaptation as set out in the DNSH framework and involves the following steps.

Step 1: Screening of Climate Hazards

10.2.44. The DNSH criteria identifies chronic and acute climate hazards, relevant to temperature, wind, water and solid mass. The location and type of Project are taken into consideration to identify which climate hazards are applicable and should be taken forward to the vulnerability assessment. Climate hazards which are not relevant to the Project are screened out.

Step 2: Current and Future Climate Baseline

10.2.45. For the in-scope climate hazards, the current climate conditions and future climate projections are described. The current and future climate baseline contained in this Chapter has been obtained from the World Bank Climate Change Knowledge Portal (World Bank, 2020b).

10.2.46. Aligning to the IEMA EIA Guide to Climate Change Resilience and Adaptation the baseline considers:

- The current climate baseline (defined by historic climate conditions) to provide an indication of past vulnerability; and
- The future climate baseline (short-term extremes and long-term variation) to assess a project's vulnerability to climate change.

[14] Swiss Re (2020) CatNet – the online natural hazard atlas

10.2.47. Climate projections have been presented for Region of Republican Subordination. Projections have been provided for SSP2-4.5 (middle of the road, equivalent to 2-degree warming) and SSP5-8.5 (fossil fuel development, equivalent to a 4-degree warming), the latter has been used to provide a 'worst case' scenario[12] against which to assess the resilience of the Project. This follows the precautionary principle. The projections have been assessed for the 2030s, 2050s and 2090s (20-year periods) using CMIP6 data.

Step 3: Vulnerability Assessment

10.2.48. The in-scope climate hazards are assessed to identify their vulnerability to climate hazards. The assessment is determined by a function of sensitivity and exposure:

- The typical sensitivity of receptors to climate variables – based on literature review and professional judgement and rated as high, moderate or low; and
- The exposure of receptors to projected change in climate variables – based on the baseline information and rated as high, medium or low.

10.2.49. The valued components of the CRVA are the project assets, known as the receptors. The vulnerability of receptors to climate variables is determined from the combination of the sensitivity and exposure ratings, using the matrix shown in **Table 10-6**.

10.2.50. The outcome of this stage of the assessment is a list of climate variables for each Project element to take forward for further assessment. 'Low' vulnerabilities are not considered further and scoped out at this stage. 'High' and 'Moderate' vulnerabilities are scoped in and assessed further on Step 4 to identify their significance and materiality.

Table 10-6 – Vulnerability Matrix

	Exposure		
Sensitivity	Low	Medium	High
Low	Low vulnerability	Low vulnerability	Low vulnerability
Moderate	Low vulnerability	Medium vulnerability	Medium vulnerability
High	Low vulnerability	Medium vulnerability	High vulnerability

Step 4: Materiality (Significance) Assessment

10.2.51. The materiality of the physical risks on the economic activity of the Project is assessed though the likelihood and consequence of the climate change impact, taking into account design control measures which mitigate climate impacts. Design control measures have been identified through existing Project information and include a combination of measures which have been and will be incorporated into the design. This provides an initial risk assessment of the assets and operations of the Project and identifies which impacts are significant, or material to the Project.

10.2.52. Likelihood and consequence were qualitatively assessed using the descriptions in

10.2.53. **Table** 10-7 and **Table 10-8** respectively. These descriptions have been developed using experience and professional judgement, informed by relevant guidance.

Table 10-7 – Definitions of Likelihood

Measure of Likelihood	Description
Very high	The event occurs multiple times during the lifetime of the project, e.g., usually annually.
High	The event occurs several times during the lifetime of the project, e.g., approximately once every five years.
Medium	The event occurs limited times during the lifetime of the project, e.g., approximately once every 15 years.
Low	The event occurs occasionally during the lifetime of the project, e.g., once in 60 years.
Very low	The event may occur once during the lifetime of the project.

Table 10-8 – Definitions of Consequences

Measure of Consequence	Description
Negligible	No facility/infrastructure damage, minimal adverse effects on health, safety and the environment. Facility doesn't shut down. No financial loss.
Minor Adverse	Localised facility/infrastructure disruption. No permanent damage, minor restoration work required: Facility closure lasting less than one day. Slight adverse health or environmental effects. Repairs cost 2% of facility reconstruction cost.
Moderate Adverse	Limited facility/infrastructure damage with damage recoverable by maintenance or minor repair. Facility/infrastructure disruption lasting more than one but less than three days. Adverse effects on health and/or the environment. Repairs cost 25% of facility reconstruction cost.
Large Adverse	Extensive facility/infrastructure damage. Facility/infrastructure disruption lasting more than three but less than ten days. Early renewal of 50-90% of infrastructure. Permanent physical injuries and/or fatalities. Significant effect on the environment, requiring remediation. Repairs cost 50% of facility reconstruction cost.
Very Large Adverse	Permanent damage. Facility/infrastructure disruption lasting more than ten days. Early renewal of facility/infrastructure >90%. Severe health effects and/or fatalities. Very significant loss to the environment requiring remediation and restoration. Repairs cost 100% of facility reconstruction cost.

10.2.54. The likelihood and consequence ratings were combined to assess the significance and materiality of the climate impacts on the Project receptors. The significance and materiality are considered in relation to the impact of the climate hazard on the receptor and the materiality of that impact on the economic activity.

10.2.55. **Table** 10-9 presents the significance matrix. Where impacts are considered significant, they are considered to have a material effect on the Project. The assessment is qualitative and based on expert judgment and knowledge of similar projects. It also includes engagement with the wider Project Team and a review of Project documentation.

Table 10-9 – Significance Rating Matrix

Likelihood	Consequence of Hazard Occurring				
	Negligible	Minor adverse	Moderate adverse	Large adverse	Very large adverse
Very High	Not Significant	Significant	Significant	Significant	Significant
High	Not Significant	Significant	Significant	Significant	Significant
Medium	Not Significant	Not Significant	Significant	Significant	Significant
Low	Not Significant	Not Significant	Not Significant	Significant	Significant
Very Low	Not Significant	Not Significant	Not Significant	Significant	Significant

Step 5: Identification of Adaptation Solutions

10.2.56. Where Significant (material) risks have been identified, additional adaptation measures are presented that can reduce the physical climate risk.

Step 6: Residual Risk Assessment

10.2.57. The assessment of residual risk takes into account the additional adaptation solutions and uses the likelihood and consequence criteria (defined in Step 4) to re-assess the impact of climate change on the Project.

10.3 CRVA IMPACT ASSESSMENT

10.3.1. The six steps presented above have been used in this Section to inform the CRVA for the Project.

STEP 1: SCREENING OF CLIMATE HAZARDS

10.3.2. **Table 10-10** identifies the climate hazards as detailed in the DNSH criteria and provides justification where climate hazards have been screened out, based on the location and nature of the Project. All climate hazards with a potential to create a climate change impact to HPPs will be screened in and taken forward within the assessment, where design control measures as part of the Rogun HPP will be considered in the risk assessment. This ensures a robust assessment and consideration of all theoretical climate hazards.

10.3.3. Where climate hazards have been screened out, they have not been considered further in the assessment.

Table 10-10 – Screening of DNSH climate hazards

Climate Hazard			Screened in	Screened out	Justification (where screened out)
Chronic	Temperature related	Changing temperature (air, freshwater, marine water)	✓		
		Heat Stress	✓		
		Temperature variability	✓		
		Permafrost thawing		✓	Permafrost is not present in the location of the Project.
	Wind related	Changing wind patterns	✓		
	Water related	Changing precipitation patterns and types (rain, hail, snow/ice)	✓		
		Precipitation or hydrological variability	✓		
		Ocean acidification		✓	The Project is located approximately 1000km from the Arabian Sea at an elevation of approximately 1000m. As such, climate risks associated with the sea will not impact the Project.
		Saline intrusion		✓	
		Sea level rise		✓	
		Water stress	✓		
	Solid mass related	Coastal erosion		✓	The Project is located approximately 1000km from the Arabian Sea at an elevation of approximately 1000m. As such, climate risks associated with the coast will not impact the Project.
		Soil degradation	✓		
		Soil erosion	✓		
		Solifluction	✓		
Acute	Temperature related	Heat wave	✓		
		Cold wave / frost	✓		
		Wildfire	✓		
	Wind related	Cyclone, hurricane, typhoon	✓		

Climate Hazard			Screened in	Screened out	Justification (where screened out)
		Storm (including blizzards, dust and sandstorms)	✓		
		Tornado		✓	Tornados are not typical in central Asia and therefore the risk associated with tornadoes are not considered further.
	Water related	Drought	✓		
		Heavy precipitation (rain, hail, snow/ice)	✓		
		Flood (coastal, fluvial, pluvial, ground water)	✓		
		Glacial lake outburst	✓		
	Solid mass related	Avalanche	✓		
		Landslide	✓		
		Subsidence	✓		

STEP 2: CURRENT AND FUTURE BASELINE

10.3.4. Baseline for the CRVA has been described in Section 10.2 above.

STEP 3: VULNERABILITY ASSESSMENT

10.3.5. The sensitivity of the Project to climate hazards and the exposure of the Project to climate hazard are outlined within this section. The assessment of receptor sensitivity is based on literature and studies of HPPs, whereas the exposure scoring considers Rogun specific exposure to the climate hazard.

Sensitivity

10.3.6. HPPs are sensitive to water-related climate hazards due to water stress causing changes in levels and load factors affecting the energy generation capacity. Other water-related climate hazards resulting from changing precipitation patterns and hydrological variability make the Project sensitive to impacts from flooding (including Glacial Lake Outburst Floods) and associated damage to dam components, debris and instability of slopes. In particular, Mechanical and Electrical (M&E) equipment, offices and roads are sensitive to the impacts of flooding[15].

[15] IHA (2019) Hydropower Sector Climate Resilience Guide (Online). Available at: https://assets-global.website-files.com/5f749e4b9399c80b5e421384/5fa7e38ce92a9c6b44e63414_hydropower_sector_climate_resilience_guide.pdf (Accessed: June 2023)

10.3.7. HPPs are sensitive to hazards such as precipitation, drought and wind conditions that could lead to soil erosion, soil degradation and potential solifluction of reservoir banks as a result of climate change as this will increase the sediment load from the catchment, resulting in loss of storage more rapidly than would occur without the increased hazard due to climate change. HPP are also sensitive to more acute solid-mass related climate hazards such as avalanches and landslides, as this could cause direct damage to dam components, particularly spillways and tunnels, and could cause displacement waves in the reservoir.

10.3.8. HPP are sensitive to changing wind patterns which could cause additional loading on dam structures or damage from storms and wind events, particularly overhead transmission lines.

10.3.9. HPPs can be sensitive to increasing temperatures, particularly transmission lines which could overheat. M&E equipment is typically located underground and less sensitive to overheating. Other components that are sensitive to high temperatures such as increased evaporation from the reservoir itself, issues with material durability and damage from wildfire. Staff associated with construction, operation and maintenance of HPPs are also sensitive to high temperatures as this can lead to heat stress although the fact that most workplaces will be underground will reduce the risk during operation. HPPs are also impacted by low temperatures and cold snaps / frost due to damage from snow loading.

10.3.10. The sensitivity of the current and proposed project elements to climate hazards has been assessed within **Table 10-11**.

Table 10-11 – Sensitivity of Project Elements to Climate Hazards

Climate hazard	Project Element										
	Construction	Temporary works	Energy generation	Dam and reservoir	Spillway and ancillary	Tunnels	Powerhouse, turbines and generators, all M&E	Access roads and replacement bridges	Permanent offices and maintenance facilities	Transmission and utilities	Human health
Water-related	Moderate	Moderate	Moderate	High	Moderate	Moderate	High	High	High	Moderate	Moderate
Temperature-related	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	High	Moderate
Wind-related	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low
Solid-mass related	Moderate	Moderate	Moderate	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Exposure

10.3.11. The exposure of the Project to climate change variables have been scored across the lifetime of the Project in **Table 10-12**. The timeframes represent a 20-year periods aligning to the baseline presented within **Section 10.2**.

Table 10-12 – Exposure of Project to Climate Change Variables Across the Lifetime

Climate Hazard	Climate change variables	2030s (Construction)	2050s, 2090s (Operation)
Water-related	Changes in precipitation patterns and types	Low	Medium
	Heavy precipitation and flood / Increase in extreme precipitation events and flooding	Low	Medium
	Glacial Lake Outburst Floods (GLOF)	Low	Medium
	Precipitation or hydrological variability including changes in glacial melt and snowmelt patterns	Low	High
	Water stress	Low	Medium
	Drought	Low	Low
Temperature-related	Changing temperature and temperature variability / Increase in annual average temperatures and extreme temperatures i.e. heatwaves and heat stress	Low	Medium
	Cold wave / frost	Low	Low
	Increase incidences of wildfire	Low	Medium
Wind-related	Changing wind patterns	Low	Low
	Cyclone, hurricane, typhoon, increase in storm conditions	Low	Low
Solid-mass related	Soil degradation, soil erosion and solifluction	Low	Low
	Increase incidences of landslide, avalanche and subsidence.	Low	High

Vulnerability Assessment

10.3.12. Utilising the results of the sensitivity and exposure scoring in **Table 10-11** and **Table 10-12**, this has enabled scoring of vulnerability for the construction period and the operational lifetime, allowing for low vulnerability assets to be scoped out of further assessment. Vulnerability of construction phase assets are shown in **Table 10-13**, and operational phase in **Table 10-14**.

Construction

Table 10-13 – Assessment of Vulnerability of the Project During the Construction Phase

Climate variables	Project Element	Vulnerability	Scoped in	Scoped out	Justification
Water related	Constructi on assets	Low		✔	Exposure of the current project to water-related climate hazards is considered low for the construction period based on minimal change from baseline.
Temperature -related	Constructi on assets	Low		✔	Exposure of the current project to temperature-related climate hazards is considered low for the construction period based on minimal change from baseline.
Wind-related	Constructi on assets	Low		✔	Exposure of the current project to wind-related climate hazards is considered low for the construction period based on minimal change from baseline.
Solid mass-related	Constructi on assets	Low		✔	Exposure of the current project to land-related climate hazards is considered low for the construction period based on minimal change from baseline.

Operation

Table 10-14 – Assessment of Vulnerability of the Project During the Operational Phase

Climate hazard	Climate change variables	Project Element	Vulnerability	Scoped in	Scoped out	Justification
Water-related	Changing precipitation patterns and types (rain, hail, snow/ice)	**Operation:** All assets	Medium	✔		The project assets are sensitive to water-related hazards, particularly the reservoir itself. Climate change is expected to increase the exposure of the assets to water-related hazards.
	Heavy precipitation events and an increase in extreme precipitation events and flooding	**Operation:** All assets	Medium	✔		
	Glacial Lake Outburst Floods (GLOF)	**Operation:** All assets	Medium	✔		
	Precipitation or hydrological variability due to changes in glacial melt and snowmelt patterns	**Operation:** Energy generation capacity Spillways Tunnels Transmission and utilities Human health	Medium	✔		
		Operation: Dam and reservoir Roads and bridges Offices and maintenance facilities	High	✔		
	Water stress	**Operation:** All assets	Medium	✔		
	Drought	**Operation:** All assets	Low		✔	The project will have low exposure to the impact of drought conditions in the project area.

Climate hazard	Climate change variables	Project Element	Vulnerability	Scoped in	Scoped out	Justification
Temperature-related	Changing temperature and temperature variability / Increase in annual average temperatures and extreme temperatures i.e. heatwaves and heat stress	**Operation:** Energy generation Dam and reservoir Spillway and ancillary Tunnels Powerhouse, turbines, MEP	Low		✓	An increase in the exposure of the project to increasing temperatures is likely, however the sensitivity of these assets to variations in temperature is low, especially for the below-ground assets.
		Operation: Roads and bridges Offices and maintenance Human health	Medium	✓		An increase in the exposure of the project to increasing temperatures is likely, increasing the vulnerability of the assets.
		Operation: Transmission and utilities	High	✓		Above-ground electrical transmission and equipment is particularly sensitive to increasing temperatures.
	Cold waves / Frost	**Operation:** All assets	Low		✓	Temperatures are projected to increase, reducing the occurrence of cold waves and frosts. Although these events may still occur it is anticipated that they will be similar to existing events.
	Increased incidence of wildfire	**Operation:** Roads and bridges Permanent offices and maintenance facilities Transmission and utilities Human health	Medium	✓		An increase in the exposure of the project to increasing incidences of wildfire, increasing the vulnerability of the above ground assets.

Climate hazard	Climate change variables	Project Element	Vulnerability	Scoped in	Scoped out	Justification
		Operation: Energy generation Dam and reservoir Spillway and ancillary Tunnels Powerhouse, turbines, MEP	Low		✔	Although an increase in the exposure of incidences of wildfire could occur, some of the project assets are located below ground and therefore are of low sensitivity to impacts related to wildfire
Wind-related	Changing wind patterns	**Operation:** All assets	Low		✔	Changes to wind patterns are not anticipated to have any adverse impact on the project, therefore any changes will not increase exposure.
	Cyclone, hurricane, typhoon / Increase in storm conditions and wind/dust events	**Operation:** All assets	Low		✔	A significant increase in storm conditions and wind speeds is not anticipated with climate change projections, therefore exposure remains low.
Solid-mass related	Soil degradation, soil erosion and solifluction	**Operation:** All assets	Low		✔	The project is not sensitive to the impacts of surrounding soils and its exposure to this climate change variable is not anticipated to change.

Climate hazard	Climate change variables	Project Element	Vulnerability	Scoped in	Scoped out	Justification
	Increase incidences of landslide, avalanche and subsidence.	**Operation:** Energy generation Powerhouse, turbines Roads and bridges Offices and Maintenance Tunnels Transmission and utilities Human health	Medium	✔		The project is particularly sensitive to landslides, especially the reservoir and spillways, due to being within a seismic region and areas of unstable slopes. Climate change could increase incidences of landslide/rock avalanche due to changing precipitation patterns.
		Operation: Dam and reservoir Spillway and ancillary	High	✔		

STEP 4: MATERIALITY (SIGNIFICANCE) ASSESSMENT

10.3.13. The following section presents the identified potential physical climate impacts during operation and maintenance where the initial risk has been assessed, considering of design control measures which mitigate climate impacts.

Direct Construction Impacts

10.3.14. Construction impacts have been scoped out of the assessment due to the vulnerability analysis showing low vulnerability of construction activities and assets to the climate change variables. The vulnerability assessment considers the sensitivity of the receptors to climate variables, and the exposure of the receptors to the projected change in climate. Exposure to projected climate trends will increase over time and given the construction phase is due to be completed in 2029, the exposure, and therefore vulnerability has been assessed as low.

Direct Operational Impacts

10.3.15. The assessment of the climate change risk builds on the vulnerability assessment (presented in **Table 10-14**). The climate change risk assessment (presented in **Table 10-15**) takes into account control measures which have been included in the design or will be developed as part of the operation and management of the Project, which will reduce the risk climate change poses to the Project assets. The climate change risk assessment concludes with assigning the significance (materiality) of the climate change impacts, The significance and materiality are considered in relation to the impact of the climate hazard on the receptor and the materiality of that impact on the economic activity.. This assessment is contained in **Table 10-15**.

10.3.16. The design and management control measures have been identified through review of existing Project information. This includes, but is not limited to design criteria, management plans, operating plans and ESIA. It is noted that some of the Project elements are already in construction and therefore there is a reduced potential for further influence on the design. It is also expected that where control measures are included in existing management plans, these measures will be adopted by any newly developed or updated management plans. In the event the materiality (significance) assessment identifies any significant risk, this is considered to have a potentially material impact on the operation of the Project during its lifetime and therefore would require adaptation measures to reduce the residual risk.

Table 10-15 – Direct Operational Impacts Assessment

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
Water-related	The dam and reservoir, roads and bridges, and offices and maintenance facilities were assessed to have **high vulnerability** to precipitation or hydrological variability due to changes in glacial melt and snowmelt patterns. All assets were assessed as having **medium vulnerability** to: ▪ Changing precipitation patterns and types (rain, hail, snow/ice) ▪ Heavy precipitation events and an increase in extreme precipitation events and flooding ▪ Glacial Lake Outburst Floods (GLOF) and water stress	Changes in precipitation patterns, types of precipitation and water stress leading to changes to flows available affecting increased/decreased generation, including a shift in seasonal peak and load factors.	▪ Cascade Dam and Reservoir Operating Plan. ▪ Further optimization studies for energy generation. ▪ Further detailed hydrology studies to inform energy generation capacity. ▪ Hydrology estimates updated regularly using latest climate change data and projections. Additional studies for Climate Change and Hydrology will be completed at the recommendation of the new Dam Safety Panel of Experts.	Medium	Minor	Not significant
		Changes in downstream water release and lower minimum environmental flows, damaging habitats and causing flooding.	▪ Modelling of the operational discharge regime will be part of the Cascade Dam and Reservoir Operating Plan, including flood routing. ▪ The volume of water transferred from summer to winter shall remain unchanged.	Low	Minor	Not significant
		Heavy precipitation, flooding, GLOF events and glacial melt leading to flooding of assets and/or exceeding of flood design	▪ The dam crest hight will be increased from 1,110 meters above sea level (masl) to 1,300 masl by 2029.	Low	Minor	Not significant

[16] Likelihood and consequence take into account control measures.

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
	▪ Water stress The energy generation capacity, spillways, tunnels, transmission and utilities, and human health project elements were assessed to have **medium vulnerability** to precipitation or hydrological variability due to changes in glacial melt and snowmelt patterns. The impacts from drought on all project assess was assessed as low vulnerability and has been scoped out.	levels and drainage systems, culverts and crossings leading to damage or overtopping. This could lead to needing to draw down the reservoir in periods of high flow events and potential safety issues.	▪ The reservoir full supply level will increase from 1,065 masl to 1,290 masl by 2036. ▪ Designed for the 1 in 10,000 year flood event and the Probable Maximum Flood (PMF) level. ▪ Dry freeboard includes for the allowance for permanent settlement, wave run up and GLOF. ▪ Additional freeboard has been taken into consideration for the risk of GLOFs. ▪ Rapid drawdown should not affect the safety of the dam. ▪ The Emergency Preparedness Plan includes a GLOF monitoring program in the catchment to complement any flood forecasting system. ▪ The Emergency Preparedness Plan requires that GLOFs or PMF changes in peak flows will be regularly updated using the latest climate change data and projections for the region. ▪ The Emergency Preparedness Plan states that the current design of the orifice spillways provides 60% of the discharge capacity. ▪ Backup power supply (diesel generator) is in place to ensure continued operation of gates in the event of a power failure related to flooding of powerhouse.			

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
		Flooding causing erosion of dam and damage to spillways.	▪ Designed and built in such a way that erosion damage caused by sediments running along it can be easily repaired by isolating part of the spillway. ▪ Spillways to protect dam and allow safe passage of water up to the PMF level. Concrete slabs or lining for strength and surface finishing for water flow of high speeds (up to 30 m/s). Concrete surface treatment to prevent cavitation (due to high speed flow), and erosion (due to sediment flow). Above 30 m/s, additional mitigation such as aeration devices will be provided. ▪ Steel lining or other anti-erosion materials in place. ▪ The Emergency Preparedness Plan sates that regular inspections of tunnel lining for evidence of cavitation and other types of damage will take place. ▪ The Emergency Preparedness Plan requires scouring impacts to be verified during operation and stabilise or infill where necessary if there are changes to original design assumptions.	Medium	Minor	Not significant
		Flooding damaging roads and restricting access for maintenance.	▪ The drainage design for roads includes an allowance for climate change. ▪ Critical operation equipment - access to that equipment have alternative access/egress routes for emergency situations.	Medium	Minor	Not significant

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
			▪ The Emergency Preparedness Plan requires regular monitoring and inspections of the key slopes adjacent to roads, with protection/maintenance measures where necessary.			
		Increased sediment load and deposition resulting in loss of storage/depleted peaking energy leading to decreased capacity, outlet blockages, upstream flooding, and corrosion of gates and turbines and M&E. This will lead to increased maintenance requirements.	▪ Reservoir Sedimentation Management and Monitoring Plan will consider the need for dredging and other measures to reduce the impact of sedimentation. ▪ Watershed Management Plan will include measures to reduce erosion and sedimentation into the reservoir from the catchment. ▪ Effective operation conditions of the reservoir can help to control the overall sedimentation, adjusting the operation rule of the reservoir to the sedimentation patterns. ▪ Ongoing emptying of sediment traps and monitoring deposition. ▪ Tactical dredging of key areas including power intakes and spillway intakes will help reduce the sedimentation in the reservoir. For Rogun HPP, this will only be applicable after several decades of when the sedimentation has accumulated, however, given high annual sediment loads. ▪ Corrosive resistant turbine blades. ▪ Additional sediment management facilities. ▪ Additional dredging as required to ensure key areas (power intakes, spill ways) remain clear.	Medium	Minor	Not significant

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
			▪ Regular inspection in the vicinity of key slopes and after large rainfall and flooding events.			
		Increased debris in reservoir from increased runoff, leading to increased risk of blocking intakes.	▪ Operation and maintenance procedures including debris clearance, will be adjusted based on need.	High	Negligible	Not significant
Temperature-related	The transmission and utilities project elements were assessed as having **high vulnerability** to changing temperature and temperature variability / Increase in annual average temperatures and extreme temperatures i.e. heatwaves and heat stress. The roads and bridges, offices and maintenance, and human health project elements were assessed as having **medium vulnerability** to changing temperature and temperature variability / Increase in annual average temperatures	High temperatures and heatwaves causing heat stress for personnel.	▪ Health and Safety procedures in place to manage current heat stress for personnel, procedures will be updated in response to changing environmental conditions. Workers are largely below ground.	Medium	Minor	Not significant
		Increased temperatures stimulate plant growth in reservoir with negative impacts on intakes and increased maintenance requirements to maintain ground clearance.	▪ Oligotrophic system at full supply level therefore unlikely to result in the stimulation of plant growth	Low	Minor	Not significant
		High temperatures causing material durability issues of above ground assets (utilities, offices, maintenance buildings, bridges), such as expansion, contraction, corrosion, or reduced ratings leading to damage	▪ Materials selected according to strength and durability characteristics. ▪ Design criteria includes anti-erosion and corrosion protection.	Low	Moderate	Not significant

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
	and extreme temperatures i.e. heatwaves and heat stress. The roads and bridges, permanent offices and maintenance facilities, transmission and utilities, and human health project elements were assessed as having **medium vulnerability** to increased incidence of wildfire The impacts from cold waves / frost on all project assets was assessed as low vulnerability and has been scoped out. The impacts from changing temperature and temperature variability / Increase in annual average temperatures and extreme temperatures i.e. heatwaves and heat stress on energy generation, dam and reservoir, spillway and ancillary, tunnels, powerhouse, turbines, MEP project elements was assessed as low	and/or instability and increased maintenance requirements.				
		Lightning risk to transmission lines.	▪ Lightning protection on assets vulnerable to lightning strikes	Very low	Minor	Not significant
		Increased frequency, distribution and severity of wildfires, damaging assets.	▪ Increased maintenance requirements for above ground infrastructure if needed	Low	Moderate	Not significant

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
	vulnerability and has been scoped out. Impacts from increased incidents of wildfire for energy generation, dam and reservoir, spillway and ancillary, tunnels, powerhouse, turbines and MEP project elements has been assessed as low vulnerability and are scoped out.					
Solid-mass related	The dam and reservoir, spillway and ancillary project elements were assessed as having **high vulnerability** to increased incidences of landslide, avalanche and subsidence. The energy generation, powerhouse, turbines, roads and bridges, offices and maintenance, tunnels, transmission and utilities and human health project elements were assessed as having **medium vulnerability** to increased incidences of landslide, avalanche and subsidence.	Increased slope instability from surface runoff causing damage to assets from rockfalls and mudslides, or displacement waves in the reservoir. Higher sedimentation rate from upstream landslides could lead to earlier blockage.	▪ Landslide Management and Monitoring Plan which will be developed to support the ESIA will include slope stability risk assessment and monitoring to minimize risk. ▪ The design criteria have taken into consideration the effects of landslides by lowering impoundment rates. ▪ The Reservoir Landslides Annex includes engineering measures to stabilize susceptible slopes and improve resilience of infrastructure to landslide movement. ▪ Anti-seepage measures e.g. grout curtain to ensure seepage in acceptable limits, reducing possible instability. ▪ The Watershed Management Plan includes measures to reduce erosion and sedimentation upstream of the dam.	Low	Moderate	Not significant

Climate variable	Vulnerability summary (from Table 10-14)	Climate impact	Control measures	Likelihood[16]	Consequence[16]	Risk
	The impacts from soil degradation, soil erosion and solifluction on all project assets was assessed as low vulnerability and has been scoped out.					

INDIRECT EFFECTS

10.3.17. No indirect effects have been identified.

TRANSBOUNDARY EFFECTS

10.3.18. The CRVA considers the effects of climate change (the environment) on the project assets, and not the effect of the project on the environment, and therefore there are no transboundary effects on the transboundary environment.

10.4 CRVA MITIGATION AND MANAGEMENT

10.4.1. There are a number of forthcoming key studies, all recommended by the Dam Safety PoE, to be undertaken to inform the climate change impact assessment and adaptation of Rogun HPP including hydrology, sedimentation modelling and management, and flood-wave hazards such as GLOFS and landslides. The outcome of these studies will help define the need for further mitigation measures for future operation of Rogun HPP.

10.4.2. A Reservoir Sedimentation Management and Monitoring Plan, Watershed Management Plan, and Landslide Management and Monitoring Plan will be developed for the Project by April 2024. The cascade emergency response plan is reviewed at each stage of the dam construction and a final will be produced for the full height of the dam. The cascade operating plan currently covers the temporary turbines, and will be updated as the Project progresses.

10.4.3. To manage the impacts of climate risk on the Project, Rogun JSC as operators of Rogun HPP will need to undertake regular monitoring of the effects of extreme weather events. The monitoring record will detail the type of extreme weather event and any impact that was realised, such as damage to equipment requiring repair works, impacts on the employees, impacts on the HPP output. The record can be used to evaluate the actual impacts affecting the Project to develop an understanding of the tolerance and thresholds of the Project assets. An understanding of this will aid implementation of planned and preventative maintenance requirement for the Project and allow adaptive management of Project operations.

10.4.4. Rogun JSC, as operator of Rogun HPP will need to review climate projection data as it is updated. Changes to climate projection data may influence operational planned and preventative maintenance schedules and information incorporated into management plans. When necessary (dependant on the updated climate data) the maintenance schedules and management plans should be updated to reflect the impacts of climate and weather related risks.

RESIDUAL EFFECTS

10.4.5. There are no reported residual significant climate physical change effects.

10.5 CLIMATE TRANSITION RISK

INTRODUCTION

10.5.1. The scope of the transition risk assessment is to assess climate risks arising from the transition to a lower carbon economy on the current, partially constructed, HPP Project (existing and proposed assets), under a high and a low emission scenario.

10.5.2. A current scenario is based on the ongoing construction of the Project, focusing on the climate impacts during 2023. The future scenarios assess the transition risks against a high and low emission scenario when the Project is in full operation (2030s).

10.5.3. In line with the EIB, it is imperative to understand the aspects of the financial risk that can occur following a rapid decarbonisation of the industry.

'With all new operations being Paris-aligned as of 2020, the transition risks of new operations will be further reduced'.

10.5.4. The EIB outlines the requirement to understand and model transition risks for all countries where the EIB operates.

STANDARDS AND GUIDELINES

10.5.5. The key standard used for this is the European Investment Bank (EIB) Standard 5 – Climate Change (EIB5) which sets out the requirement for projects to assess, manage and monitor project-related transition climate risks. EIB5 aims for the Transition Risk Assessment to build resilience and adaptive capacity in response to current and future climate change-induced impacts.

10.5.6. The EIB defines transition risks in line with the Taskforce for Climate-related Financial Disclosure Framework (TCFD). TCFD outlines the disclosures to be considered and the themes of a transition risk assessment, namely; policy, technology and market changes used to facilitate the change to a lower carbon economy. Transition risks may pose varying levels of financial and reputation risks on the Project.

SCOPING

10.5.7. The risks identified in the Transition Risk Assessment have been scoped in and adapted according to relevance to Rogun HPP. The transition risks identified in the TCFD Implementation Guidance, as referenced in the EIB Roadmap, which are not relevant to Rogun HPP have not been included in the assessment.

ASSESSMENT METHODOLOGY

10.5.8. The assessment of transition risks follows the criteria set out by the TCFD Framework and involves the following steps:

- Screening of the relevant policy, technological and market risks relevant to the Project.
- Assessment of relevant scenarios for the Project, a scenario of 2023 has been assigned for the current baseline, and future scenarios include a 2030 high emission, and a 2030s low emission scenario.
- A likelihood and impact rating are assigned to each relevant risk, giving a final risk rating of low medium or high. The likelihood of the risk is based on the likelihood of the risks occurring to Tajikistan or the renewable energy industry. The impact is based on an assessment of relevant

datasets including IEA and the World Bank which provide context on the exposure of the Project to the transition risks.

10.6 TRANSITION RISK IMPACT ASSESSMENT

10.6.1. There are a number of transition risks relevant to the Rogun HPP which have been outlined below. The transition risks have been identified as policy and legal, technology and market risks in line with the EIB (and subsequent TCFD) guidance.

10.6.2. The following subsections have been set out as follows:

- **Risk**: in line with EIB guidance
- **Impact**: specific impact on the Rogun HPP
- **Context**: review of data received on aspects and process of the construction, operation and maintenance of the Rogun HPP
- **Current scenario**: the risk rating for the 2023 construction period
- **Future scenario**: the risk rating for the 2030 operation period
- **Summary**: outlining the requirements for management.

POLICY AND LEGAL CHANGES

Risk

- Enhanced GHG and climate reporting obligations and monitoring for future reporting obligations.

Impact on Rogun HPP

- Resources will be needed to record full GHG emissions from construction, operation and maintenance, including recording offset emissions of the Rogun HPP; as well as monitoring and understanding future reporting obligations.

Context

10.6.3. Tajikistan is part of the IEA's EU4Energy Programme, a collaborative programme design to support countries in implementing sustainable energy policies and energy sector development. The programme is made up of five components to assist Eastern and Central Asian countries in reporting on energy sources and demand.

10.6.4. (Component 1): enhanced energy data management and (Component 3) generate an improved energy legislative and regulatory framework and implemented policy recommendations as well as to promote investments in key energy infrastructure strategic projects suggest a higher reporting standard on energy use / carbon will be required. The FP040 project by the Green Climate Fund (2023) aims to protect Tajikistan's hydropower from climate risks. There are three elements to the project: adopting best international practices, re-training Tajik hydropower operators and assessing and managing climate risks. The funds show progress for Tajikistan to develop a framework for efficient management of hydropower projects.

10.6.5. This implies reporting on carbon will become more stringent, whilst also being influenced by surrounding countries following commitments to reduce overall national emissions. It is likely that Tajikistan's requirement to report at a country level will feed down to a project level, and reporting requirements will increase under the low emission scenario. The regulatory landscape for climate and carbon in Tajikistan is not considered to be a leader in policy frameworks, therefore the risk remains low for the high emission scenario.

Current Scenario

2023		
Current Scenario		
Likelihood	**Impact**	**Risk**
Low	Low	**Low**

Future Scenario

2030s					
Low Emissions Scenario			**High Emissions Scenario**		
Likelihood	**Impact**	**Risk**	**Likelihood**	**Impact**	**Risk**
High	Low	**Low**	Medium	Low	**Low**

Summary

10.6.6. The assessment of enhanced GHG and climate reporting obligations and monitoring for future reporting obligations has revealed low risks in both scenarios. Rogun JSC as operators of Rogun HPP will need to monitor GHG emissions ensure relevant County and Local policies and regulations are monitored to ensure any reporting requirements are caried out.

Risk

- Exposure to litigation and mandates on existing services.

Impact on Rogun HPP

- Resources will be required for monitoring / horizon scanning to understand projects exposure to environmental litigation; carbon, climate resilience, water, land use; and social impacts on local community and employees. These are considered to be relatively minor in relation to the overall resources required for Rogun HPP construction and operation.

Context

10.6.7. The Project has a high exposure to regulations on water and biodiversity, given the position of the Project within the Vakhsh River. The financial risk is that more rigorous / precise measures will be required following updates to regulations, particularly under a low emission scenario, where protection of water resources and biodiversity is likely to be more stringent.

"The Water Codex of the Republic of Tajikistan contains provisions for particular uses of water for which there is a charge and for compensation of damage to water sources (Tajikistan Ministry of Justice 2020)".

"The Law of the Republic of Tajikistan on Protection and Using of Flora defines principles of protection and rational use of flora, determines the legal, economic and social basis in this area and is directed on preserving and protecting flora (Tajikistan Ministry of Justice 2018)".

10.6.8. The Programme for Reforming the Water Sector of Tajikistan for 2016-2025 contains adaptation measures through the development of a long-term strategy for the use and protection of water resources, development of seasonal and annual plans for the distribution and management of water resources in river basins, restoration of irrigation infrastructure and improvement of conditions for its maintenance and operation, and introduction of new water-saving technologies (Tajikistan Ministry of Justice 2015).

10.6.9. On the basis of the recommendations provide in the Biodiversity assessment (summarised in Section 8.11 of this report) are implemented, it is understood that all residual impacts to biodiversity will all be reduced to a maximum of Minor (Not Significant) effects. The exception is the creation of altering the Vakhsh River into a deep lake which remains a moderate impact. The transition risk is therefore assessed as medium under the 2030 low emissions scenario and low under the 2030 high emissions scenario.

Current Scenario

2023		
Current Scenario		
Likelihood	Impact	Risk
Low	Low	**Low**

Future Scenarios

2030s					
Low Emissions Scenario			High Emissions Scenario		
Likelihood	Impact	Risk	Likelihood	Impact	Risk
Medium	Medium	**Medium**	Medium	Low	**Low**

Summary

10.6.10. The assessment of exposure to litigation and mandates on existing services has revealed medium risk in the low emission scenario and low risk in the high emission scenario. Rogun JSC as operators of Rogun HPP will need to monitor changes to regulatory requirements as they are published and ensure compliance is maintained.

Risk

- Policy changes causing higher compliance costs, requirements on offsetting activities.

Impact on Rogun HPP

- Increased operating costs.

Context

10.6.11. As the Project will be producing hydropower energy and will be 100% self-sufficient, the risks from increased operating costs will remain low for both the high and low emissions scenarios.

Current Scenario

2023		
Current Scenario		
Likelihood	**Impact**	**Risk**
Low	Low	**Low**

Future Scenarios

2030s					
Low Emissions Scenario			**High Emissions Scenario**		
Likelihood	**Impact**	**Risk**	**Likelihood**	**Impact**	**Risk**
Low	Low	**Low**	Low	Low	**Low**

Summary

10.6.12. The assessment of policy changes causing higher compliance costs, requirements on offsetting activities has revealed low risks in both scenarios. Rogun JSC as operators of Rogun HPP will be required to monitor policy changes as they are implemented to minimise the impact on operating costs.

Risk

- Policy changes associated with write-offs, asset impairment, and early retirement of existing assets due to policy changes.

Impact on Rogun HPP

- An increase in the requirement for the replacement of assets, plant and machinery and other equipment with lower carbon options.

Context

10.6.13. The number of vehicles during operation is likely to be relatively low, with access required only for maintenance and servicing. The majority of these will be light vehicles with HGVs only required if components need replacing.

10.6.14. WeBuild, the current contractor for Lot 3 are currently working on modernisation / reconstruction / and completion of the Diversion tunnels (DT), it is assumed there will be equivalent practices for any assets, plant and machinery and other equipment which need modernizing or reconstructing for lower carbon options.

10.6.15. Under a low emission scenario there may be a requirement to replace operational plant and machinery with lower carbon alternatives or electric vehicle options, however due to the low volume of vehicles, the risk remains low in both the High and Low emission scenarios.

Current Scenario

2023		
Current Scenario		
Likelihood	Impact	Risk
Low	Low	**Low**

Future Scenario

2030s					
Low Emissions Scenario			High Emissions Scenario		
Likelihood	Impact	Risk	Likelihood	Impact	Risk
Medium	Low	**Low**	Low	Low	**Low**

Summary

10.6.16. The assessment of policy changes associated with write-offs, asset impairment, and early retirement of existing assets due to policy changes has revealed low risks in both scenarios. Rogun JSC as operators of Rogun HPP will be required to monitor policy changes to allow any required replacement of assets can be factored into planned replacement regimes.

TECHNOLOGY CHANGES

Risk

- Technological advances causing existing products to become obsolete and substituted with lower emissions options.

Impact

- Costs of replacing assets plant and machinery and other equipment.
- Extra resource needed for replacing assets plant and machinery and other equipment.

Context

10.6.17. There are a number of energy dependant assets within the Project, namely; the power house, turbines, power supplies, permanent maintenance facilities and site offices, as well as several transmission lines, where new lines and sub-stations are under construction.

Construction

10.6.18. The largest contractor is currently working to replace diesel engines used during construction with electrical engines. Five new electrical engines were commissioned for the construction of the Rogun HPP in 2021.

Operation

10.6.19. The entirety of these assets will be powered by the Project; however, there will be 2 diesel back-up generators on standby should supply shortages impact the HPP.

10.6.20. The opportunity to substitute to lower emission assets is low, making the overall risks under each of the future scenarios also as low.

10.6.21. Under a high emission scenario, the risk to transition to a lower carbon back-up may be required. However, this is expected to be minimal in comparison to the power generated by HPP, as such the risk is considered to be low for each future scenario.

Current Scenario

2023		
Current Scenario		
Likelihood	Impact	Risk
Low	Low	**Low**

Future Scenario

2030s					
Low Emissions Scenario			High Emissions Scenario		
Likelihood	Impact	Risk	Likelihood	Impact	Risk
Low	Low	**Low**	Low	Low	**Low**

Summary

10.6.22. The assessment of technological advances causing existing products to become obsolete and substituted with lower emissions options, has revealed low risks in both scenarios. Rogun JSC as operators of Rogun HPP should ensure replacement of assets with lower emission options can be factored into planned replacement regimes.

Risk

- Investment in successful and unsuccessful new technologies.

Impact

- Unsuccessful investments will cause loss of finance and impact supply and demand of the energy generated.
- Successful investments will impact current processes and incur costs to revenue, or energy capacity from process changes in the management of the Rogun HPP Scheme.

Context

10.6.23. According to the IEA, the Tajikistan Strategy (Tajikistan Ministry of Justice, 2030), highlights the most significant problems faced by the energy sector are, amongst others, environmental pollution and high production losses in electricity generation, and insufficient electricity supply during the autumn and winter due to reduced water flow.

10.6.24. The physical risk assessment projects the increase in temperatures and extreme weather events, which can in turn lead to water stress affecting power generation. However the design control measures and hydrology studies will serve to mitigate any significant risk. Therefore the impact and risk are considered low for both emission scenarios.

Current Scenario

2023		
Current Scenario		
Likelihood	**Impact**	**Risk**
Low	Low	**Low**

Future Scenarios

2030s					
Low Emissions Scenario			**High Emissions Scenario**		
Likelihood	**Impact**	**Risk**	**Likelihood**	**Impact**	**Risk**
High	Low	**Low**	Medium	Low	**Low**

Summary

10.6.25. The assessment of investment in successful and unsuccessful new technologies has revealed low risks in both scenarios. Rogun JSC as operators of Rogun HPP should undertake sufficient research into any replacement equipment to ensure investments are, to the best of their ability, sound.

Risk

- Updates and innovations within hydropower production are driven by policy changes.

Impact

- Updates required to existing HPP resulting in financial implications and potential loss in energy capacity during updating and implementing innovations.

Context

10.6.26. Hydropower is well established as an energy source, though there are a number of innovation trends focused on increasing the resilience and capacity of hydropower plants. The six main themes when understanding the development of hydropower are:

i. Hydropower flexibility,

ii. Hydropower digitalisation,

iii. Energy storage and variable speed turbines,

iv. Generators with current-controlled rotors.

v. Novel small-scale hydropower technologies and

vi. Fish-friendly hydropower technologies.

10.6.27. Under a low emissions scenario, it is likely the policy transition will be more stringent thereby putting pressure on technological developments to achieve a lower carbon scenario. As such, under a low emission scenario the risk would be Medium.

10.6.28. Under a high emissions scenario, it is likely the Project's ability to be self-sufficient will be enough to abide with current and projected policies and targets, given the current political landscape in Tajikistan.

Current Scenario

2023		
Current Scenario		
Likelihood	Impact	Risk
Low	Low	**Low**

Future Scenario

2030s					
Low Emissions Scenario			High Emissions Scenario		
Likelihood	Impact	Risk	Likelihood	Impact	Risk
Medium	Medium	**Medium**	Medium	Low	**Low**

Summary

10.6.29. The assessment of updates and innovations within hydropower production are driven by policy changes has revealed medium risk in the low emission scenario and low risk in the high emission scenario. Rogun JSC as operators of Rogun HPP will need to ensure that upgrades and innovation are suitably planned to minimise the financial and loss in energy production impacts.

MARKET CHANGES

Risk

- Uncertainty in market signals.

Impact

- Variances in supply and demand for hydropower (in both a national and international context).

Context

10.6.30. Tajikistan is highly dependent on hydropower, making it prone to exposure to water stress and therefore leave consumers exposed to seasonal water shortages. A market for energy services does not currently exist in Tajikistan, as there is a need to develop a more comprehensive framework. The uncertainties created by the lack of framework for Tajikistan may leave the HPP exposed to abrupt and unexpected shifts in energy demand and consumer markets.

10.6.31. The Tajikistan Governments are exploring frameworks in dealing with energy efficiency and renewable energy market developments; however, these have previously been unsuccessful due to the scarcity of public financing available for creating a dedicated fund to move these sectors forward and attract foreign markets.

10.6.32. Given the lack of a political energy framework and fundings for renewable energy within the region, the direction of Tajikistan's transition journey in renewable energy generation and consumption is currently unknown. Therefore, the uncertainty in market risks would be high under a low emission scenario. The risk under a high emission scenario is 'medium' due to the scenario analysis that there will be a more relaxed transition to a lower carbon economy under a high emission scenario.

Current Scenario

2023		
Current Scenario		
Likelihood	**Impact**	**Risk**
Medium	Low	**Low**

Future Scenarios

2030s					
Low Emissions Scenario			**High Emissions Scenario**		
Likelihood	**Impact**	**Risk**	**Likelihood**	**Impact**	**Risk**
High	High	**High**	Medium	Medium	**Medium**

Summary

10.6.33. The assessment of uncertainty in market signals has revealed high risk in the low emission scenario and medium risk in the high emission scenario. Rogun JSC as operators of Rogun HPP will need to monitor the market status to ensure any potential risks are identify early and measures can be implemented in a timely manner.

LIMITATIONS

10.6.34. The developments within the climate / carbon market are highly uncertain for Tajikistan and therefore the risks identified have the potential to differ in severity, compared to despite what is reported on here.

10.6.35. Over time the Project should investigate these risks further and identify measures to decrease the impacts of the risks on the operation of the Project over its lifetime.

10.7 GREENHOUSE GASES

INTRODUCTION

10.7.1. A Carbon Footprint Assessment is to be undertaken as part of the Environmental and Social Impact Assessment (ESIA) report of the Project. Not all investment projects for the EIB require a carbon footprint assessment to be undertaken, investment projects with significant emissions must be assessed according to the EIB methodologies, and the thresholds are:

- Absolute emissions or carbon sequestration exceeding 20,000 tonnes CO2e/year;
- Relative emissions (relative to baseline) exceeding 20,000 tonnes CO2e/year (positive or negative).

10.7.2. EIB conducted research that indicates the project types that will or will not require a GHG assessment. Hydropower Dams, such as Rogun, falls under the category 'Renewable Sources of Energy' for which, a GHG assessment is required.

10.7.3. The overarching methodology to be used for calculating the carbon footprint must be consistent with the European Investment Bank (EIB)'s Project Carbon Footprint Methodologies **(Ref: 1.1)** guidance (in line with EIB Environmental and Social Standards 5 **(Ref: 1.2)** and the requirements of other lenders.

10.7.4. The EIB Board commitment in 2019 to: "*align all its financing activities with the principles and goals of the Paris Agreement by the end of 2020*". The commitment is to cover all its financing activities and the notion of alignment is to "*make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development*" and that "*assets created today are consistent with a pathway to a climate-neutral economy, and that new investment should not undermine efforts to achieve the 1.5°C goal*". **(Ref: 1.3).**

10.7.5. The GHG Impact Assessment aims to support the meeting of these requirements by:

- Quantifying GHG emissions from the Proposed Scheme;
- Providing relevant information for the assessment in-line with EIB and other requirements; and
- Considering alternative measures to minimise project related GHG emissions.

10.7.6. This chapter includes a discussion on the direct effects and the indirect effects arising from the Project, and reports on the whole project impact assessment.

STANDARDS AND GUIDELINES

Legislation

- **Nationally Determined Contributions (NDC) of The Republic of Tajikistan (Ref: 2.1)**: Tajikistan submitted its revised NDC in October 2021. Tajikistan's revised NDC commits to a 40-50% reduction in emissions by 2030 compared to 1990 levels, conditional on international support. The country also set an unconditional emissions reduction target of 30-40% by 2030 compared to 1990 levels.
- **National Action Plan (NAP) of the Republic of Tajikistan for Climate Change Mitigation** (**Ref: 2.2**): The NAP 2003 is a national-wide policy aiming at implementing the commitments of the Republic of Tajikistan concerning the UN Framework Convention on Climate Change (UNFCCC).Tajikistan's NAP includes the following measures on reduction of GHG emissions and enhancing of natural sinks of carbon:

- Enhancement of energy efficiency in relevant sectors of the national economy;
- Application of effective technologies and use of energy sources that promotes high rates of economic growth and reduce or limit GHG emissions;
- Protection and enhancement of natural sinks and reservoirs of GHG emissions;
- Promotion of sustainable forest management practices, afforestation and reforestation;
- Promotion of sustainable forms of agriculture;
- Research on promotion, development and use of new and renewable energies together with advanced and environmentally sound technologies;
- Encouragement of appropriate reforms in relevant sectors to promote measures to limit or reduce GHG emissions.

Standards

- **EIB Environmental and Social Standards (Ref: 1.2)**: This Standard promotes the alignment of projects supported by the EIB with the goals and principles of the Paris Agreement and the Sustainable Finance Action Plan. It states that all projects located outside Europe shall comply with the applicable national legislation and this standard, which reflects the core principles and essential procedural elements laid down by EU legislation that the EIB considers relevant to climate mitigation. A requirement for compliance with EIB's alignment framework, as set out in the EIB Group Climate Bank Roadmap (CBR) is to ensure consistency with the "Do No Significant Harm" principle to climate change mitigation, as defined by the EU Taxonomy Regulation.

Guidance documents

- **Environmental, Climate and Social Guidelines on Hydropower Development**[17]: The document mandates a carbon footprint assessment for all hydropower project with the exception where the emissions fall below the threshold levels. The methodology for calculating the hydropower carbon footprint must be consistent with the EIB's Methodologies for the Assessment of Project GHG Emissions and Emission Variations.
- **EIB Project Carbon Footprint Methodologies**[18]: This document contains the EIB's carbon footprinting methodology. It provides guidance on how to calculate the carbon footprint of EIB-financed investment projects.
- **IEMA Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance**[19]**:** This guidance was published to assist practitioners in delivering robust, appropriate, and consistent assessments. Section 5 sets out the steps a GHG emissions assessment should take, including detailed guidance to support each of these steps:

  1. Define goal and scope of GHG emissions assessment;

17 EIB. (2019). Environmental, Climate and Social Guidelines on Hydropower Development. [Accessed: 14/07/2023]

18 EIB. (2023). EIB Project Carbon Footprint Methodologies. Available at: [Accessed: 14/07/2023]

19 IEMA. (2022). Assessing-greenhouse-gas-emissions-and-evaluating-their-significance (iema.net). [Accessed: 11/07/2023]

2. Set study boundaries;
3. Decide upon assessment methodology;
4. Collect the necessary calculation data; and
5. Calculate/determine the GHG emission inventory.

OTHER LENDER STANDARDS CONSIDERED

- **Greenhouse Gases from Reservoirs Caused by Biogeochemical Processes[20]**: This document by the World Bank acts as a technical note to provide guidance on how to assess GHG emissions from reservoirs at an early stage of the preparation process. It recommends the use of GHG Reservoir tool (G Res tool) which has been developed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Hydropower Association (IHA).
- **Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects[21]**: The ADB guidance document puts forth general methodologies to estimate GHG emissions during project appraisal/development stage. The methodologies included are consistent with the approaches used by International Finance Institutions (IFI) and are based on the Clean Development Mechanism (CDM) methodologies and Japan Bank for International Cooperation's Guidelines for Measurement, Reporting and Verification of GHG Emission Reductions (Japan Bank for International Cooperation's J-MRV)[22].

EXISTING ASSESSMENT

ESIA From 2014

10.7.7. The Environmental and Social Impact Assessment (ESIA) Report 2014[23] for the project touches upon the assessment of GHG emissions stating:

'Under certain conditions (large amounts of biomass submerged, eutrophication of the reservoir with high productivity or organic material) there is a risk that due to high oxygen consumption for the breakdown of this biomass, the water gets anoxic in deeper layers of the reservoir, which in turn can lead to an emission of methane from the reservoir, a very potent greenhouse gas. This is the case mainly in large reservoirs in moist tropical areas. On the other hand, hydropower can reduce greenhouse gas emissions by reducing the amount of fossil fuels (coal, oil and gas) burned for producing electricity in thermal power plants, and thus the emission of CO_2.'

10.7.8. However, calculation of emissions from the project was not undertaken as part of the 2014 ESIA report. The methane emissions produced by the reservoir have not been calculated to date and any potential carbon savings from replacing fossil fuels with hydropower was not calculated either.

[20] World Bank. (2017). Greenhouse Gases from Reservoirs Caused by Biogeochemical Processes. [Accessed: 11/07/2023]

[21] ADB. (2017). Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects. [Accessed: 08/08/2023]

[22] Japan Bank for International Cooperation. (2021). Guidelines for Measurement, Reporting and Verification of GHG Emission Reductions in JBIC GREEN Operation (J-MRV Guidelines). [Accessed: 08/08/2023]

[23] Pöyry: Engineering Balanced Sustainability. (2014). ESIA Report (Draft) Volume I [offline] [Accessed: 07/08/2023]

10.8 BASELINE – CURRENT CONDITIONS

10.8.1. The current and future baseline conditions shall be explored under two scenarios:

'DO NOTHING' SCENARIO

10.8.2. The 'Do Nothing' scenario comprises of "without project" baseline emissions associated with the current operations of 2x400MW units generating power. One typical year of operational emissions are to be calculated following the EIB methodology[24].

'DO SOMETHING' SCENARIO

10.8.3. The 'Do something' scenario assesses the emissions from the whole project. One typical year of the whole project's operations emissions is to be calculated following the EIB methodology.

10.8.4. As part of Phase 2, the 2x400MW ("without project") will be upgraded to 2x600MW along with the additional 4x600MW units. Hence, the total power generated in the "with project" would be 3,600MW (6x600MW).

SCOPING

Area of Influence

10.8.5. The 2014 ESIA report stated that the study area for the project has been defined to be inclusive of:

- Construction site including dam and powerhouse site, appurtenant structures and immediate surroundings;
- Future reservoir, that is, the area that will be covered by water;
- Immediate reservoir catchment, implying the area directly surrounding the reservoir which is likely to be influenced due to change in groundwater regime; and
- Downstream area at the risk of water pollution and its potential impacts from the Project.

10.8.6. GHG assessment is not restricted by geographical area but instead includes any increase or decrease in emissions as a result of the Project, wherever that may be.

Scope of the GHG Assessment

10.8.7. The scope of the carbon footprint assessment has therefore been updated and reviewed as per the EIB Project Carbon Footprint Methodology[25] wherein the 'project boundary' defines what is to be included in the calculation of total and relative emissions of a typical year of operations. The EIB methodologies use the concept of 'scope' (as defined in the section *Assessment Methodology*) based on definitions from the WRI/WBCSD GHG Protocol Corporate Accounting and Reporting Standard[26] when defining the project boundaries.

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24 EIB. (2023). EIB Project Carbon Footprint Methodologies. Available at: [Accessed: 14/07/2023]

25 EIB. (2023). EIB Project Carbon Footprint Methodologies. Available at: [Accessed: 14/07/2023]

26 World Business Council for Sustainable Development / World Resources Institute. (2015). The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard. [Accessed: 08/08/2023]

10.8.8. As per the EIB methodology (and broader GHG accounting best practice) emissions are classified as follows:

- Scope 1 emissions: These include direct GHG emissions that are physically emitted from sources operated by a particular project. For example, emissions produced by the combustion of fossil fuels, by industrial processes and by fugitive emissions, such as SF6 leakage or in the case of a reservoir, the breakdown of organic matter and the release of methane.
- Scope 2 emissions: These account for indirect GHG emissions associated with energy consumed but not produced by the project i.e. electricity. These are included because the project has direct control over energy consumption, for example, by improving it through energy-efficiency measures or by switching to consuming electricity from renewable sources.
- Scope 3 emissions: As per the EIB methodology, Scope 3 emissions are to be excluded, unless they are from 100% dedicated sources that without the project, would not exist. It was advised that the concrete plants will not operate during a typical year of operations of the baseline or the future baseline. All scope 3 emissions were excluded from this Carbon Footprint Assessment.

10.8.9. Scope 3 emissions represents all indirect emissions and relate to all other GHG emissions associated with the supply chain, this includes any carbon emissions arising during the manufacturing of building materials, the transportation of these materials to the job site and the construction practices used. The combination of these represents the typical definition of ‘construction’ emissions, which is therefore outside the scope of assessment.

10.8.10. Potential sources of emissions for each scope are set out as per **Table 10-16**, including justification of each being scoped in or out of the assessment.

Table 10-16 – Scope of the GHG Assessment

Scope	Potential Sources of Emissions	Scope In or Out for Assessment	Justification
Scope 1	SF6 gas leaks from Switch gear Any fuel powered machinery in operation of the dam	In	These sources of emissions are included within the EIB methodology and have the potential to generate emissions considered to be material to the assessment.
Scope 1	Combustion of fuel by site vehicles	In	These sources of emissions are included within the EIB methodology and have the potential to generate emissions considered to be material to the assessment.
Scope 1	Biogenic emissions from the reservoir	In	These sources of emissions are included within the EIB methodology and have the potential to generate emissions considered to be material to the assessment.

Scope	Potential Sources of Emissions	Scope In or Out for Assessment	Justification
Scope 2	Electricity, heating, cooling and/or steam is procured from off site for operations	In	These sources of emissions are included within the EIB methodology and have the potential to generate emissions considered to be material to the assessment.
Scope 3	Embodied Carbon of Materials Construction Processes	Out	This is out of scope as defined in the EIB Methodology.

ASSESSMENT METHODOLOGY

Introduction

10.8.11. The overarching methodology to be used for calculating the carbon footprint of the Project is consistent with that set out in detail in the EIB Project Carbon Footprint Methodology[27]. The EIB methodology is based upon the internationally recognised Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories[28], the World Resource Institute (WRI) and World Business Council for Sustainable Development (WBCSD) GHG Protocol Corporate Accounting and Reporting Standard[29] and the International Financial Institutions (IFI) Framework for a Harmonised Approach to Greenhouse Gas Accounting[30]. The development of the methodology has also been informed by ISO 14064 Parts 1[31] and 2[32] and the Verified Carbon Standard[33] which provide guidelines for the development of GHG inventories at the corporate and project levels.

10.8.12. The responsibilities regarding project specific GHG emissions assessment, management and monitoring have been outlined in EIB Standard 5[34] as follows:

- Projects are required to assess GHG emissions and their alignment with pathways to limit global warming to 1.5oC above pre-industrial levels and options to reduce transition risks; and

27 EIB. (2023). EIB Project Carbon Footprint Methodologies. Available at: [Accessed: 14/07/2023]

28 IPCC. (2019). IPCC Guidelines for National Greenhouse Gas Inventories. Available at: [Accessed: 08/08/2023]

29 World Business Council for Sustainable Development / World Resources Institute. (2015). The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard. [Accessed: 08/08/2023]

30 International Financial Institutions. (2015). International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting. [Accessed: 08/08/2023]

31 International Organization for Standardization. (2018). ISO 14064-1:2018 Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. [Accessed:08/08/2023]

32 International Organization for Standardization. (2019). ISO 14064-2:2019 Greenhouse gases - Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements. [Accessed: 08/08/2023]

33 Verra. (2019). Verified Carbon Standard. [Accessed:08/08/2023]

34 EIB. (2022). Environmental and Social Standards. Available at: [Accessed: 11/07/2023]

- Projects will provide the EIB with all relevant information on the nature and magnitude of its GHG emissions and/or sequestration.

10.8.13. The aim is to determine alignment with the EIB Group Climate Bank Roadmap (CBR)[35], its consistency with the "Do No Significant Harm" principle to climate change mitigation objectives, as set out in the EU Taxonomy Regulation[36].

VALUED COMPONENTS

VC2-1

10.8.14. Valued Components (VC) are the receptors of the receiving environment that is impacted, for example this could either be a component of the physical, ecological or atmospheric environment. In terms of this carbon footprint assessment, the value component is the atmosphere. The impacts of GHG emissions, in terms of their contribution to climate change, are global in nature, every tonne contributes to impacts on natural and human systems. The VC2-1 is therefore the Global Atmosphere.

METHODOLOGY

10.8.15. The main steps involved in the carbon footprint assessment of the Project are as follows:

- **Step 1: To define the 'project boundaries' for the Project.**
  - Based on the limits of project boundaries, emission sources are scoped in for the calculation of total/absolute and relative emissions. The EIB methodologies use the concept of 'scope' based on definitions from the WRI/WBCSD GHG Protocol Corporate Accounting and Reporting Standard37 when defining the project boundaries.

10.8.16. The EIB methodology advocates the approach for assessment of GHG emissions depending on the type and scale of a project. In table 3 from the EIB methodology below, the Rogun Hydropower project is considered to fall under All Project, when it comes to project type. Therefore, this carbon footprint assessment follows the Footprint Boundary Clarification outlined in Table 3 below.

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[35] EIB. (2020). Climate Bank Roadmap. [Accessed: 08/08/2023]

[36] European Union. (2021). EU Taxonomy Regulation. [Accessed: 08/08/2023]

[37] World Business Council for Sustainable Development / World Resources Institute. (2015). The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard. [Accessed: 08/08/2023]

Table 3: Carbon footprinting of projects: boundary clarifications

PROJECT TYPE	FOOTPRINT BOUNDARY CLARIFICATION
ALL PROJECTS (OTHER THAN THOSE EXCEPTIONS SPECIFIED BELOW)	INCLUSION: Scope 1 and 2 emissions for a typical year of operation. EXCLUSION: Scope 1 and 2 emissions associated with the commissioning, construction and decommissioning of the project. EXCLUSION: Scope 3 emissions. INCLUSION: Scope 3 emissions from 100% dedicated sources upstream or downstream that would not otherwise exist, and a number of specific cases below. An example of the first case would be a power plant that exists solely to supply the project (upstream) or a waste disposal site for the exclusive use of the project (downstream) that would not have otherwise existed.

- **Step 2: To quantify a typical year of operational GHG emissions from the Project.**
  The GHG emissions are calculated with respect to the project boundaries defined in Step 1.
- **Step 3: To identify and quantify "without project" baseline emissions.**
  Evaluation of the "without project" baseline emissions of the project provides a credible alternative do nothing' scenario, against which the "with project" do something' scenario can be compared. Emissions for the current baseline scenario (or 'do nothing' scheme scenario) shall also be calculated using equations from 'Step 2', as per the EIB Methodology[38]. However, in this case, the flooded total surface area would correspond to that of the existing "without project" scheme (2x400MW).
- **Step 4: To calculate relative emissions.**
  The potential impact of the project in terms of carbon footprint has been calculated by the following equation:

  Relative Emissions = "With / Do something" Project Emissions (W_p) - "Without / Do nothing" Project Emissions, or Baseline Emissions (B_e).

  Relative emissions (R_e) concern a project's emissions from a typical year of operation (that is, not including its commissioning or unplanned shutdowns). The "with / do something" project emissions must have the same boundary as the "without / do nothing" project emissions in terms of scope[39].

  Relative emissions may be positive or negative; where negative, the project is expected to result in savings in GHG emissions relative to the baseline and vice versa (subject to the general caveats surrounding the carbon footprint methodologies).

[38] EIB. (2023). EIB Project Carbon Footprint Methodologies. Available at: [Accessed: 14/07/2023]

[39] EIB. (2023). EIB Project Carbon Footprint Methodologies. Available at: [Accessed: 14/07/2023]

Expressing relative carbon footprint is one way of evaluating the impact in emissions' terms since it provides a context to the emissions of the Project (whether it reduces or increases GHG emissions overall).

- **Step 5: To report potential impacts**.

  Relative carbon emissions (potential impacts) of the Project are used as an indicator of its environmental performance and are compared to the relevant national and local carbon budgets and reduction targets and other relevant guidance. This is reported in the Carbon Footprint Assessment. The construction emissions, though not included explicitly as part of the EIB Methodology, were considered in the development of mitigation measures for the Project.

Calculation methods

10.8.17. Of the four scoped in emissions sources, data was only available for Biogenic emissions from the reservoir. This is expected to be the largest source of emissions scoped in. Emissions related to project owned vehicles, SF6 leakage and purchased electricity are not expected to be large and their quantification and management is covered in the Construction Environmental Management Plan (CEMP).

10.8.18. For biogenic emissions from the reservoir, these were quantified using the EIB methodology outlined in the box below.

Figure 10-4 - EIB GHG Assessment Equations

The EIB Methodology (**Ref: 1.1**) gives the following formula for the calculation of GHG emissions for a reservoir:

$CO_2 = 365 * ii * i$ ...1

$CH_4 = (365 * iii * i) + (365 * iv * i)$ ...2

wherein,

'i' is the flooded total surface area,

'ii' is CO_2 diffusive emission factor,

'iii' is CH_4 diffusive emission factor and

'iv' is CH_4 bubbles emission factor.

10.8.19. The climate data for the Region of Republican Subordination has been taken from the 'Techno-Economic Assessment Study for Rogun Hydroelectric Construction Project'. This data with the IPCC classification scheme for default climate regions, found the Project within a 'Cold temperate' climate zone.

10.8.20. The EIB methodology provides emission factors only for 'Cold Temperate, wet' climate zone, however it should be noted that the region is more aligned with a 'Cold Temperate, dry' climate zone for which an emissions factor is not available. Therefore, it is likely that the emissions factors are an over estimation. The GHG emission factors for the Project are provided in **Table 10-17**.

Table 10-17 – Reservoir GHG Emission Factors

Emission factor	Value	Unit
CO2 diffusive emission factor	0.2	$kgCO_2/ha/d$
CH4 diffusive emission factor	9.3	$kgCH_4/ha/d$
CH_4 bubbles emission factor	0.14	$kgCH_4/ha/d$

10.8.21. The flooded total surface area for the project use for the calculation was 17,000 hectares, in line with the 2014 ESIA. Using the equations as set out in the methodology, the baseline CO_2 and CH_4 emissions for the 6 x 600 MW units are 1.24 kt and 58.57 kt respectively. With 27 as the GWP conversion factor for CH_4, the total project emissions are 1,582 $ktCO_2e$ for a typical year[40].

10.8.22. The latest 100-year time horizon GWP for methane (non-fossil) is 27, relative to CO_2 as per IPCC's Sixth Assessment Report (AR6).[41]

10.8.23. For the existing units, that is, 2 x 400 MW unit, flooded total surface area is 2,402 hectares. The emission factors from Table 10-18, the absolute CO_2 and CH_4 emissions for the baseline (2 x 400 MW) are 0.17 kt and 8.28 kt respectively. With 27 as the GWP conversion factor, the total baseline emissions are 223 $ktCO_2e$.

Table 10-18 – Reservoir GHG Emission Factors

Scenario	Project capacity	Flooded total surface area (ha)	Methane emissions ($ktCO_2e$ per year)
Stage 1 Dam "Without Project" Baseline	800 MW (2 X 400 MW)	2,402	223
Stage 2 Dam "With Project" Emissions	3,600 MW (6 X 600 MW)	17,000	1,582
Stage 2 Dam "With Project" Emissions	3,600 MW (6 X 600 MW)	17,000	1,582

10.8.24. The electricity generation to calculate the emission intensity was calculated by subtracting the assumed Stage 1 Dam "without project" baseline electricity generation from the estimated Stage 2 Dam "with project" generation from the project.

10.8.25. The estimated electricity generation from the Project is assumed at 17 billion kWh.

10.8.26. The electricity generated from the baseline (2 x 400 MW) was apportioned from the total project (i.e., 17 billion kWh X (2 x 400 MW) / (6 x 600 MW)) and estimated as 3.67 billion kWh.

40 EPA. (2023). Understanding Global Warming Potentials | US EPA. [Accessed: 18/09/2023]

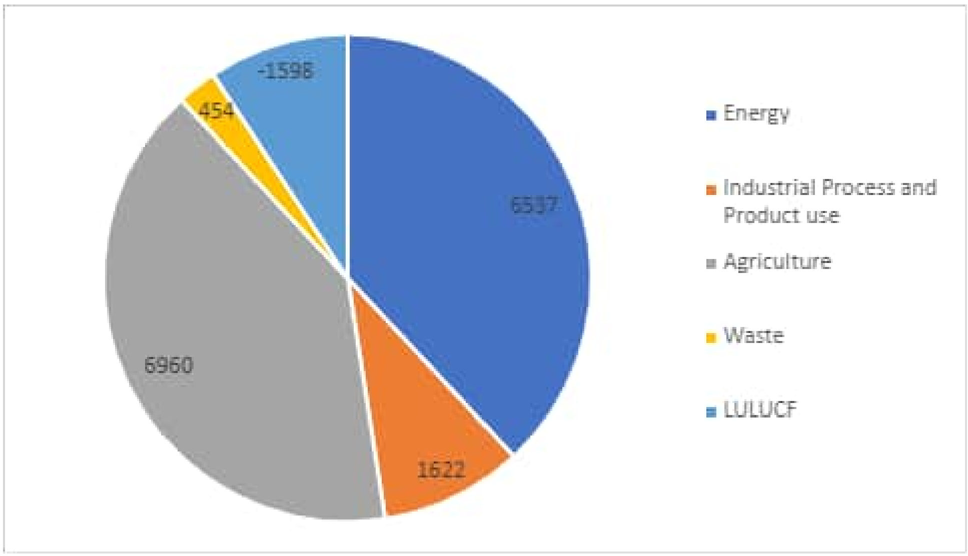
41 IPCC. (2023). Sixth Assessment Report — IPCC. [Accessed: 18/09/2023]

10.8.27. The emission intensity was estimated by dividing the relative emissions with the electricity generation.

10.8.28. In order to provide context to the GHG emissions, the estimated GHG emissions arising from the Project will be compared with the Tajikistan's National emissions and the grid average.

10.8.29. According to fourth National Communications submitted to UNFCCC, most of Tajikistan's 13.9 Gg of GHG emission (including LULUCF) in 2016 was from agriculture (45%), followed by emissions from energy (42%), industrial process and product use (10%) and waste (3%)[42].

Figure 10-5 - Sector wise GHG emissions (Gg CO_2e) in Tajikistan for 2016



10.8.30. The Tajikistan electricity emission factors was provided in Table A1.3 (Country-specific electricity emission factors) of the EIB methodology, which is 106 gCO_2/kWh.

10.8.31. The fossil fuel alternatives for Tajikistan would likely be coal or natural gas, which would have a higher carbon intensity than the grid average. Based on available data from the IFC[43], the typical CO_2 emissions performance of new thermal power plants for coal (using the lowest carbon option of integrated gasification combined cycle (IGCC) technology) would be in excess of 700 gCO_2/kWh, similarly for gas (using the lowest carbon option of combined-cycle gas turbine (CCGT)) would be over 300 gCO_2/kWh.

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[42] UNFCC. (2022). Fourth National Communication of The Republic of Tajikistan under The United Nations Framework Convention on Climate Change. Available at: Tajikistan. National Communication (NC). NC 4. | UNFCCC [Accessed: 21/08/2023]

[43] IFC. (2008). Guide for Preparation of Draft Industry Sector EHS Guidelines (ifc.org). [Accessed: 15/09/2023]

10.9 IMPACT ASSESSMENT

ASSESSMENT OF IMPACTS

10.9.1. The magnitude of GHG emissions from the Project has been calculated and contextualised with the various other power generating sources.

10.9.2. GHG emissions is defined as the tonnes of carbon dioxide equivalent (tCO_2e), emitted. The quantity of these gases emitted must be multiplied by the correct global warming potential (GWP) to convert this into tonnes CO_2e. GWP has extensively been employed in climate policy to report emissions of different GHGs on the same scale.

10.9.3. The assessment, results presented in **Table 10-19**, finds that the GHG emissions from the Project (With Project Emissions) are expected to be 1,582 tCO_2e/year, with a GHG emission intensity of 102 gCO_2/kWh.

Table 10-19 – Estimated Emission Intensity

	Value	Unit
Relative Emissions	1,359	$ktCO_2e$/annum
Electricity generation (4 X 600 MW) and 2 X 200 MW)	13.22	Billion kWh
Emission intensity	102	gCO_2e/kWh

EMISSIONS CONTEXT

10.9.4. In the context of total annual emissions available (2016) for Tajikistan, the Project represent an annual emission of 9.73%.

10.9.5. Additionally, the Project emission intensity is much lower when compared to the Tajikistan Grid Mix, Coal (IGCC) and Gas (CCGT), as detailed in **Table 10-20**. This present a reduction of 4%, 87% and 71% respectively.

Table 10-20 – Emissions Context

	Emissions Intensity (gCO2/kWh)	% Reduction this Project Represents
This Project	102	
Tajikistan Grid Mix	106	4%
Coal (IGCC)	760	87%
Gas (CCGT)	348	71%

10.9.6. The emission intensity presented in this GHG assessment likely represents an over estimation of potential emission (a worst-case scenario), as vegetation will be removed prior to construction (as committed in the watershed management plan and using representative emissions for “Cold Temperate, Wet” as there was emission factor available for “Cold Temperate, Dry” which would be lower.

DIRECT EFFECTS

10.9.7. The direct effect of GHGs released from the project into the atmosphere is that it contributes to the greenhouse effect, amplifying climate change. The greenhouse effect keeps the Earth’s climate liveable, but human activities have increased the amounts of carbon dioxide and other GHGs like methane in the atmosphere which is warming the globe and changing the climate. A changing climate results in more flooding, droughts, fires, and sea level rise.

INDIRECT EFFECTS

10.9.8. The indirect effects of climate change include impacts on health from air pollution, disease, extreme weather events, forced displacement, food insecurity due to increased extreme weather events.

WHOLE PROJECT IMPACT ASSESSMENT

10.9.9. The GHG emissions have been calculated for this project align to the EIB methodology as per detailed in the section “Assessment Methodology”. This methodology requires a “without project” and “with project” conditions from a typical year of the project operations.

TRANSBOUNDARY EFFECTS

10.9.10. The impacts of GHG emissions, in terms of their contribution to climate change, are global in nature, and therefore have a transboundary effect that occurs in the global atmosphere. As a result, it is difficult to specifically name the effects and so a transboundary screening has not been completed.

SUMMARY OF IMPACTS

10.9.11. The assessment of Impacts is presented in **Table 10-21**.

Table 10-21 – Greenhouse Gases Impact Assessment Summary

Impact Factor	Impact Factor 1 - What is the Impact of Reservoir Emissions on Climate Change?
Valued Component	**VC2-1 - Impact of GHGs on Climate Change**
Sensitivity	**High**
	Any increase in GHG emissions from human activity is said to impact Climate Change, and therefore the sensitivity is high.
Type	**Negative**
	The proposed project will lead to an increase in GHG emissions from the baseline existing project. This will have a negative effect on climate change, but it will have less of a negative effect if the proposed project output of electricity was met with coal or gas power stations instead.
Extent	**Global**
	Increasing GHG emissions into the atmosphere has a global impact, as it affects the global climate.
Duration	**Long-term**
	Releasing GHG emissions into the atmosphere has a long-term impact on the climate. Each GHG has a different average lifetime in the atmosphere i.e. CO_2 = 100's to 1000's of years, CH_4 = about a decade, SF6 = 3200 years.
Frequency	**Constant**
	The GHG emissions presented in this Carbon footprint represent 1 typical year of the reservoir's operations. These GHG emissions will be calculated annually, the amount of reservoir emissions will depend on the flooded area covered by the reservoir.
Likelihood	**Likely**
	It is likely that the reservoir will emit GHG emissions into the atmosphere. It is also likely that there will be other emissions from the Projects Scope 1 & 2 emissions emitted, although compared to the reservoir emissions the remaining emissions are of lesser significance.

Impact Factor	Impact Factor 1 - What is the Impact of Reservoir Emissions on Climate Change?
Reversibility	**Irreversible**
	Many of the impacts of climate change are now irreversible according to the UN's latest IPCC assessment.
Magnitude	**Medium**
	The reservoir will emit GHG emissions into the atmosphere but compared to the number of emissions released from an alternative coal of gas fired power station the impacts will be a lot less.
Significance	**Medium**
	Compared to the of various Power Generation types, Hydropower comes in at medium significance, Coal and Gas are Major significance, with Wind On-shore and Nuclear are minor significance, based on median lifecycle carbon emissions (gCO_2/kWh).
Additional Mitigation?	**Yes**
	Included as AM2-1 & AM2-2 Section 8 – Management and Mitigation
Residual Significance	**Minor**

MANAGEMENT AND MITIGATION

10.9.12. GHG mitigation for a project like Rogun requires planning, design optimisation, efficient construction methods and sustainable operational practices. PAS 2080 is a global framework developed by the Infrastructure Carbon Review (ICR) which outlines a systemic approach to managing and mitigating carbon emissions in infrastructure projects and operations.

10.9.13. To manage and mitigate carbon emissions effectivity it requires a process such as PAS 2080:

- Assessment and Baseline: quantify whole life carbon;
- Strategy and Target Setting: develop strategy to reduce emissions;
- Implementation and Innovation: put strategy into action, include innovative technologies to reduce emissions during construction and operation; and
- Monitor and Continuous Improvement: Monitor emissions and track against targets and seek improvements.

10.9.14. A carbon management process can really help to focus in on emissions and ensure that the mitigation measure being taken are having the desired outcome of carbon reduction. Outlined below are some construction phase mitigation measures that have been taken to date and then some mitigation measures for during operations are presented.

Construction Phase

10.9.15. To reduce the carbon footprint of the Project and ensure energy efficiency, mitigation measures have been incorporated in its construction phase, examples of which are listed below from 8.1.1 to 8.1.7. These measures stated below form part of the Energy Saving Initiatives for the Project and help to reduce GHG emissions in the construction phase.

10.9.16. Green air ventilation system is an automated ventilation system capable of optimizing jet fan speed based on real-time pollutants measurements. The main benefits if the system include:

- Better healthy conditions in tunnels through continuous monitoring of pollutants (CO_2, NO_2) and ventilation speed adaptation.
- Greater energy efficiency leading to reduced consumption and GHG emissions.
- The system ensures energy efficiency of 96.78% on average, which implies reduction in:
  - Energy consumption by 6023 kWh/day;
  - Emissions by 337.28 kg CO2/day;
  - Running costs by 216.82 €/day.

10.9.17. This is a 10.8km electrically controlled belt conveyance system proposed to transfer crushed materials from crusher plants to silos near the dam area. The main benefits from the system include:

- Capable of handling wide range of bulk materials;
- Reduced risk of accidents;
- Configured to change elevation;
- Reduced manpower;
- Energy savings.

10.9.18. Approximately 4.8km of the conveyance system was installed under Phase 1 and the remaining 6.02km is to be installed under Phase 2. The system is expected to result in annual energy savings of 9 million kWh and annual CO_2 savings of 13.7 kilo tonnes[44].

10.9.19. As part of the continuous effort to minimise the use of diesel-powered generator sets as a source of electricity power for site works of the Project, a direct power source was solicited from the Nurek Power Station. The external power feeds into a 16,000kVA transformer substation which subsequently phases down the infeed power into usable electricity power source. In this way, the direct power feed effectively replaces the use of 12 generator sets of 1200kVA. This is expected to result in 101 million kWh energy savings, 2.3 million € cost savings and 73.08 kilo tonnes CO_2 savings annually.

10.9.20. LED lights have been introduced to replace the more conventional fluorescent lighting. Energy efficient lighting has been installed at various locations of the site. LED lighting is expected to result in annual energy savings of 239,919 kWh for the main offices and camp area and 460,776 kWh for the workshop area.

10.9.21. This involves the use of on-site water resources for dust suppression. The use of energy efficient water hoses, energy and water efficient water guns significantly reduces water consumption. Energy savings also result from reduced water truck mileage. These measures are expected to lead to annual energy savings of 76,000 kWh, annual cost savings of 4,000 € and annual CO_2 savings of 69.02 tonnes.

10.9.22. In September 2021, a refurbishment of the diesel-powered engines by replacing them with electrically driven engines was proposed. The engine transformation project commenced in the 4th quarter of 2021 for a duration of 2 months. Testing and commissioning of the new engines for a total 5 drilling & grouting machines was completed in October 2021. This shift to electric engines is likely to result in energy savings of 1.3 million kWh, cost savings of 110,700 € and CO_2 savings of 345.1 tonnes on an annual basis.

10.9.23. To reduce these emissions further, it is recommended that all engines are turned off when not in use to be implemented through the CEMP.

10.9.24. Savings in fuel consumption can reduce GHG emissions to a great extent. Transportation emissions during the construction phase of the Project have been optimised by:

- Deploying only vehicles that will get better fuel mileage;
- Ensuring regular and proper vehicles' technical inspection and maintenance;
- Re-siting expat camps next to Main Office to cut down travelling; and
- Using multiple-passenger vans or bus to transport staff.

10.9.25. This is expected to result in energy savings of 6 million kWh per year, cost savings of 342,500 € per year and CO_2 savings of 917.6 tonnes per year.

[44] 1 Ton = 0.99 tonnes; values in tons have been converted to tonnes in order to maintain uniformity throughout the assessment.

OPERATIONAL PHASE

10.9.26. The recommended good practice measures to reduce the generation and release of methane and other GHGs to the atmosphere include:

- Hydropower projects (e.g. those with emissions greater than 20 kt CO2e/year), like the Rogun Dam, must consider alternative project design configurations to minimise emissions wherever possible:
  - One means of achieving this might be the removal of vegetation from the reservoir footprint prior to inundation, which has already been proposed as part of the 2014 ESIA.
  - Other measures may include re-siting offtake structures to avoid drawing water from the anoxic bottom layer of a reservoir, or a reduction in surface area by lowering the operating level.
  - The current estimate of Rogun Dam is 102g of CO2e per kWh, this may be an overestimate of GHGs, as it is deemed that the catchment area is low on biomass compared to other Hydropower projects and it also plans to clear biomass and trees before impoundment.
  - EIB also requires that all hydropower projects considered large Hydropower projects, must undertake direct and continuous monitoring of CO2e emissions during operation. The assessment is based on available data, which is from Scope 1 and 2 operations. To manage these emissions, it is recommended that an ongoing monitoring and mitigation plan (GHG Reduction Plan) of operational GHG sources is put in place. This will need to include the sources of emissions described in Table 10-22.

Table 10-22 – Mitigation measures for identified Scope 1 and Scope 2 Emissions.

Monitor	Manage and Mitigate
Scope 1 Emissions:	
What amount of SF6 gas leaks from Switch gear per annum?	Measure, monitor and reduce leakage to as great and extend as possible.
Are there any processes that release emissions during operations? For example: Are any fuel powered machinery used to remove plant matter from the dam?	Measure, monitor and switch to low carbon or no carbon plant machinery instead.
What fuel is combusted on site, per annum for the Project operations? For example: How much diesel, petrol, gas is used in operations per annum?	Measure, monitor and switch to low carbon or no carbon vehicles or generators, where possible.
Reservoir Emissions – where appropriate	Rogun, is likely to have a relatively small amount of biomass to be submerged. A thorough pre-impoundment reservoir clearing, should decrease the amount of methane released during the reservoir operations. Rogun reservoir will be filled in stages. The pre-impoundment clearing will have to be in coordination with this staged filling, with the aim of clearing areas as shortly before impoundment as possible, in order to prevent regrowth. In the last stage, care will have to be taken not to cut any trees, and not to burn any vegetation above this level. Watershed management (will be required as part of the Watershed Management Plan) will help reduce the contribution of organic matter from the catchment area to the reservoir and the removal of decomposable vegetative matter from the inundation area before flooding. Thermocline: a temperature gradient in a reservoir, can trap methane by limiting vertical water mixing. Methane, produced in deeper, cooler layers, stays dissolved due to this barrier. Less soluble in warm water, trapped methane is less likely to reach the surface and escape into the atmosphere, reducing emissions. However, effectiveness depends on factors like thermocline strength and reservoir dynamics.
Scope 2 Emissions:	
Is there any electricity, heating, cooling and/or steam is procured from off site for operations per annum?	Energy efficiency measures and switching to renewable electricity will reduce Scope 2 emissions.

RESIDUAL EFFECTS

10.9.27. The GHG indicates that this Project is expected to have an Emission intensity of 102 gCO2e/kWh.

10.9.28. The emission intensity presented in this GHG assessment likely represents an over estimation of potential emission (a worst-case scenario), vegetation will be removed prior to construction (as committed in the watershed management plan and using representative emissions for "Cold Temperate, Wet" as there was emission factor available for "Cold Temperate, Dry" which would be lower.

10.9.29. An alternative to SF6 for switch gear may not yet be available. Research into options to replace this with a low carbon alternative is recommended to deal with any residual emissions.

10.9.30. As with most hydropower dams, the project is anticipated to contain biomass which will be submerged. The project will work to reduce any residual emissions. Where practicable monitoring of methane emissions can be undertaken to understand the long-term effects on carbon and carbon equivalent emissions.

11 CUMULATIVE IMPACT ASSESSMENT (RAPID)

11.1 INTRODUCTION

11.1.1. Cumulative impacts are those that arise due to an impact from the Project interacting with an impact from another activity to create an additional impact. The Cumulative Impact Assessment (CIA) is an assessment of these impacts.

11.1.2. Environmental and social impacts arising from existing, planned and foreseeable future developments within the Project Area of Influence (AoI) might individually be insignificant, but when combined, could amount to a significant cumulative impact. Direct and indirect effects of the Project have been defined in **Volume 1, Chapter 8** of this ESIA.

11.1.3. The assessment of cumulative impacts is an integral part of the ESIA process to ensure that multiple effects on people, heritage and environmental receptors arising from the Project combined with impacts from other projects/activities have been identified and addressed.

11.1.4. The identification and appraisal of cumulative impacts in this chapter is restricted to a high-level qualitative assessment of existing, planned or reasonably defined developments. Accordingly, this is considered a Rapid Cumulative Impact Assessment. The final ESIA will include an expanded assessment.

11.2 INTERNATIONAL GUIDELINES

11.2.1. Several international guidelines have provided points of reference to the approach and method for assessing risk and impacts, including:

- International Finance Cooperation, Good Practice Handbook, Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets, 2013.
- Guidance for the Private Sector in Emerging Markets, The World Bank Group Environmental and Social Framework, 2017; and
- World Business Council for Sustainable Development, Guidelines for Environmental & Social Impact Assessment, 2016.

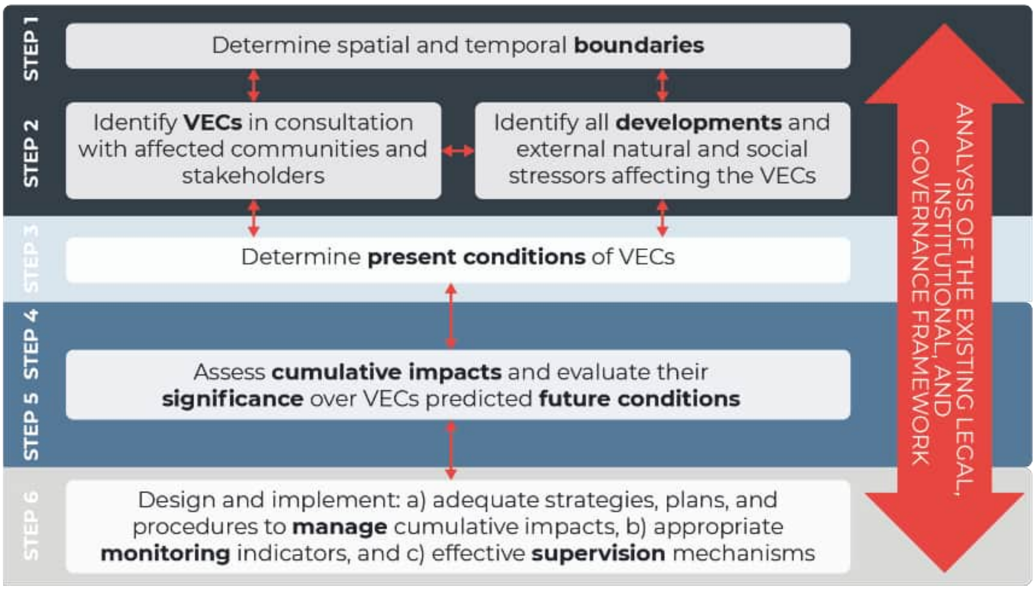
11.3 METHODOLOGY

11.3.1. A six step Rapid Cumulative Impact Assessment (RCIA) methodology has been followed, as summarised in Figure 11-1, aligned to the IFC (2013).

11.3.2. The focus of the cumulative impact assessment is limited to proposed developments and activities that have the potential to have a significant impact on sensitive human, heritage and environmental values and/or raise concerns from Affected Communities.

11.3.3. The IFC guidance states that Government and regional planners have ultimate responsibility for CIA and, accordingly, the rapid CIA may evolve into a more robust and comprehensive CIA. A most robust assessment will be completed and presented in the final ESIA.

Figure 11-1 - IFC's Six Step Approach to Rapid CIA (RCIA) (IFC, 2013)



11.3.4. Cumulative impacts consider what impacts the Project will have on valued environmental and social components (VCs) in terms of existing or future developments and how to avoid or minimise these impacts to the greater extent possible.

11.3.5. Cumulative impact assessment can be challenging, particularly in emerging markets. The RCIA process entails a desk review that, in consultation with the affected communities and other stakeholders, enables the developer to determine whether its activities are likely to significantly affect the viability or sustainability of identified receptors. This approach recognises the many challenges associated with managing a good cumulative impact assessment process in emerging markets, such as limited baseline data, uncertainty associated with anticipated developments, limited government capacity, and absence of strategic regional, sectoral, or integrated resource planning schemes.

11.3.6. The initial screening results of the RCIA can identify several potential scenarios provided in Table 11-1.

Table 11-1 - Potential RCIA screening scenarios

Significant Risk for Cumulative Impacts, with Significant Leverage	Significant Risk for Cumulative Impacts, with Limited Leverage	Limited to No Contribution to Cumulative Impacts
The Project under consideration represents a significant contributor to the expected cumulative impacts or will be the first of several future reasonably anticipated developments that will use the same resource and/or potentially affect the same receptors.	The Project under consideration is immersed in an environment where the cumulative impacts are evident, but the issues are complex, many actors are already involved, and the solution is clearly beyond any individual Project sponsor.	The RCIA determines that even though there are clear cumulative impacts, the Project's contribution to the cumulative impacts over the affected receptors are negligible or nil.

Significant Risk for Cumulative Impacts, with Significant Leverage	Significant Risk for Cumulative Impacts, with Limited Leverage	Limited to No Contribution to Cumulative Impacts
Through consultation with stakeholders, the RCIA will help assess potential cumulative impacts that could be expected over time and guide the developer in defining the required mitigation measures.	The RCIA will help developers to: ▪ Determine the significance of the overall cumulative impacts and its contribution to these cumulative impacts; and ▪ Design environmental and social management plans and procedures to appropriately mitigate hose contributions.	No measures other than the ones resulting from the ESIA process are necessary.
A developer could design a strategy to appropriately manage cumulative impacts and provide advice to the government on the appropriate governance structure to ensure other developers will follow suit. This is an ideal case, where the developer can capitalise on the ESIA process, and the RCIA may organically evolve into a more robust CIA process and contribute to leveraging governments by outlining a strategic approach to managing cumulative impacts.	Developers should be accountable only for the design and implementation of mitigation measures commensurate with the magnitude and significance of its contribution to the cumulative impacts. They should also use best efforts to engage other developers, governments, and other stakeholders in acknowledging the cumulative impacts and risks and in designing coherent management strategies to mitigate them.	Note: If there are cumulative impacts from other sources that are not being addressed, developers may consider it pertinent to draw this to the attention of the government or other stakeholders and assess whether its Project may be at risk from the unmanaged cumulative effect.

11.3.7. It is noteworthy that the Rogun project cannot be placed entirely into a single column, as various aspects and potential impacts of Rogun could fall into any one of the categories or subcategories.

11.4 STAGE 1: SPATIAL AND TEMPORAL BOUNDARIES

SPATIAL BOUNDARIES

11.4.1. The spatial boundaries of the RCIA have been defined by reference to the Project characteristics (see Volume I, Chapter 3). The AoI for each topic area are presented in the relevant topic annexes (Volume II, Annexes A01-A14) and are summarised in **Volume 1, Chapter 7** of this ESIA. They correspond to the assessment area for the defined Valued Environmental and Social Components (VCs) for the CIA.

11.4.2. While this scope has been used to identify potential interactions with any VCs present, it does not necessarily equate to the extent of the VCs being affected. A flexible approach has been maintained, with the geographical boundaries of the RCIA varying depending on the characteristics of the potentially impacted VC. In some cases (e.g., mobile fauna), an interaction may occur in one area, but cumulative impacts may occur across the extent of the VC. In these cases, the cumulative assessment has evaluated any across the extent of the VC.

TEMPORAL BOUNDARIES

11.4.3. The cumulative impact assessment temporal boundary covers the construction and operation phases of the Project. It should be noted that the further into the future the assessment looks, the greater the level of uncertainty around other potential developments. A decommissioning phase has not been considered in the RCIA as the Project has an expected life of 115 years, dependent on sediment inflow.

11.4.4. For the purpose of this RCIA, it is assumed that the construction phase of the Rogun HPP project will be completed by 2029.

11.5 STAGE 2: IDENTIFY RECEPTORS AND OTHER DEVELOPMENTS

VALUED ENVIRONMENTAL AND SOCIAL COMPONENTS

11.5.1. VCs are those prevailing environmental and social attributes within areas that are potentially impacted by the Project (during the construction and operation phases). VCs have been identified through the ESIA process, including through relevant stakeholder engagement (as detailed Volume I, Chapter 6: Stakeholder Engagement) and through reviews and assessments undertaken by relevant specialists as part of the ESIA process.

11.5.2. The VCs for which the Project itself is assessed to have a significant (Moderate or Major) adverse or positive effects will be considered as part of this RCIA. A summary of the VC residual effects defined for the Rogun HPP Project are presented in Table 11-2, and only includes in-scope VCs that may be cumulatively impacted by the Project.

11.5.3. Because of the importance of the water resource, this has also been scoped in, although as discussed in Chapter 8 the impacts of Rogun HPP are considered to be minor or negligible, largely due to the presence of Nurek downstream of Rogun.

Table 11-2 - Summary of Rogun HPP Project Major, Moderate or Positive Residual Effects

Aspect/ ESIA Chapter	VC(s)	Impact	Construction Phase	Operation Phase	Residual Significance
Social	Community assets and infrastructure	Loss of current community assets and infrastructure. New resettlement to provide improved infrastructure	✓	✓	Positive

Aspect/ ESIA Chapter	VC(s)	Impact	Construction Phase	Operation Phase	Residual Significance
Water	River flow (biodiversity and downstream users)	Conversion of 80+km of river to reservoir. Reduced flow in 17km—no users affected each. No impact beyond Nurek HPP.	✓	✓	Biodiversity: Minor to Moderate River flow: Minor to Negligible

OTHER PROJECTS AND DEVELOPMENTS

11.5.4. A summary of other projects identified as part of the RCIA are provided in **Table 11-3**.

11.5.5. The location of these projects in relation to the Rogun HPP Project AoI is provided in **Figure 11-2**. These developments have been screened to identify those with the potential to result in cumulative impacts when the spatial and temporal scope of the Project is considered.

11.5.6. Although details concerning impacts of existing developments are beyond the scope of this ESIA and RCIA, those impacts are recognized in broad terms in this RCIA, and to some extents have been taken into consideration in the assessment of significance of Rogun impacts (e.g., from the presence of Nurek having interrupted fish migration). Planned developments have been assessed subject to the availability of relevant ESIA reports and other readily available information. Where information is incomplete or unknown, these developments are deemed as having 'Deficient Data' and have been identified in assigned as such in Table 11-4.

11.5.7. The Human Health survey (refer to Volume I**, Chapter 6; Stakeholder Engagement**) identified the following projects as having affected stakeholders and these projects have been considered in the RCIA screening process:

- International Highway (Vakhdat – Jirgital); and
- Central Asia–China gas pipeline, Line D (identified in the questionnaire as Turkmenistan-China Natural Gas Pipeline Project).

Multiple displacement impacts are assessed in detail under the 2017-2025 RAP 2 and LRP 2 (see **Volume I, Chapter 3: Project Description**, Section 3.10 for details).

Table 11-3 – Other Projects

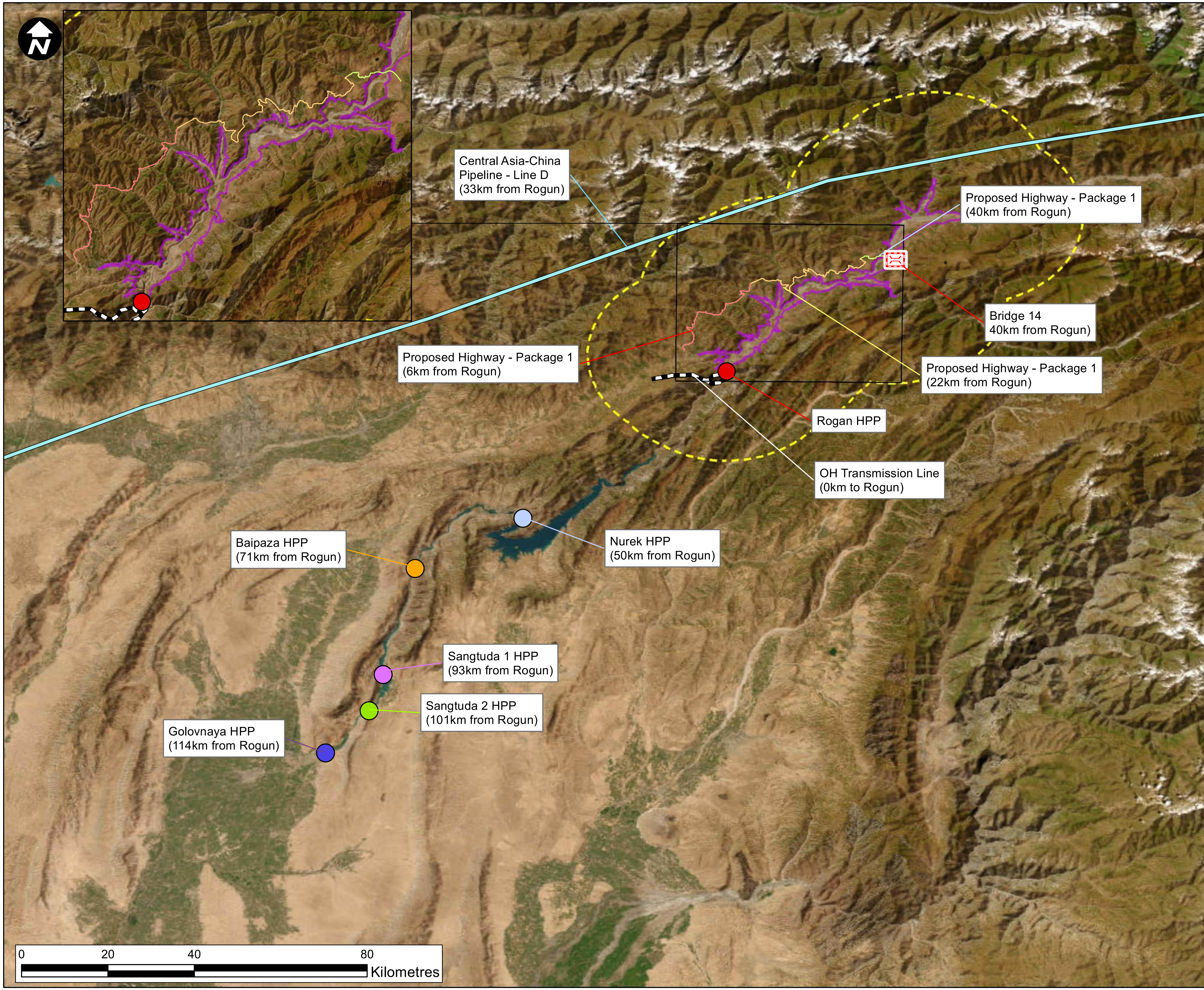
Project Name [industry/sector]	Status	Location	Description	Screened In / Screened Out
Nurek Hydropower Rehabilitation Project [Hydro Electric Power Plant]	Operational HPP is under rehabilitation	Located 70 km downstream from the Rogun HPP	At present, Nurek HPP is the farthest hydropower project upstream in the Vakhsh watershed, a position which will be taken by Rogun. Nurek is currently the largest hydroelectric power plant in Tajikistan and supplies more than 70 % of all the electricity generated in the country at present. The HPP was put into full operation in 1979 and is part of the Vakhsh HPP Cascade (refer to Table 3-1 in Volume I, Chapter 3: Project Description). The HPP installed capacity is 3,000 MW. Nurek HPP Is currently under rehabilitation, which is being carried out in 2 phases: Phase 1 includes rehabilitation of three generating units, key infrastructure components of the plant, and replacement of six autotransformers; and enhancement of dam safety Phase 2 covers the finalisation of the Nurek HPP rehabilitation and involves the replacement of six turbines and five transformers as well as the rehabilitation of Nurek bridge, the powerhouse, and other buildings/structures. Completion of the Nurek dam in the 1960s and 1970s had a significant effect on the Vakhsh River and the Amu Darya (see the 2014 Rogun ESIA for more details—Pöyry 2014). In summary, the dam interrupted migration of fish and other aquatic species. It also resulted in significant changes in seasonal flows downstream in the Vakhsh and Amu Darya, and this in turn has allowed significant agricultural and economic development in riparian countries.	**Screened In** – temporal overlap
Baipaza HPP [Hydro Electric Power Plant]	Operational	71 km downstream	Baipaza HPP is part of the Vakhsh HPP Cascade (refer to Table 3-1 in Volume I, Chapter 3: Project Description) and has been in operation since 1986.	**Screened Out** - operation has been captured within the

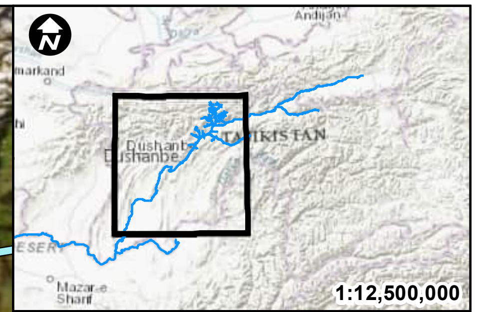
Project Name [industry/sector]	Status	Location	Description	Screened In / Screened Out
		of Rogun HPP		baseline data for this Project. All are effectively run-of-river operations with little or no downstream effect. No effect of Rogun on these projects, nor of these projects on Rogun.
Sangtuda 1 HPP [Hydro Electric Power Plant]	Operational	93 km downstream of Rogun HPP	Sangtuda 1 HPP is part of the Vakhsh HPP Cascade (refer to Table 3-1 in Volume I, Chapter 3: Project Description) and has been in operation since 2009.	
Sangtuda 2 HPP [Hydro Electric Power Plant]	Operational	101 km downstream of Rogun HPP	Sangtuda 2 HPP is part of the Vakhsh HPP Cascade (refer to Table 3-1 in Volume I, Chapter 3: Project Description) and has been in operation since 2011.	
Golovnaya 240-Megawatt Hydropower Plant Rehabilitation Project [Hydro Electric Power Plant]	Operational HPP is under rehabilitation	114 km downstream of Rogun HPP	Golovnaya Dams are part of the Vakhsh HPP Cascade (refer to Table 3-1 in Volume I, Chapter 3: Project Description) and have been in operation since 1963. The Rehabilitation Project will comprise a refurbish of electric and mechanical equipment for power generation at Golovnaya Hydropower Plant (HPP) in Tajikistan. The Project will increase the generation capacity and operational efficiency of the power plant.	
Shurob HPP Project [Hydro Electric Power Plant]	Planned	Proposed location between Rogun HPP and Nurek HPP	Shurob is a proposed Run-On-River HPP of about 850 MW, to be built between Rogun and Nurek. Dam would be at the upper end of Nurek reservoir and the Shurob reservoir would extend nearly to the toe of Rogun dam. The Shurob HPP Project cannot be built without Rogun in place, since its small reservoir would be filled in a very short time (Pöyry Energy AG 2014). The project has not progressed beyond feasibility studies since it was announced in 2012. The project remains in the preliminary	**Screened in** – potential temporal overlap with Rogun operation

Project Name [industry/sector]	Status	Location	Description	Screened In / Screened Out
			planning stage, with no formal decision to proceed or any prospective date. If it is constructed, it would not begin until Rogun construction is complete.	
International Highway (Vakhdat – Jirgital) [Road & Transport]	Packages ½ in Operation. Package 3 in Construction.	6 km – 40 km	The main road from Dushanbe to Obi Garm (M41) branches shortly before reaching Obi Garm to access the Rogun HPP site. Shortly after Obi Garm, short stretches of this road will be submerged in Stage 1 of the reservoir filling while, at later stages of impoundment, longer distances including the only bridge suitable for heavy traffic crossing the river, will disappear. This road is an important international and national road and has been replaced and, where required, road and bridge access to villages lying at higher elevations which will not be relocated have been provided. Two major new roads were planned for the area surrounding the reservoir. One along the left bank of the lower part of the reservoir, from the dam to the main bridge which will cross the reservoir, the other on the right bank, upper part of the reservoir, between the bridge and the village of Gharm, located approximately 50 km to the north-east. The new alignment of the M41, relocated the connection between Obi-Garm and Nurobod in three Packages of construction. Package 1: Obi-Garm – Tagikamar: Two tunnels, (Kandak and Karagch), 4 new bridge constructions and 2 bridge rehabilitations and approximately 30km of local access roads. Package 2: Tagikimar – Nurobod: Tunnel 3 (Tagikamar), 6 new bridge constructions, 1 bridge rehabilitation approximately 40km of local access roads.	**Screened in (Associated Facility—see Volume I, Chapter 3)**

Project Name [industry/sector]	Status	Location	Description	Screened In / Screened Out
			Package 3: Long Bridge at Darband: The permanent bridge is approximately 760m long, crossing the Surkhob River. This project is considered an associated facility to the Rogun HPP, and it has been subject to a separate ESIA process. The EIA for the 'Central Asia Regional Economic Cooperation Corridors 2, 3, and 5 (Obigarm–Nurobod) Road Project' (Ministry of Transport for the Asian Development Bank 2019) notes that construction for all packages will have been completed by November 2025. Road works for the project have substantially been completed as of late 2023.	
Transmission Line (High Voltage) [Electrical Infrastructure]	Planned	0 km	Rogun HPP will significantly enhance supply security in Tajikistan by producing an average of 30% of domestic electricity demand between 2020 and 2050. The electricity generated by the Rogun HPP is planned for evacuation through 500kV high-voltage transmission lines to the power grid of the Republic of Tajikistan. The surplus power generated from the hydroelectric facility is proposed for export to Afghanistan and Pakistan through the CASA-1000 (Central Asia-South Asia) cross-border Ultra-High-Voltage (UHV) transmission line.	**Screened Out** - operation has been captured within the baseline data for this Project.
Central Asia–China gas pipeline, Line D [Energy]	Construction	33 km*	The fourth gas pipeline of this system will have a capacity of 30 bcm/year and will run 966km from the Galkynysh gas field in Turkmenistan to western China through Uzbekistan, Tajikistan, and Kyrgyzstan. The first three pipelines are in operation and do not pass through Tajikistan. The pipeline owner and operator are Trans-Tajik Gas Pipeline Company Ltd.	**Screened in**

Project Name [industry/sector]	Status	Location	Description	Screened In / Screened Out
			Construction commenced in Tajikistan in 2018 and has been intermittent since this time. No project completion date has yet been announced by the stakeholders and little information is available due to security and commercial considerations.	
Qosh Tepa Canal, Afghanistan [Irrigation]	Construction	Circa. 225 km downstream of Rogun HPP	This 285 km canal project is located in northern provides of Afghanistan. It proposes to divert water from the Amu Darya River to allow 550,000 hectares to be used for agriculture. The proposed location of intake from the river near Khoshtepa (Afghan/Tajik border). Phase 1 construction commenced in 2022 and has been completed. Phase 2 has commenced. There is no formal timeline for completion of the project, but it is understood to be of high national priority. The project was initiated by the former Government of Afghanistan and USAID. The Khush Tepa Irrigation and Power Generation Feasibility Study was carried out between 2018-2021. Arial imagery from 2023 indicates that phase 2 construction has been rapid under the current leadership regime in Afghanistan and that: ▪ construction methods used may be basic, ▪ industry best practice engineering design may not have been use. For example, no lining of the canal or reinforcement of banks. As of late 2023, Afghanistan is not party to the water management agreement for the Amu Darya basin.	**Screened In**





Legend

- Rogun Site Location
- Central Asia-China Pipeline (Line

Proposed Highway

- Package 1
- Package 2
- Package 3
- OHL Transmission Line
- 1290m Inundation Boundary
- Area of Interest

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri

wsp

PROJECT TITLE

Rogun HPP E&S Support and Monitoring for World Bank

DRAWING TITLE

Figure 11-2
Distances from Rogan HPP

DRAWING STATUS
FOR INFORMATION

DRAWN	CHECKED	APPROVED	AUTHORISED
RKR	CB	RL	AB

SCALE @ A3 SIZE	DATE	REVISION
1:800,000	19/09/2023	P01

DRAWING NUMBER
ROGUN-WSP-DR-GI-0042

Table 11-4 - Scoping of Other Projects for Consideration in Cumulative Impact Assessment

Project Aspect	VC(s)	Potential Cumulative Impact	Project Phase		Developments (Existing/ Planned/ Somewhat Defined)						Scoped In/Scoped Out
			Construction	Operation	Nurek HPP Operation	Nurek HPP Rehabilitation Project Phase1 & 2	International Highway (Vakhdat - Jirgital)	Central Asia–China gas pipeline, Line D	Qosh Tepa Irrigation Canal, Afghanistan	Shurob HPP	
Soils & Geology	Loss of Soil	Erosion and sedimentation in permanent and temporary Rogun inundation zone	✓	-	X	X	X (de minimis)	X	X	X	Scoped out
Soils & Geology	Loss of Soil	Change in Land Capability in the Rogun inundation zone	✓	✓	X	X	X (de minimis)	X	X	X	Scoped out
Soils & Geology	Loss of Soil	Loss of arable soils in the seasonal inundation (drawdown) zone	-	✓	X	X	X	X	X	X	Scoped out
Minimum Environmental Flows	Floodplain habitats	Changes in flow/circulation in natural water bodies (Vakhsh River) due to seasonality	-	✓	✓	X	X	X	✓	X	Scoped in
Minimum Environmental Flows	Floodplain habitats	Dewatering of watercourses (Rogun to Nurek)	-	✓	X	X	X	X	✓	X	Scoped in
Minimum Environmental Flows	Aquatic Ecology	Dewatering of watercourses (Rogun to Nurek)	-	✓	X	X	X	X	✓	X	Scoped out
Minimum Environmental Flows	Floodplain habitats	Modification of the characteristics of the channels downstream of Rogun	-	✓	✓	X	X	X	✓	X	Scoped in
Minimum Environmental Flows	Aquatic Ecology	Modification of the characteristics of the channels downstream of Rogun	-	✓	✓	X	X	X	X	X	Scoped in
Minimum Environmental Flows	Floodplain habitats	Habitat loss and degradation downstream of Rogun	-	✓	✓	X	X	X	X	X	Scoped in
Minimum Environmental Flows	Aquatic Ecology	Habitat loss and degradation downstream of Rogun	-	✓	✓	X	X	X	X	X	Scoped in
Biodiversity	Floodplain habitat	Loss/degradation of habitat from flooding of Rogun reservoir	-	✓	X	X	X	X	X	X	Scoped out
Biodiversity	Juniper woodland	Loss/degradation of habitat from flooding of Rogun reservoir	-	✓	X	X	X	X	X	X	Scoped out
Biodiversity	Aquatic Ecology	Loss/degradation of existing lotic (river) habitat in the Rogun flooding zone as a result of flooding.	-	✓	X	X	X	X	X	X	Scoped out
Biodiversity	Aquatic Biodiversity	Increased human pressures in flooding zone	-	✓	X	X	X	X	X	X	Scoped out

Project Aspect	VC(s)	Potential Cumulative Impact	Project Phase		Developments (Existing/ Planned/ Somewhat Defined)						Scoped In/Scoped Out
			Construction	Operation	Nurek HPP Operation	Nurek HPP Rehabilitation Project Phase1 & 2	International Highway (Vakhdat - Jirgital)	Central Asia–China gas pipeline, Line D	Qosh Tepa Irrigation Canal, Afghanistan	Shurob HPP	
Biodiversity	Notable mammal species	Change in habitat composition leading to better foraging habitat and increased freshwater availability for otters (Rogun reservoir)	-	✓	X	X	X	X	X	X	Scoped out
Biodiversity	Migratory Birds	Change in habitat composition leading to significantly increased freshwater resource in the landscape that is beneficial to aquatic/semi-aquatic birds (Rogun reservoir).	-	✓	X	X	X	X	X	X	Scoped out
Biodiversity	Aquatic Biodiversity	Change in habitat composition (Rogun reservoir and downstream to Nurek)	-	✓	X	X	X	X	X	✓	Scoped out
Biodiversity	Aquatic Ecology (Fish)	Loss of tributaries and short-range migration in Rogun inundation zone. Some fish species could be adversely impacted by loss of refugee and spawning habitat.	-	✓	X	X	X	X	X	X	Scoped out
Ecosystem Services	Trees used for memorials and shrines	Loss of trees due to land and vegetation clearance within the Rogun flooding zone.	✓	-	X	X	X	X	X	X	Scoped out
Ecosystem Services	Trees associated with local stories and taboo	Loss of VC due to land and vegetation clearance within the Rogun flooding zone.	✓	-	X	X	X	X	X	X	Scoped out
Ecosystem Services	Trees used for memorials and shrines	Loss of valued trees in Rogun flooding zone	-	✓	X	X	X	X	X	X	Scoped out
Ecosystem Services	Trees associated with local stories and taboo	Loss of valued trees in Rogun flooding zone	-	✓	X	X	X	X	X	X	Scoped out
Social	Local economy & employment	Increase in local income due to employment expenditure	-	✓	X	X	X	DD	X	✓	Scoped out
Social	Community assets and infrastructure	Loss of current community assets and infrastructure. New resettlement to provide improved infrastructure.	✓	✓	X	X	✓	DD	X	X	Scoped in
Social	Community health, safety, and security	Potential noise and air pollution and reduced safety and security of local families and construction workers.	✓	-	X	X	X	DD	X	X	Scoped out
Landscape and Visual	Visual Amenity: Residences on the North Bank edges	Views will be improved in construction areas once construction ceases, and inundation takes place.	-	✓	X	X	X	X	X	X	Scoped out
Landscape and Visual	Visual Amenity: Residences on the South Bank edges	Views will be improved in construction areas once construction ceases, and inundation takes place.	-	✓	X	X	X	X	X	X	Scoped out
Landscape and Visual	Visual Amenity: Users of the highways	Views will be improved in construction areas once construction ceases, and inundation takes place.	-	✓	X	X	X	DD	X	X	Scoped out

DD = Deficient Data

X = No overlap in spatial/temporal scope, no potential for cumulative impacts

✓ = Potential for cumulative impacts

- = Not applicable

NUREK HPP

11.5.8. As noted above, Nurek HPP is currently the farthest upstream hydropower project in the Vakhsh watershed, a position which will be taken by Rogun. Nurek is currently the largest hydroelectric power plant in Tajikistan (3,000MW, with some units currently under rehabilitation) and supplies more than 70 % of all the electricity generated in the country. The HPP was put into full operation in 1979 and is part of the Vakhsh HPP Cascade (refer to Table 3-1 in Volume I, Chapter 3: Project Description).

11.5.9. Nurek has changed the seasonal flow of the Vakhsh and Amu Darya Rivers by reducing flows in summer and increasing flows in winter. To ensure that downstream riparian countries are not deprived of water during the critical summer growing season, annual water flows in the Amu Darya are allocated among Central Asian countries by the Basin Water Organization Amu Darya, which has been established by the Interstate Commission for Water Coordination of Central Asia (ICWC), which itself is an element of the International Fund for Saving the Aral Sea (IFAS). As noted in Chapter 4, water is allocated according to rules and procedures set forth in agreements among the Central Asian riparian Governments.

11.5.10. Nurek has had a major effect on the Vakhsh River. It flooded 70km of river, riparian, and terrestrial habitat, it interrupted fish migration, and it made significance changes in seasonal flows downstream of the dam. Besides reducing flood risks at certain time of the year, this in turn has affected riparian habitat for long distances downstream, including at least one protected area.

SHUROB HPP

11.5.11. As noted above, Shurob is a proposed 850MW run-of-river HPP that would be located at the upper end of Nurek reservoir and with the Shurob reservoir extending nearly to the toe of Rogun dam. It would occupy the Vakhsh River reach that would be affected by releases from Rogun HPP.

11.5.12. The project was announced in 2012 but has not progressed beyond early feasibility. The project remains in the preliminary planning stage, with no formal decision to proceed or any prospective date.

11.5.13. If Shurob is indeed constructed, construction would not begin until Rogun construction is complete.

INTERNATIONAL HIGHWAY (VAKHDAT - JIRGITAL)

11.5.14. As noted in Table 11-3, roads have been or will be relocated so they lie outside the reservoir footprint or to provide access to village that lie above the reservoir but that will be cut off. These are Associated Facilities and are described in Chapter 3 and Chapter 8.

CENTRAL ASIA–CHINA GAS PIPELINE, LINE D

11.5.15. The Central Asia–China gas pipeline, Line D project is considered to be data deficient for the purposes of scoping for consideration in cumulative impact assessment (see Table 11-4) due to the limited publicly disclosed information being available for the project. From the information available, it is understood that the pipeline is being built in remote areas to the north of the Rogun HPP Project by a foreign labour workforce. Works carried out to data having included blasting in some areas of mountainous terrain along the pipeline route in Tajikistan although it is not clear where this has taken place. Regardless, it is not expected that the pipeline will be close enough to affect any of the natural resources or communities that would be affected by Rogun.

11.5.16. Considering the distance of the Rogun HPP to the closest mapped potential location of the pipeline route is over 30 km distant, there is considered to be very limited potential for cumulative impacts to human health due to noise or increased pollution from mobile (e.g. vehicles) and static (e.g. generators) plant sources.

11.5.17. Dust generated from construction works for Rogun HPP Project is generally large particle size and is understood to not travel far from the dust generation areas so is unlikely to result in a cumulative impact with the construction of a remote pipeline route over 30 km distant.

11.5.18. Consequently, there is considered to be very limited potential for cumulative impacts to human health from dust generation during Rogun HPP construction activities and third-party blasting and construction activities for the gas pipeline, should the projects interface during construction phases.

QOSH TEPA IRRIGATION CANAL, AFGHANISTAN.

11.5.19. The Qosh Tepa Irrigation Canal in Afghanistan has limited publicly available information, but for the purposes of scoping for consideration in cumulative impact assessment (see Table 11-4), the project has been scoped in due to transboundary concerns.

11.5.20. It is understood to be an irrigation canal project located in northern provides of Afghanistan, with the diversion of water from the Amu Darya River at the Tajik/Afghan border near Khoshtepa, Afghanistan. Upon completion, it is expected be 285 km long, ending in Faryab Providence, with a width of 152 meters and a depth of 8.5 meters. It is planned to irrigate around 550,000 hectares (5500 square kilometres) of desert into arable farmland.

11.5.21. The distance between Rogun HPP and the closest mapped potential location of the canal is circa. 225 kilometres. The canal is not located within the Rogun HPP's AoI, however; the canal is downstream of Rogun HPP on the Amu Darya River. In addition, to Tajikistan's international obligations under Protocol 566, with the average annual unused water allocation to fill the reservoir, and during operation, ensuring a minimum environmental flow. The flow regime in the Vakhsh River will only be significantly altered between Rogun and Nurek HPPs; therefore, there will be no impacts on the flow regime and water availability downstream of Nurek HPP, including on the Qosh Tepa Canal.

11.5.22. Currently, Afghanistan is not party to any water management agreements with the riparian countries to govern water allocations on the Amu Darya River. As a result, there could be adverse effects associated with changes in flow/circulation in natural water bodies due to seasonality or dewatering of Amu Darya downstream from the Qosh Tepa Canal, subject to Afghanistan's water-usage from the river. Therefore, downstream riparian countries such as Uzbekistan and Turkmenistan could be impacted, but not directly by Rogun HPP.

11.5.23. Therefore, the Project will not have an additional or cumulative effect. We recommend given the concerns raised by the Riparian countries and all of the new projects that monitoring of the outflows along the Vakhsh river is undertaken and specifically the following:

- Upstream on the two main tributary inflows to the Rogun Reservoir
- Outflows from the Rogun HPP dam
- Outflows from the Nurek Dam
- Outflows at the downstream end of the cascade; and
- At the border with Uzbekistan.

11.5.24. , We also recommend that a basin wide study is conducted for the Amu Darya. This would, however, sit outside of the Project remit.

11.6 STAGE 3: RECEPTOR BASELINE

11.6.1. For the VCs that have been screened into the cumulative impact assessment, the baseline conditions are summarised in Table 11-5. For all VCs more detailed information on baseline conditions is provided Volume I, **Chapter 7: Environmental and Social Baseline** and in the various topic area annexes (Volume II: Annexes A01-A15).

Table 11-5 - VC Baseline Conditions

Aspect/ ESIA Chapter	VC(s)	Baseline Conditions
Social	Community assets and infrastructure	The main road M41 has been interrupted shortly after Obi Garm as part of the road realignment being carried out by the International Highway (Vakhdat-Jirgital) Project. Some local roads within the Project AoI are in poor condition.
Environmental (water)	Water resources (biodiversity, downstream users)	Flows downstream of Nurek have been substantially modified by Nurek since the 1980s. At the time Shurob is constructed (if indeed it is), the river reach will have modified flows due to seasonal and daily releases by Rogun HPP. Depending on the timing of Shurob, biodiversity and riparian habitat may have stabilized to some extent and will be flooded and changed to lotic habitat. Construction of the highway could contribute sediment to the current and future reservoir due to poor construction practices.

11.7 STAGE 4 & 5: ASSESS CUMULATIVE IMPACTS AND DETERMINE EFFECT SIGNIFICANCE

SOCIAL

Community assets and infrastructure

11.7.1. The general poor quality of roads in the Rogun HPP Project AoI was raised as an adversity for local people in responses received to the Human Health survey. During the Operation Phase of Rogun HPP Project, communities within the Flooding Zone face the loss of existing facilities and infrastructure, including roads. However, new settlements are anticipated to provide improved infrastructure, and this may provide the opportunity to improve, or reduce reliance, on poor-quality existing roads in some areas for local people.

11.7.2. The completion of the International Highway (Vakhdat - Jirgital) Project, expected to be operational in 2025, will provide improved road infrastructure access to local communities, including an improved bridge at Long Bridge, Darband.

11.7.3. Minor adverse effects associated with road travel on existing poor-quality roads may be felt by local communities, including host communities, during the construction phases of both Rogun HPP Project and International Highway (Vakhdat - Jirgital) Project. However, effects are anticipated to be short term and are expected to be minimised by the phased resettlement of people.

11.7.4. Improved roads are considered beneficial to local communities during the operation phases of both Rogun HPP Project and International Highway (Vakhdat - Jirgital) Project. Effects are considered as Positive, and no mitigation is proposed.

11.7.5. Construction of Shurob could lead to employment of many workers who will no longer be needed for Rogun construction. This would reduce the adverse social and economic impacts of major retrenchments at Rogun at least for some years during the construction period.

ENVIRONMENTAL

Water

11.7.6. Relocation of the International Highway could lead to erosion and sedimentation in the river upstream of the current reservoir and into the current reservoir. This would be relatively minor since the highway is at some distance from the river, reservoir, and its tributaries for most of its length, even if proper erosion controls are not implemented during construction.

11.7.7. As described in Chapter 3 and Chapter 8, Rogun HPP will not change the current operation of Nurek and thus river flows downstream of Nurek. Indeed, Rogun and Nurek will operate in tandem, with Nurek becoming a run-of-river operation and Rogun assuming the regulation function. Thus, as concluded in Chapter 8, Rogun will not have an effect on the downstream Vakhsh River, either in Tajikistan or in riparian countries. Rogun will provide some benefit by being able to withstand the Probable Maximum Flood, which Nurek and the other dams in the cascade are not designed to do.

11.7.8. If Shurob is constructed, the cumulative impact on habitat would be to extend the loss of riverine and riparian habitat by an additional 17km since the 17km river reach between Rogun dam and the upper end of the Nurek reservoir would be flooded by the Shurob reservoir. However, it is important to note that this reach will have already been affected by the changes in seasonal flow rates due to Rogun operation, as described in Chapter 8. Thus, the impact is considered minor.

11.8 STAGE 6: MITIGATION MEASURES

11.8.1. The purpose of the cumulative impact assessment is to identify and mitigate the Project's contributions to any potential significant cumulative impacts on VCs. As it is not expected there would be significant additional or synergistic effects in combination with impacts of Rogun, no additional mitigation is proposed beyond that set out in the technical annexes (Volume II).

11.8.2. It is noted that Community Liaison Officers for the Rogun HPP Project will be available for stakeholders to contact should they feel they are impacted by potential cumulative effects from the Rogun HPP Project and other project(s).

12. ENVIRONMENT AND SOCIAL MANAGEMENT

12.1. INTRODUCTION

12.1.1. This chapter provides an overview of how the management of Environmental and Social issues are to be undertaken by PMG, Rogun JSC, DFZ, and contractors' A stand-alone Environmental and Social Management Plan has been developed based on the ESIA. It focusses on the environmental and social management actions that will be implemented for the construction and operation phases.

12.2. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

12.2.1. The ESMP provides a framework to enable the effective implementation of the E&S management measures developed through the ESIA.

12.2.2. The ESMP has been developed as part of the 2023 ESIA and is located in Volume III of this ESIA It identifies and provides guidance for the development of the full suite of E&S management plans that have been or will be prepared to support the management of key E&S risks, focussing on E&S management actions required for the HPP construction and operations phase and construction and demolition activities of the resettlement program.

12.2.3. Decommissioning of the Rogun HPP infrastructure will be subject to a full decommissioning plan in line with national requirements and international best practice in place at the appropriate time. Consequently, E&S actions associated with the decommissioning phase of the Project are not included in the ESMP.

12.2.4. The purpose of the ESMP is to guide the implementation of mitigation measures and monitoring requirements identified through the ESIA process to reduce adverse environmental and social effects to acceptable levels and enhance positive effects. Broadly, the objectives of the ESMP are to:

- Ensure compliance with Project standards.
- Support the development of detailed management plans for the Project and enable appropriate resources and responsibilities to be allocated.
- Demonstrate to stakeholders such as lenders and local communities how the commitments and mitigation measures identified through the ESIA process will be planned, implemented, and monitored/checked.

12.2.5. The ESIA identifies and evaluates measures that avoid, reduce, or offset the significant adverse effects of the Project.

12.2.6. The mitigation and enhancement measures reported within the topic chapters have been included in the ESMP.

12.2.7. The ESMP describes the responsibilities for ESHS management within the various organizations, outlines monitoring requirements, and describes how ESHS performance will be reported by the parties.

12.2.8. Figure 12-1 outlines the structure of the Project ESMP and supporting plans.

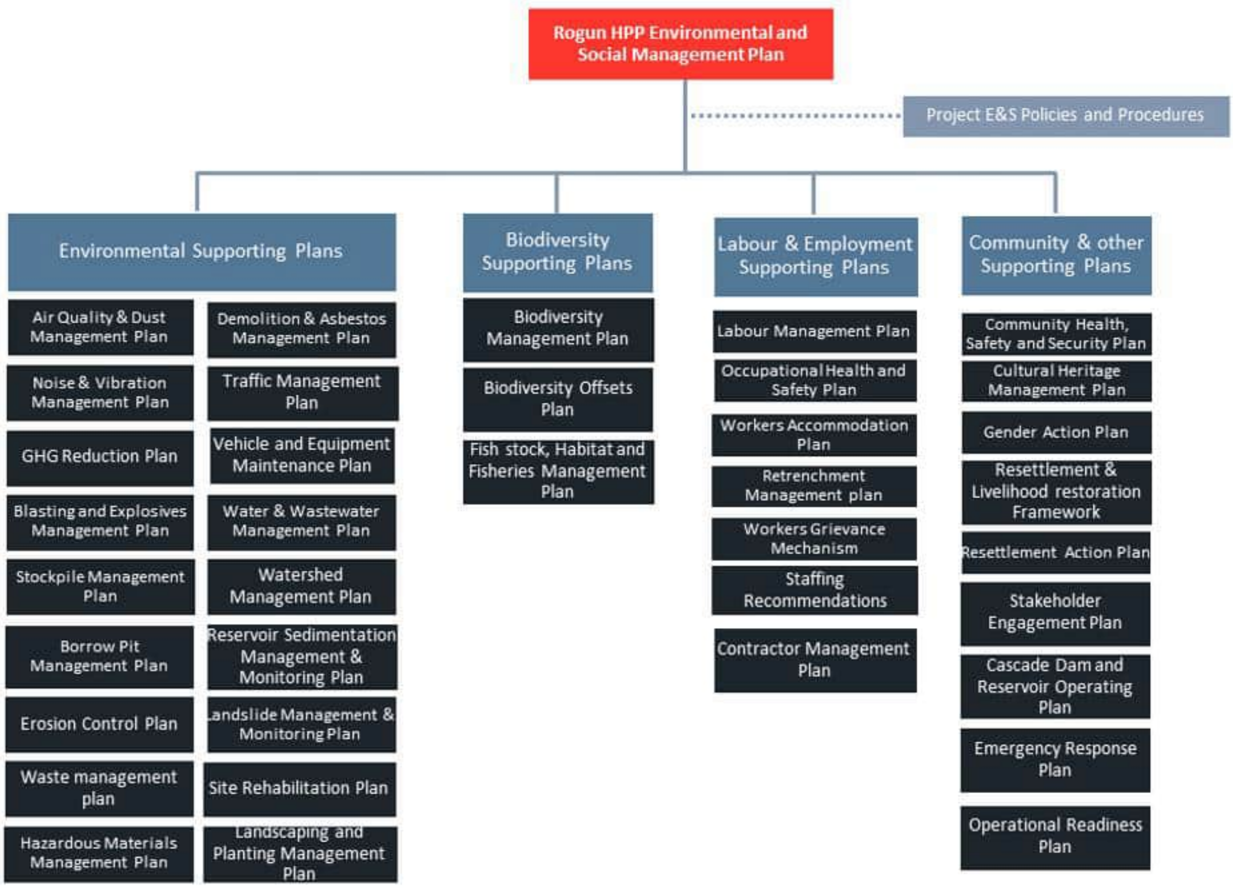


Figure 12-1 - Outline of the ESMP and Supporting Plans

12.3. IMPLEMENTATION OF THE ESMP

12.3.1. The management of the Project is underpinned by project-specific policies and procedures that provides a coherent and cohesive structure to the management of E&S risks. The key objectives of the policies and procedures that have been or will be developed for the Project is:

- To ensure all activities and persons responsible anticipate and take action to avoid as far as possible adverse impacts or risks to communities and the environment.
- To help ensure that the Rogun JSC and all contractor activities comply with the relevant laws and regulations of the Government of Tajikistan and Lenders' requirements (typically referred to as the "Project Standards").
- To identify and assess E&S risks and impacts, both adverse and beneficial.
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment.
- To ensure that affected communities and stakeholders are engaged on issues that could potentially affect them.

- To promote and provide means for adequate engagement with affected communities throughout the Project life-cycle on issues that could potentially affect them, and to ensure that relevant environmental and social information is disclosed and disseminated.
- To promote improved social and environmental performance through the effective use of management systems.
- To ensure all activities and persons responsible consciously foster positive E&S impacts and benefits through proactive planning and Project design.
- To ensure sufficient organizational capacity and competency exists at all levels within the project organization structure throughout the project lifecycle.
- To ensure that Emergency Preparedness and Response is appropriately managed, including for major unplanned events and responsibilities clearly set out.
- To ensure that change is managed through mechanisms.
- To set out a process for Monitoring and Review of the procedures and policy that promotes continual improvement.
- To set out formal reporting and documentation requirements, and responsible parties.
- To set out a requirement for Management Review.

12.3.2. Project procedures and policies will draw on the elements of the established business management process, in implementing a Plan-Do-Check-Act (PDCA) cycle. This provides a methodological approach to managing E&S risks and impacts in a structured way on an ongoing basis.

12.3.3. The ESMP and supporting management plans will be "live" documents and tools against which E&S performance can be monitored, corrected, and improved. Continual improvement of these tools will be achieved through the continual assessment of E&S management performance against the relevant policies, objectives, and specific targets to identify areas for improvement.

12.3.4. Key elements of the management system outlined here and how this aligns with the PDCA cycle for the construction phase of the HPP Project are provided in Table 12-1.

Table 12-1 Project Alignment with Management Framework

Element	Objective	Project Requirement
Policy	▪ To achieve sound environmental and social performance through establishment, documentation, implementation, and continuous improvement of the policies underpinning the ESMP.	PMG, Rogun JSC and DFZ will develop ESHS policies that express the commitment that the organizations have has made to managing environmental and social risks and impacts from the Project.
Project Standards, Legal Compliance, and other requirements	▪ Compliance with all relevant Tajik environmental, occupational health and safety, labour and other and social law and regulations.	DFZ and Rogun JSC will develop and maintain: ▪ A Legal Register identifying all applicable standards, legal requirements, and requirements in relation to health, safety, communities, and environment.

Element	Objective	Project Requirement
		▪ A system of procedures will be established and communicated to all management and staff to ensure project compliance.
Risk Identification and Management of Risk	▪ Identify and manage environmental and social risks and impacts throughout the construction phase and operation phase.	▪ PMG will assist Rogun JSC and DFZ set a procedure to identify and assess associated risks and impacts throughout the Project life. This ESIA is the initial step to address this element of the ESMP.
Management Programme and improvements	▪ Ensure implementation of measures defined in the ESMPs.	Rogun JSC and DFZ will: ▪ Implement of all the mitigation, management and monitoring measures defined in the ESIA, ESMP and associated management plans through its contractual arrangements and audits/inspections. ▪ Ensure that all Project personnel are aware, capable and competent to perform their responsibilities in a way that minimizes impacts on people and the environment.
Organisational Structure and competency	▪ To establish roles and responsibilities within the organisation.	▪ PMG, Rogun JSC, and DFZ will ensure sufficient management sponsorship of human and financial resources, establish roles and responsibilities for personnel to implement the Project ESMP and other plans.
Communication and Reporting	▪ Comprehensive record keeping. ▪ Clear communication and accountability on Project compliance with the ESMP and Stakeholder Engagement Plan (SEP). ▪ Issues and concerns of affected communities are proactively addressed through the Grievance Mechanism (GM). ▪ Ongoing communication to avoid risks and address existing issues.	PMG, Rogun JSC, and DFZ will: ▪ Ensure that responsible personnel report the compliance status of the Project ESMP performance to lenders, senior management, regulatory authorities and affected communities. ▪ Systematically control and maintain documents and records associated with E&S management. ▪ Posting of official notices at the site entrance and at strategic locations to advise of construction commencement. ▪ Installation of community grievance boxes. ▪ Notification to relevant statutory authorities to provide information on construction activities and timelines, and information about the emergency response procedures and any required coordination in case of specific emergencies. ▪ Establish, implement, and maintain procedures for the identification, storage,

Element	Objective	Project Requirement
		protection, retrieval, retention and disposal of records.
Monitoring and Evaluation	▪ To ensure compliance and promote continual improvement.	PMG, Rogun JSC, and DFZ will: ▪ Establish and implement procedures to monitor and evaluate E&S management and performance and take measures to continually improve performance. ▪ Processes such as inspection, audit and physical E&S monitoring will be implemented. Details of mentoring will be identified in the supporting ESMPs or corresponding monitoring plans, where applicable.
Emergency Response	▪ To prevent major emergencies. ▪ To provide a structure of actions and behaviours expected from people and relevant organisations should a major unplanned even occur.	Rogun JSC and DFZ will: ▪ Prepare an Emergency Preparedness & Response Plans for construction phase and operation phases. ▪ An emergency response plan for the Vakhsh cascade has been developed for the project at the current dam crest level. An Emergency Response plan for the full Dam Crest level reservoir fill is currently under preparation.
Training and Awareness	▪ To ensure people and organisations have the training and other competencies to complies to E&S requirements set out in the ESMP and underpinning policies and procedures.	▪ PMG, Rogun JSC, and DFZ will ensure personnel are aware of their role and responsibilities by appointing competent people and enabling them to meet their requirements.
Management of Change	▪ To ensure E&S policies, procedures and the ESMP are applicable to any future development, construction, expansions or changes to this scope.	▪ A Management of Change Process is required. This will require that the applicability of the ESMP is reviewed and updated in response to changes in the Project (including expansion, additional sub-project/sub-activity, third parties, and associated facilities) and to changes in the organisation, personnel, operations, and processes.

12.3.5. Detailed information regarding the E&S management of the Project including the elements described in Table 12-1 are documented in Volume III: Environmental and Social Management Plan.

12.4. EMERGENCY RESPONSE REQUIREMENTS

12.4.1. Emergency response is a critical requirement for the management and maintenance of life from any potential breach of the Rogun dam.

12.4.2. The Rogun dam has been designed to hold the PMF, however, dam breach or overtopping could occur from a variety of different natural and anthropogenic events which have been identified in Chapters 8 and 9 of this ESIA including seismic events. Of critical importance is the effect this would have on the downstream cascade of hydropower dams.

12.4.3. An Emergency Response Plan for the Vakhsh Cascade has been developed which includes the Rogun dam at its current level in line with World Bank Good Practice note on Dam Safety – Emergency Preparedness plan, 2021 (WB Dam Safety GPN-EPRP) This plan is scheduled to be updated as the dam height increases until it reaches its full height, and the reservoir reaches its full service level. The outline structure of the plan is provided in **Table 12-2**.

Table 12-2 Outline structure of the EPRP

Topic	Key Contents
Introduction	▪ Outlines the key elements of the plan including links to other plans. ▪ Outlines (in summary) the legal and International Requirements for the plan.
Purpose and Scope of the EPRP	▪ Provides a summary of the key aims and objectives of the plan (e.g., identification of emergency conditions, provision of example scenario outlines, detailing the response plan etc). ▪ Defines the scope of the plan (temporal and geographical)
Main Features of the Vakhsh Cascade	▪ Provides the location of the cascade and an overview of the Vahksh cascade. ▪ Provides a description of the main features of each dam in the cascade. ▪ Provides a list of downstream or adjacent communities that could be affected by dam failure or flooding. ▪ Provides a map and key drawings of the cascade, dams in the cascade, and all sensitive receptors, especially communities.
Roles and Responsibilities	▪ Clearly identifies all parties involved in developing and implementing the plan including emergency services, government bodies, civil defense bodies, research agencies, transboundary counterparts, community representatives amongst others. ▪ sets out the roles and responsibilities of each party for each phase of construction and operation including but not limited to those responsible for: • Monitoring • Investigation • Operation and maintenance of the dame • Notifications • Warnings • Evacuation ▪ Provides a comprehensive contact list for all key staff at the dam, and external agencies responsible for implementation of the plan. ▪ Sets out the locations around the site where this list is displayed.
Emergency Identification, Classification and Evaluation	▪ Identification of key scenarios from the Emergency Response Matrix (ERM). Emergency Response Matrix to be Appended to the EPRP. ▪ Sets out the key steps in the Emergency response process once an unusual or emergency incident is identified including emergency termination. ▪ Clearly describes the circumstances under which a dam safety emergency is to be declared, who is empowered to declare such an emergency, and how the emergency is to be classified and recorded. ▪ Describes clearly the classification level for each type of emergency e.g., large flood discharge with no failure; internal warning, potential emergency/failure, imminent failure.
Notification Procedures	▪ Provides a clear notification process with accompanying procedures including a list of all persons to be notified with names, titles, office and home telephone contact details, and alternative means of communication. ▪ Clear flow chart for the notification procedures

	▪ Locations of where this flow chart is to be displayed on site.
Preventative And Emergency Actions	▪ Provides a comprehensive and detailed set of actions that may be taken or each emergency categorization level to remedy reduce or mitigation the potential effects of a dam failure including but not limited to: • Reservoir drawdown • Limiting inflows and outflows • Placing materials and sandbags at low spots on the dam crest o to prevent potential seepage. • Controlled breaching ▪ Provides a list of action that can be taken before identification of a potential emergency such as installation of warning systems for alerting the populations at risk, establishing coordinated plans with emergency services and civil defense authorities, stockpiling of materials etc
Preparedness Activities	▪ Provides a detailed set of procedures for terminating a dam safety emergency including notification of emergency services and communities. ▪ Sets out the access to site requirements in the event of an emergency including alternative access routes, alternative power sources, location of emergency supplies and maintenance and training requirements.
Documentation and reporting	▪ Sets out a clear processes and requirements for an emergency response report including assessing damage to the dam, reservoir or other structures, a review of the emergency response and identification of corrective actions. ▪ Provides the justification for both the declaration and termination of the emergency.
Training, Review and Update	▪ Sets out the requirements for appropriate review of the EPRP at key phases, responses to emergencies, changes in staff or legislation and should be at least annually. ▪ Details the requirements and frequency for training of personnel including training exercises, testing of communication and warning equipment including where appropriate full drills. ▪ Sets out the requirements for engagement with key stakeholders, communities, and transboundary countries.
Dam Breach and flooding simulation	Presents the results of dam failure analysis and flooding simulations. Provides inundation maps at sufficient scale to identify critical infrastructure, identification of critical areas. Provides inundation tables that clearly show the flood inundation peak levels, velocities, elevations and arrival times at key locations. Provides inundation information for a range of different scenarios.

12.4.4. A series of appendices to the EPRP may be included including site plans, operating instructions for gates and valves etc, tunnel safety, drawdown procedures, example templates etc.

12.4.5. The Emergency Preparedness and Response plan shall be developed by the Owner and Developer in consultation with the Dam Safety Panel of Experts and shall be made available to all key parties.

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