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JSC "Rogun HPP"

State Enterprise, "Directorate of the 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 2

Volume 2 of the ESIA includes the following:

Annex 7-1 : Baseline Conditions Report

Annex 10-1: Climate Change

Annex 13-1: Minimum Environmental Flows

Annex 13-2: Reservoir Slope Stability

Annex 13-3: Water Resource Modeling

Annex 15-1: Critical Habitat Assessment

Annex 17-1: Gender Assessment

Annex 20-1: Gazetteer of Archaeological, Historical, Paleontological, Cultural and Sacred Sites

Annex 20-2: Gazetteer of Villages

Annex 20-3: Village Ethnography Data

Annex 20-4: M-Vector Household Data

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

ROGUN HYDROPOWER PROJECT - UPDATED ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

ANNEX 7-1: Baseline Conditions Report

PUBLIC

PROJECT NUMBER

PROJECT REF

DATE: SEPTEMBER 2025

QUALITY CONTROL

CONTENTS

1 INTRODUCTION 1

1.2 PROJECT OVERVIEW 1
1.3 PURPOSE OF THE REPORT 1

2 AIR QUALITY 2

2.1 INTRODUCTION 2
2.2 CLIMATIC CONDITIONS 2
2.3 EMISSION SOURCES 2
2.4 POLLUTANT SPECIES 3
2.5 BASELINE DATA COLLECTION METHODOLOGY 3
2.6 BASELINE DATA 8
2.7 SUMMARY 57

3 CLIMATE AND GREENHOUSE GASES 59

3.1 CLIMATE BASELINE 59
3.2 GREENHOUSE GASES (GHG) 62

4 NOISE AND VIBRATION 65

4.1 INTRODUCTION 65
4.2 BASELINE SURVEY 65
4.3 BASELINE DATA 66
4.4 RECEPTORS 77

5 SOILS AND GEOLOGY 79

5.1 INTRODUCTION 79
5.2 SOILS 79
5.3 GEOLOGY 89

6 CONTAMINATED LAND 96

6.1 INTRODUCTION 96
6.2 FUEL STORAGE 97
6.3 WORKSHOPS & CONSTRUCTION AREAS 100
6.4 SEWAGE 100
6.5 WATER TREATMENT & RUNOFF 101
6.6 LANDFILLS & WASTE MANAGEMENT 103
6.7 SUB-STATIONS & TRANSFORMERS 103
6.8 ASBESTOS 103

7 WATER ENVIRONMENT 105

7.1 INTRODUCTION 105
7.2 HYDROGEOLOGY 105
7.3 FLOOD RISK 125
7.4 SURFACE WATER QUALITY 130
7.5 SEDIMENT 145
7.6 GEOMORPHOLOGY 149

8 LANDSCAPE AND VISUAL 155

8.1 OVERVIEW OF THE SITE AND STUDY AREA 155

9 BIODIVERSITY 163

9.1 BASELINE DATA COLLECTION 163
9.2 TERRESTRIAL ASSESSMENT (2014) 163
9.3 DESKTOP STUDY 165
9.4 CURRENT BASELINE 175
9.5 FUTURE BASELINE 231

10 ECOSYSTEM SERVICES 232

10.1 SOURCES OF BASELINE DATA 232

10.2 CURRENT BASELINE 233
10.3 GENDER CONSIDERATIONS 237
11 SOCIAL BASELINE 238
11.2 DATA COLLECTION 238
11.3 SOCIO-ECONOMICS: POPULATION AND DEMOGRAPHICS 239
11.4 SOCIO-ECONOMICS: LOCAL ECONOMY AND EMPLOYMENT 244
11.5 LAND ACQUISITION AND RESETTLEMENT 249
11.6 LABOR AND WORKING CONDITIONS 252
11.7 COMMUNITY ASSETS AND INFRASTRUCTURE 255
11.8 COMMUNITY HEALTH, SAFETY AND SECURITY 259
11.9 INCLUSION, VULNERABILITIES AND GENDER 267
12 CULTURAL HERITAGE 276
12.1 INTRODUCTION 276
12.2 SOURCES OF BASELINE DATA 276
12.3 BASELINE METHODOLOGY 276
12.4 ASSUMPTIONS AND LIMITATIONS 278
12.5 EXISTING CONDITIONS 280
12.6 PALEONTOLOGICAL BACKGROUND 283
12.7 CULTURAL HERITAGE BACKGROUND AND CONTEXT 286
12.8 CURRENT CONDITIONS 288
12.9 PREDICTED FUTURE BASELINE CONDITIONS 308
13 MATERIALS AND WASTE 310
13.1 INTRODUCTION 310
13.2 MATERIALS 310
13.3 WASTE 311
14 TRAFFIC AND TRANSPORT 353
14.1 INTRODUCTION 353

14.2 TAJIKISTAN TRANSPORT NETWORK 353
14.3 ROADS IN PROXIMITY TO THE PROJECT 354
14.4 ACCIDENTS AND SAFETY 359
14.5 TRAFFIC FLOWS 360
14.6 EXISTING TRANSPORT MANAGEMENT PLAN (TMP) 363
15 REFERENCES 367

TABLES

Table 2-1 – Mitigation Criteria (Air Quality) 7
Table 2-2 – Pollutant Detection By Location (-- denotes no sample taken) 44
Table 2-3 - Spot Sampling Results 50
Table 3-1 – DRS Historic Average Temperature Comparison 60
Table 3-2 – DRS Historic Average Precipitation 61
Table 4-1 - Summary of Measured Noise Levels 65
Table 4-2 - Noise Measurement Distance 66
Table 4-3 - Receptors for Noise 77
Table 7-1 - Vakhsh River Hydropower Plants 109
Table 7-2 - Amu Darya, Vakhsh and Panj River Basin Characteristics 114
Table 7-3 - Hydrometric Stations on Amu Darya River Basin (Pöyry, 2014) 114
Table 7-4 - Hydrometric Stations on Vakhsh River Basin (Coyne et Bellier et al., 2014f) 116
Table 7-5 - Vakhsh Average Flow Statistics at Rogun Dam over the 'Full' Dataset (Annual, April-September and October-March Periods). 120
Table 7-6 - Darband Average Flow Statistics for Annual, April-September and October-March Periods. 122
Table 7-7 - Gharm Average Flow Statistics for Annual, April-September and October-March Periods. 122
Table 7-8 - Flow requirements for the Vakhsh River downstream of the Rogun Dam (m3/s) 124
Table 7-9 - Flood frequency data for the Rogun HPP dam catchment (from Coyne et Bellier et al., 2014f). 126

Table 7-10 - Summary of annual average historical water quality data (after Poyry, 2014), annual average national hydrometeorology agency water quality data (2013-2022), and WSP spot water quality monitoring (2023). 132

Table 7-11 - Vakhsh River average monthly water temperature profiles at Gharm and Darband monitoring stations (2005 to 2020). 135

Table 7-12 - Locations of WeBuild routine water quality monitoring program. 136

Table 7-13 - Water quality sampling locations from WSP site visit, May 2023 (WSP, 2023a). 137

Table 7-14 - Grainsize distribution of the suspended load (Coyne et Bellier et al., 2014c). 146

Table 7-15 - Grain size distribution of the bed load (Coyne et Bellier et al., 2014c). 147

Table 9-1 - Characteristics of caught fish during 2011 (2014 ESIA) 165

Table 9-2 - Protected Areas 179

Table 9-3 - Habitat composition 181

Table 9-4 - Notable flora records 201

Table 9-5 - Notable mammal records 204

Table 9-6 - eDNA results summary: mammals. 208

Table 9-7 - Notable reptile records 211

Table 9-8 - Notable bird records 213

Table 9-9 - eDNA results: birds 217

Table 9-10 - Fish species expected and recorded within the Rogun HPP AoI - Updated February 2024 223

Table 10-1 - Baseline Ecosystem Services within the scope of the ESIA assessment for Rogun HPP 233

Table 11-1 - Social Indicators 239

Table 11-2 - District Populations (August 2022) 240

Table 11-3 - Jamoat Populations (source: Jamoat interviews, July 2023) 241

Table 11-4 - Education Indicators 242

Table 11-5 - Highest education level in affected households 242

Table 11-6 - Youth in Sample Population (NEET) 243

Table 11-7 - Economic Indicators 244

Table 11-8 - Multi-dimensional poverty indicators 246

Table 11-9 - Main source of income/occupation in households 247

Table 11-10 - Jamoat economic activity 248
Table 11-11 - Resettlement Documents 251
Table 11-12 - Labor Indicators 252
Table 11-13 - Project workforce statistics (August 2023) 253
Table 11-14 - Workplace incident statistics 254
Table 11-15 - Healthcare indicators (WHO, 2024) (World Bank, 2021) 255
Table 11-16 - Utilities Indicators (World Bank Group, 2024) 256
Table 11-17 - Health data for Tajikistan (World Bank Group, 2024) 261
Table 11-18 - Mental health indicators 264
Table 11-19 - Vulnerability Indicators 268
Table 11-20 - Vulnerable Households Reported by Jamoats 271
Table 12-1 - Summary of Previous Archaeological Surveys (prior to 2023) 280
Table 12-2 - Summary of Previous Ethnographic Surveys (prior to 2023) 282
Table 13-1 - Construction material production in Tajikistan, 2015-2021 (Metric tons, gross weight, unless otherwise specified) (USGS, 2024) 310
Table 13-2 - IFC landfill design measure and landfill design in the AoI 313
Table 13-3 - Types and Quantities of Wastes Generated by WeBuild during Q2 2023 321
Table 13-4 - Types and Typical (Monthly) Quantities of Wastes Generated by TGEM 326
Table 13-5 - Types and Typical (Monthly) Quantities of Wastes Generated by Ariana 333
Table 14-1 - Summary of Ministry of Transport Accident Data 2017 - 2022 359
Table 14-2 - Summary of Ministry of Transport Data for Traffic Flows pm 360
Table 14-3 – Shift Rotation Day Traffic Flows at the Rogun Site Entrance Gate (15th Sept 2024) 362

FIGURES

Figure 2-1 - Upstream Area - Stockpiles, Plant, Conveyors and Transport Routes for Lot 2 Dam Construction (WeBuild) 2
Figure 2-2 - Downstream Area – Stockpiles, Plant, Conveyors and Transport Routes for Lot 2 Dam Construction (WeBuild) 3
Figure 2-3 Outdoor Sampling Locations 6
Figure 2-4 Indoor Sampling Locations 7

Figure 2-5 - Upstream Cofferdam Dust 8
Figure 2-6 - Upstream Cofferdam Carbon Monoxide 9
Figure 2-7 - Upstream Cofferdam Sulfur Dioxide 9
Figure 2-8 - Upstream Cofferdam Hydrogen Sulfide 10
Figure 2-9 - Upstream Cofferdam Silicon Dioxide 10
Figure 2-10 - Downstream Cofferdam Dust 11
Figure 2-11 - Downstream Cofferdam Carbon Monoxide 11
Figure 2-12 - Downstream Cofferdam Sulfur Dioxide 12
Figure 2-13 - Downstream Cofferdam Hydrogen Sulfide 12
Figure 2-14 - Downstream Cofferdam Silicon Dioxide 13
Figure 2-15 - GIS Yard (portal of Tunnel 4) Dust 13
Figure 2-16 - Main Dam Core Dust 14
Figure 2-17 - Main Dam Core Nitrogen Dioxide 14
Figure 2-18 - Main Dam Core Nitrogen Oxide 15
Figure 2-19 - Main Dam Core Sulfur Dioxide 15
Figure 2-20 - Main Dam Core Hydrogen Sulfide 16
Figure 2-21 - Main Dam Core Silicon Dioxide 16
Figure 2-22 - Main Dam Core (Middle) Dust 17
Figure 2-23 - Main Dam Core (Left Side) Dust 17
Figure 2-24 - Quarry No. 26 Sulfur Dioxide 18
Figure 2-25 - Quarry No. 26 Hydrogen Sulfide 18
Figure 2-26 - Quarry No. 26 Silicon Dioxide 19
Figure 2-27 - GG2 Carbon Monoxide 19
Figure 2-28 - GG2 Nitrogen Dioxide 20
Figure 2-29 - GG2 Nitrogen Oxide 20
Figure 2-30 - GG2 Sulfur Dioxide 21
Figure 2-31 - GG2 Hydrogen Sulfide 21
Figure 2-32 - GG2 Methane 22
Figure 2-33 - GG2 Silicon Dioxide 22
Figure 2-34 - Asphalt Plant Nitrogen Dioxide 23
Figure 2-35 - Asphalt Plant Sulfur Dioxide 23

Figure 2-36 - Asphalt Plant Silicon Dioxide **24**
Figure 2-37 - CP-2 Sulfur Dioxide **24**
Figure 2-38 - CP-2 Silicon Dioxide **25**
Figure 2-39 - CP-2 Silicon Dioxide **25**
Figure 2-40 - Quarry No. 17 Silicon Dioxide **26**
Figure 2-41 - Tunnel 2 Entrance Dust **27**
Figure 2-42 - Intersection with Tunnel 8 Dust **27**
Figure 2-43 - Intersection with Tunnel 4) Dust **28**
Figure 2-44 - Tunnel 4 Middle Dust **28**
Figure 2-45 - Tunnel 4 Entrance Dust **29**
Figure 2-46 -Tunnel 4 Entrance Carbon Monoxide **29**
Figure 2-47 - Tunnel 4 Entrance Nitrogen Dioxide **30**
Figure 2-48 - Tunnel 4 Entrance Nitrogen Oxide **30**
Figure 2-49 - Tunnel 4 Entrance Sulfur Dioxide **31**
Figure 2-50 - Tunnel 4 Entrance Hydrogen Sulfide **31**
Figure 2-51 - Tunnel 4 Entrance Methane **32**
Figure 2-52 - Tunnel 4 Entrance Silicon Dioxide **32**
Figure 2-53 - Tunnel GIS Yard Dust **33**
Figure 2-54 - Tunnel 3A Carbon Monoxide **33**
Figure 2-55 - Tunnel 3A Nitrogen Dioxide **34**
Figure 2-56 - Tunnel 3A Nitrogen Oxide **34**
Figure 2-57 - Tunnel 3A Sulfur Dioxide **35**
Figure 2-58 - Tunnel 3A Hydrogen Sulfide **35**
Figure 2-59 - Tunnel 3A Methane **36**
Figure 2-60 - Tunnel 3A Silicon Dioxide **36**
Figure 2-61 - Tunnel 22 Carbon Monoxide **37**
Figure 2-62 - Tunnel 22 Nitrogen Dioxide **37**
Figure 2-63 - Tunnel 22 Nitrogen Dioxide **38**
Figure 2-64 - Tunnel 22 Silicon Dioxide **38**
Figure 2-65 - Tunnel 22 Hydrogen Sulfide **39**
Figure 2-66 - Tunnel 22 Methane **39**

Figure 2-67 - Tunnel 22 Silicon Dioxide **40**
Figure 2-68 - Tunnel 5 Carbon Monoxide **40**
Figure 2-69 - Tunnel 5 Nitrogen Dioxide **41**
Figure 2-70 - Tunnel 5 Nitrogen Dioxide **41**
Figure 2-71 - Tunnel 5 Sulfur Dioxide **42**
Figure 2-72 - Tunnel 5 Hydrogen Sulfide **42**
Figure 2-73 - Tunnel 5 Yard Methane **43**
Figure 2-74 - Tunnel 5 Silicon Dioxide **43**
Figure 2-75 - On -Site Spot Sampling Locations **47**
Figure 2-76 - On Site Observations of Visible Dust from Construction Activities. **53**
Figure 2-77 - Dust cloud above the construction area on the left bank (2024) **54**
Figure 2-78 - On Site Observations of Visible Dust from Construction Activities **55**
Figure 2-79 - Poor Air Quality in Underground Working Area (Lot 4 Early Works). **56**
Figure 2-80 - The 'Flying Belt' Conveyor (2024) **57**
Figure 3-1 - Average Monthly Temperature for the DRS (red) and Tajikistan (orange) (1991-2021) **60**
Figure 3-2 - Average Monthly Precipitation for the DRS (blue) and Tajikistan (pink) (1991-2021) **61**
Figure 3-3 - Average Monthly Wind Speed (mph) for the DRS 2022 **62**
Figure 3-4 - GHG Inventory of Tajikistan, 1990-2016 (MtCO2eq) **63**
Figure 3-5 - Estimated fuel combustion emissions of the Republic of Tajikistan (IEA) (MtCO2) and population 2000-2022 **63**
Figure 4-1 - Noise Survey Locations **66**
Figure 4-2 - Time History Noise Levels - Area 1 Campsite **67**
Figure 4-3 - Baseline Noise Survey Photos - Area 1 Campsite **68**
Figure 4-4 - Noise Level Spectrum - Area 1 Campsite **68**
Figure 4-5 - Time History Noise Levels - Haul Road **69**
Figure 4-6 - Baseline Noise Survey Photos - Haul Road **69**
Figure 4-7 - Noise Level Spectrum - Haul Road **70**
Figure 4-8 - Time History Noise Levels - DT4 Activities **71**
Figure 4-9 - Baseline Noise Survey Photos DT4 Activities **71**

Figure 4-10 - Noise Level Spectrum - DT4 Activities 72
Figure 4-11 - Time History Noise Levels - Cofferdam Activities 72
Figure 4-12 - Baseline Noise Survey Photos - Cofferdam Activities 73
Figure 4-13 - Noise Level Spectrum - Cofferdam Activities 73
Figure 4-14 - Time History Noise Levels - Conveyor 74
Figure 4-15 - Baseline Noise Survey Photos - Conveyor 74
Figure 4-16 - Noise Level Spectrum - Conveyor 75
Figure 4-17 - Time History Noise Levels - Crushing Plant 76
Figure 4-18 - Baseline Noise Survey Photos - Crushing Plant 76
Figure 4-19 - Noise Level Spectrum - Crushing Plant 77
Figure 4-20 - Diagram indicating locations of noise sources and receptors 78
Figure 5-1 - Soil types by proportion in Central Asia 79
Figure 5-2 - Cambisols 81
Figure 5-3 - Leptosols 82
Figure 5-4 - Fluvial Arenosols 84
Figure 5-5 - Ferralsols 85
Figure 5-6 - Ferralsol Anthrosols 86
Figure 5-7 - Cambisol Anthrosols 86
Figure 5-8 - Site Soils 87
Figure 5-9 - Focussed Site Soils 88
Figure 5-10 - Location of the main geological faults in relation to Rogun HPP 91
Figure 5-11 - Geological and tectonic structure of Rogun area, with the upper figure being a plan of faults in the dam area and the lower diagram comprising a schematic cross section of the site showing the geological structure and geodynamic setting (from Torgoev et al, 2017) 93
Figure 6-1 - Visible Seepage from 'Main' Rogun Tank Farm 98
Figure 6-2 - Contractor Tank Farms 99
Figure 6-3 - Contractor (Single) Diesel Tanks 99
Figure 6-4 - Visual Evidence of Spills / Leaks 100
Figure 6-5 - Workshops 100
Figure 6-6 - Construction Site 1 Sewage Treatment 101

Figure 6-7 - 'Septic Tanks' Used for the collection of water runoff. 102

Figure 6-8 - Washout Areas 102

Figure 6-9 - Waste Storage - Contractors Compounds 103

Figure 6-10 - Possible ACM 104

Figure 7-1 - The Amu Darya Basin and Vakhsh Subbasin (Pöyry 2014) 106

Figure 7-2 - Vakhsh River and Main Tributaries (Pöyry 2014) 107

Figure 7-3: Rogun Reservoir layout map, Vakhsh River and tributaries. 108

Figure 7-4: Schematic of the Vakhsh HPP cascade 110

Figure 7-5 - Dynamics of Aral Sea transformation 111

Figure 7-6 - Aral Sea Volume, Level and Surface Timeseries. 112

Figure 7-7 - Water abstractions in the Amu Darya river by sector for 1997. 113

Figure 7-8 - Average Monthly Discharges at Rogun and Average Monthly Precipitation at Mehrobod (Komsomolabad) 115

Figure 7-9 - Vakhsh River watershed with locations of the Rogun and Nurek dams (Coyne et Bellier et al., 2014) 116

Figure 7-10 - Annual average flows box plot comparison (Coyne et Bellier et al., 2014f, World Bank, 2023). 118

Figure 7-11 - April-September average flows box plot comparison (Coyne et Bellier et al., 2014f, World Bank, 2023). 119

Figure 7-12 - October-March average flows box plot comparison (Coyne et Bellier et al., 2014f, World Bank, 2023). 119

Figure 7-13 - Peak flow discharge box plot comparison (Coyne et Bellier et al., 2014f; World Bank, 2023). 127

Figure 7-14 - Observed Flood Events at Tutkaul gauging station during 1953, 1958, 1969 (Coyne et Bellier et al., 2014f). 129

Figure 7-15 - Dimensionless annual flood hydrographs and observed flood events during 1953, 1958, and 1969 (Coyne et Bellier et al., 2014f). 129

Figure 7-16 - Estimated annual flood hydrographs - 10,000-Year flood and PMF (Coyne et Bellier et al., 2014f). 130

Figure 7-17 - Water quality sampling locations 143

Figure 7-18 - Suspended Solid Load vs. Liquid Discharge on the Vakhsh River (Coyne et Bellier et al. 2014) 146

Figure 7-19 - Bed Load vs. Liquid Discharge on the Vakhsh River (Coyne et Bellier et al. 2014). 147

Figure 7-20 - Composite Grain Size Distribution of Sediment Load on the Vakhsh River (Coyne et Bellier et al. 2014). 148

Figure 7-21 - Constrained channel downstream of Rogun dam site (Esri mapping imagery) 150

Figure 7-22 - Photo of a constrained channel upstream of the Rogun dam site 150

Figure 7-23 - 1.4 km wide braided channel on Surkhob tributary at Navobod (Esri mapping imagery 151

Figure 7-24 - Photo of a braided channel at a location upstream of Rogun dam site 151

Figure 7-25 - Vegetated braided channel downstream of Nurek dam 152

Figure 7-26 - Meandering channel in the Tigrovaya Balka State National Reserve (Esri mapping imagery) 153

Figure 8-1 - Topographic Map of Tajikistan 155

Figure 8-2 - Landscape view close to Proposed Dam site. 157

Figure 8-3 - Landscape view of area about 10 km upstream of dam site. 158

Figure 8-4 - Landscape view of area about 15 km upstream of proposed dam site. 159

Figure 8-5 - Landscape view of area about 25 km upstream of proposed dam site. 160

Figure 8-6 - Landscape view of area about 34 km upstream of proposed dam site. 161

Figure 8-7 - Landscape view of area between the confluence of the Surkhob and Khingob rivers and Nurobad village (where the river Muksu meets the river Surkhob) 162

Figure 8-8 - Landscape view of constrained river valley between high hills 162

Figure 9-1 - Biodiversity sampling sites 169

Figure 9-2 - Fish sample sites 173

Figure 9-3 - eDNA samples 174

Figure 9-4 - Tajikistan ecosystems schematic (as taken from Safarov, 2003) 177

Figure 9-5 - Nurek Dam, 304 m (997 ft). 178

Figure 9-6 - Protected Areas within 50km of the Project (taken from the IBAT report). 180

Figure 9-7a - Habitat mapping 182

Figure 9-8 - Pasture/degraded grassland habitat near Mehrobod 184

Figure 9-9 - Degraded grassland habitat near Mehrobod (eroding cliffs also visible) 184

Figure 9-10 - Floodplain Natural Habitat 187

Figure 9-11 - Modified floodplain habitat at Chorsada 188
Figure 9-12 - Floodplain habitat upstream of the Vakhsh/Obikhingou confluence 188
Figure 9-13 - 2003 floodplain status 189
Figure 9-14 - 2023 floodplain status 190
Figure 9-15 - 2003 left bank status 191
Figure 9-16 - 2022 left bank status 192
Figure 9-17 - Confined channel of the Vakhsh River with steep banks. 194
Figure 9-18 - Open gorges of the Vakhsh River with alluvial cobbles and boulders 194
Figure 9-19 - Braided channels within the Vakhsh River 195
Figure 9-20 - Tributaries of the Vakhsh River 195
Figure 9-21 - Mesophilic juniper woodland 198
Figure 9-22 - Remnant juniper woodland 198
Figure 9-23 - Modified and Natural Habitats 200
Figure 9-24- Species richness at each sample location - mammals 206
Figure 9-25 - Brown bear prints 210
Figure 9-26 - Otter prints 210
Figure 9-27 - Asian tortoise Testudo horsfieldii 212
Figure 9-28 - Species Richness (fish) as detected through eDNA 222
Figure 9-29: Amu Darya Trout from 2011 survey (ESIA, 2014) 229
Figure 9-30 - Common Marinka caught by local fishermen 230
Figure 9-31 - Species Richness (non-fish) as detected through eDNA analysis 231
Figure 11-1 - Sample Population Nationality Breakdown 244
Figure 11-2 - GDP share of different sectors in the economy of Tajikistan (Q4 2021) (Statista, 2024) 245
Figure 11-3 - Jamoat Community Infrastructure 257
Figure 11-4 - Tajikstan population pyramid 2023, and projected change 2050 (WHO, 2024) 260
Figure 11-5 - Sample Population Age Breakdown (N=5,148) 260
Figure 11-6 - Top causes of death in Tajikistan (2019) 262
Figure 11-7 - Deaths from infectious and parasitic disease in Tajikistan in 2017 (WHO, 2023) 263

Figure 11-8 - Road accident rate (national and in Rasht) 266

Figure 11-9 - Road accident fatality rate (national and in Rasht) 267

Figure 12-1 - Fossilised dinosaur footprints identified adjacent to an existing construction road (RHPP-AR-36) (Seller, 2023) 285

Figure 12-2 - Terraces 1 - 3 between the villages of Tagi Agba and Tagi Kamar, with the first and second terraces preserved only in narrow sections (Filimonova, 2023) 289

Figure 12-3 - Location of Qal'ai Kofir Fortress (RHPP-AR-01; Filimonova, 2023) 290

Figure 12-4 - View to the west of Qal'ai Mir / Qal'ai Shokhon Fortress (RHPP-AR-02) (Filimonova, 2023) 291

Figure 12-5 - View to the west of Zindan Hill at Magzori Sir village (Filimonova, 2023) 291

Figure 12-6 - The terrace on which the fortress at Mehrobod (RHPP-AR-38) was located (Filimonova, 2023) 292

Figure 12-7 - Pottery fragments from the fortress at Mehrobod (RHPP-AR-38; Filimonova, 2023) 293

Figure 12-8 - The site of the Kalankok Fortress (RHPP-AR-39; Filimonova, 2023) 294

Figure 12-9 - Pottery fragments recovered from the surface at Kalankok Fortress (RHPP-AR-39), Sari Ju village (Filimonova, 2023) 294

Figure 12-10 - Remains of fortress near Roghuni poyon (RHPP-AR-40; Filimonova, 2023) 295

Figure 12-11 - Ceramic fragments recovered from the surface at the fortress near Roghuni poyon (RHPP-AR-40; Filimonova, 2023) 295

Figure 12-12 - Qal'ai Bacha Fortress (RHPP-AR-05), Navdonak village (Filimonova, 2023) 296

Figure 12-13 - Qal'ai Dukhtarak Fortress (RHPP-AR-06), Navdonak village (Filimonova, 2023) 297

Figure 12-14 - Dakhana Fortress (RHPP-AR-03; Filimonova, 2023) 298

Figure 12-15 - Mound near Dakhana Fortress (Filimonova, 2023) 298

Figure 12-16 - Possible site of a watchtower between the villages of Obi Mehnat and Dakhana (RHPP-AR-11; Filimonova, 2023) 299

Figure 12-17 - Sycamore tree (*Chanor*), Mehrobod 304

Figure 13-1 - Landfill site at Vadhat and litter in roadside draining gutter 318

Figure 13-2 - WeBuild Office waste bins 323

Figure 13-3 - WeBuild Camp domestic waste skips **323**
Figure 13-4 - WeBuild Domestic Waste storage area **324**
Figure 13-5 - WeBuild Hazardous Waste storage area **324**
Figure 13-6 - Waste bitumen **325**
Figure 13-7 - TGEM Domestic Waste storage area **329**
Figure 13-8 - TGEM Construction Waste storage area **330**
Figure 13-9 - Waste Storage - Contractors' Compounds **335**
Figure 13-10 - 'Dump' Site - Construction Area 1 (Photo 1) **336**
Figure 13-11 - 'Dump' Site - Construction Area 1 (Photo 2) **337**
Figure 13-12 - 'Dump' Site - Construction Area 5 **338**
Figure 13-13 - 'Dump' Site on east bank **339**
Figure 13-14 - Potential Construction upon Waste Materials **339**
Figure 13-15 - Possible Asbestos Containing Materials **340**
Figure 13-16 - WeBuild Accommodation Camp WWTP **341**
Figure 13-17 - WeBuild Office septic tank **342**
Figure 13-18 - WeBuild Office perimeter fence area (1) **342**
Figure 13-19 - WeBuild Office perimeter fence area (2) **343**
Figure 13-20 - Construction Site 1 Sewage WWTP **344**
Figure 13-21 - 'Septic Tanks' used for the collection of water runoff **346**
Figure 13-22 - Washout Areas (1) **347**
Figure 13-23 - Washout Areas (2) **347**
Figure 13-24 - Contractor Tank Farms **348**
Figure 13-25 - Contractor (Single) Diesel Tanks **348**
Figure 13-26 - Visual Evidence of Spills / Leaks **348**
Figure 13-27 - Community waste collection point (1) **350**
Figure 13-28 - Community waste collection point (2) **350**
Figure 13-29 - Community waste collection point (3) **351**
Figure 13-30 - Community waste collection point (4) **351**
Figure 13-31 - Community waste collection point (5) **352**
Figure 13-32 - Vehicles used for waste removal **352**
Figure 13-33 - Waste deposition location **352**

Figure 14-1 - Schematic of Pamir Highway (M41) Obigarm-Nurobod Road Realignment (Ministry of Transport of the Republic of Tajikistan, 2019) 355

Figure 14-2 – Roads around the Rogun HPP Project area 357

Figure 14-3 - To-be-resettled and non-resettled villages of the Kamarob Valley 358

Figure 14-4 - Indication of routes to Main Dam Core 365

1 INTRODUCTION

1.1.1 This Environmental and Social Baseline Conditions Report is an Annex to the Environmental and Social Impact Assessment (ESIA) for the Rogun Hydropower Project (HPP) (hereafter referred to as 'the Project').

1.1.2 The Laws of Tajikistan, including international agreements to which Tajikistan is a party, will apply to the Project. There are potentially a number of financial institutions (hereafter referred to as 'Lenders') involved in the Project, including the World Bank (WB), Asian Infrastructure Bank (AIIB), Islamic Development Bank (IsDB), Asian Development Bank (ADB), and several others. A full list including an overview of their environmental and social (E&S) frameworks is provided in **Volume 1, Chapter 2** (Legislation and Standards).

1.2 PROJECT OVERVIEW

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.

1.2.2 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 2032, with full inundation of the reservoir area expected to be reached by 2038.

1.3 PURPOSE OF THE REPORT

1.3.1 This document describes the full environmental and social baseline conditions for the Project and is an Annex to **Volume 1: ESIA**. A summary of environmental and social baseline conditions is presented in **Volume 1, Chapter 7** of this ESIA.

1.3.2 This document presents information from a wide range of publicly available information, as well as independent studies carried out for the ESIA and associated documentation. The existing information has been reviewed for consistency and these studies are referenced where appropriate.

2 AIR QUALITY

2.1 INTRODUCTION

2.1.1 This section presents the baseline data for Air Quality for the Project. The information presented here is summarized in **Volume 1, Chapter 7** of this ESIA.

2.2 CLIMATIC CONDITIONS

2.2.1 Temperature, precipitation and wind have the potential to impact baseline air pollutant concentrations through the limitation of the availability of pollution sources and their dispersion. **Section 3.1: Climate Baseline** of this Annex provides a summary of the climatic conditions at the Project Site.

2.3 EMISSION SOURCES

2.3.1 The following areas of the site contain potential sources of emissions to air:

Figure 2-1 - Upstream Area - Stockpiles, Plant, Conveyors and Transport Routes for Lot 2 Dam Construction (WeBuild)

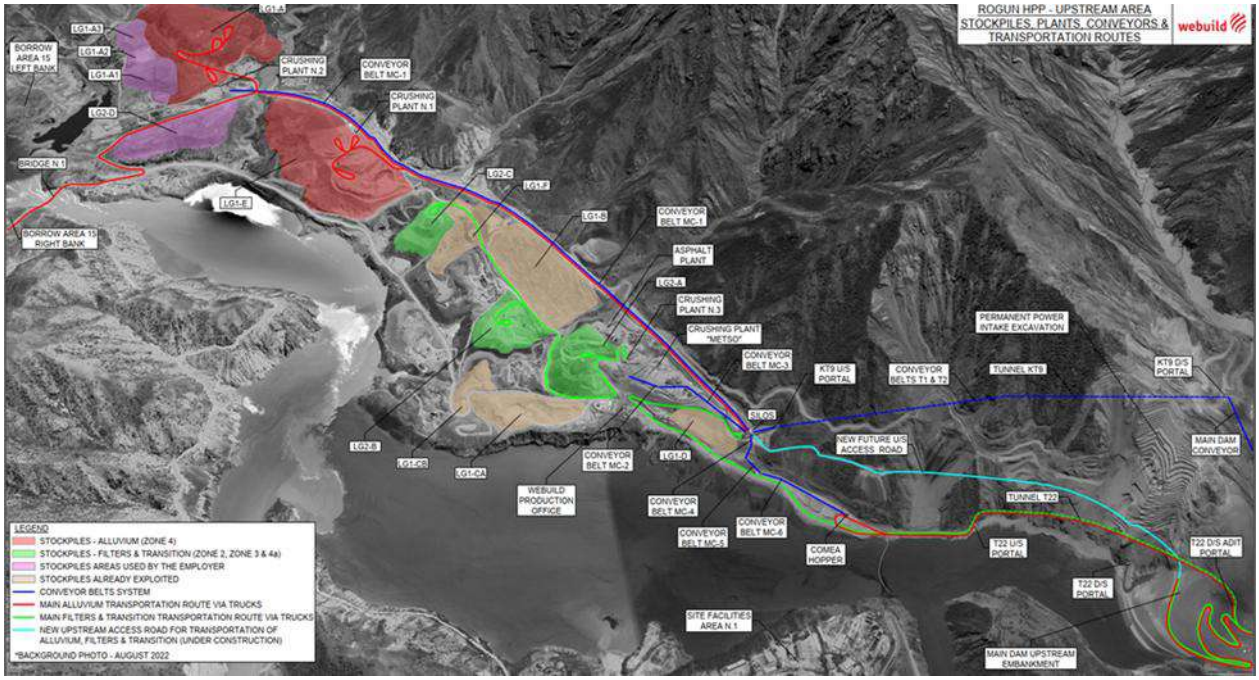
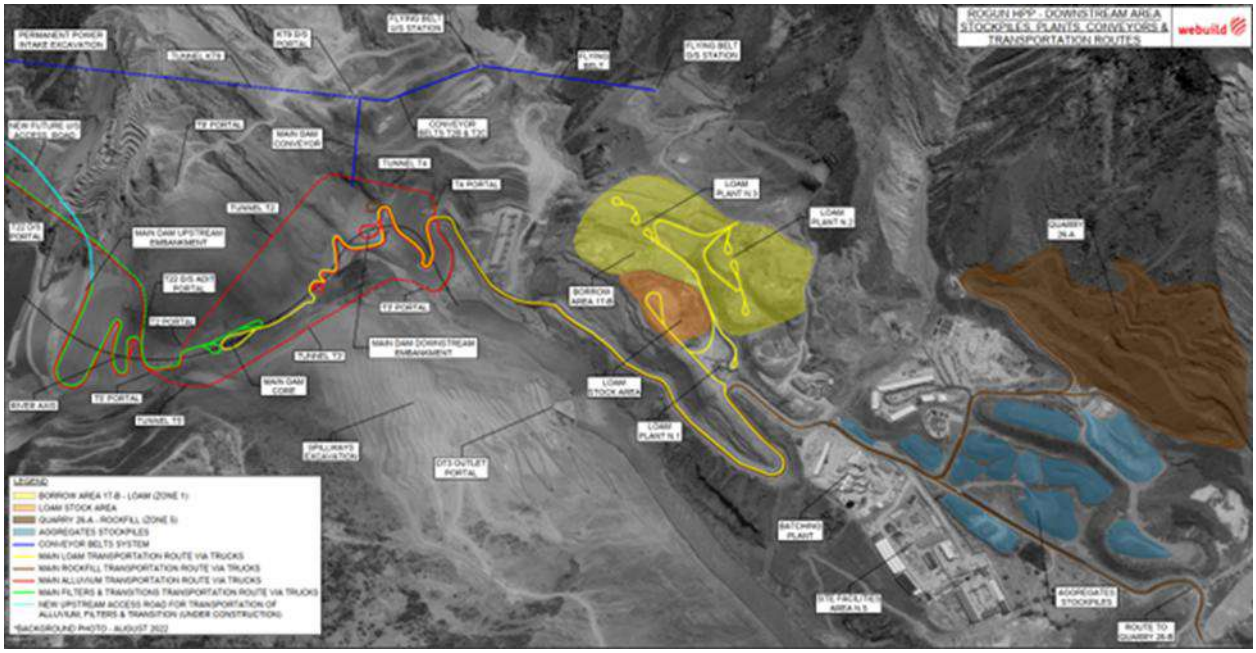


Figure 2-2 - Downstream Area – Stockpiles, Plant, Conveyors and Transport Routes for Lot 2 Dam Construction (WeBuild)



2.4 POLLUTANT SPECIES

2.4.1 The main pollutants of interest during construction are:

- Dust in the form of deposited dust and particulate matter (PM) – PM_{10} and $PM_{2.5}$ (note that baseline information for $PM_{2.5}$ is not available); and
- Nitrogen oxides (NO_x) and carbon monoxide (CO) from fuel combustion, particularly vehicles and plant within enclosed spaces.

2.4.2 Air pollutant concentration data has been collected to characterize the air quality baseline. The data evidence a suite of readings which have recorded outdoor and indoor dust (Total Suspended Particulate), carbon monoxide (CO), nitrogen dioxide (NO2), nitrogen oxide (NOx), sulfur dioxide (SO2), hydrogen sulfide (H2S), methane (CH4), propane (C3H8) and silicon dioxide (SiO2).

2.5 BASELINE DATA COLLECTION METHODOLOGY

LEGISLATIVE REQUIREMENTS

2.5.1 As a requirement of the Law of the Republic of Tajikistan on the Protection of Atmospheric Air (2012), air quality monitoring for the Project is required under **Article 28**.

2.5.2 Air quality monitoring is undertaken by the Republican Military Mine Rescue Service (RMMRS), under the Head of the State Safety Control Service in Industry and Mining under the Government of the Republic of Tajikistan. A branch of the RMMRS was established for the Rogun HPP in 2021 (OSCE, 2022).

2.5.3 As a contractor requirement, WeBuild commenced a routine monitoring program at the site in 2023. Samples were taken in final week of (across one day or two days maximum) each month between November 2023 and October 2024.

TRAINING

2.5.4 The RMMRS has historically held responsibility for the training of specialists to complete monitoring and management of air quality. Their responsibilities include ensuring that the air quality in mines meets Tajik safety standards, derived from the Russian Federation Occupational safety standards system (RussianGost, 1988), to protect workers from hazardous conditions[1]. A branch of the RMMRS have been commissioned to undertake various elements of safety and maintenance, including emergency drills and cleaning the surface of the reservoir as well as ensuring safety of the air environment within the tunnels. Monitoring hazardous gases, particularly dust and explosive gases, is one of the core responsibilities of the RMMRS.

EQUIPMENT

2.5.5 All monitoring is undertaken using hand-held devices which are provided by central government. Scheduled and unscheduled monitoring takes place. The RMMRS use the following equipment for air quality monitoring and have been provided training on their use.

- Psychrometer – used to check humidity inside the tunnels;
- ShI-10 mining interferometer (ШИ-10) – used to measure methane (CH_4)
- PKA-01 (ПКА-012) – measurement of airborne dust;
- M-02 – combustible gases, CH_4 and explosive CH_4 compounds, carbon monoxide (CO), hydrogen sulfide (H_2S); and
- Cup anemometer – wind speed.

CALIBRATION

2.5.6 The 2023 training schedule shows that eight training sessions on air quality monitoring and analysis were undertaken in that year. The current policy prescribes that the equipment is sent every six months to the Agency on Hydrometeorology under the Committee for Environmental Protection for calibration.

POLLUTANT SPECIES

SAMPLING LOCATIONS

2.5.7 Samples are taken outdoors and indoors at the following outdoor and indoor locations:

Outdoor

- Upstream cofferdam (dust, CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- Downstream Coffer Dam (dust, CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- GIS yard (portal of T4) (dust);

[1] Russian standard GN 2.1.5.1338-03 on maximum allowable (permissible) concentrations for pollutants in the outdoor air of populated areas.
[2] Прибор контроля запыленности воздуха (Air Dust Control Device)

- Main Dam Core (dust, CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- Main Dam Core (middle) (dust);
- Main Dam Core (left side) (dust);
- Quarry No. 26 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- GG2 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- Asphalt Plant (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- CP-2 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- CP-3 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2); and
- Quarry No. 17 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2).

2.5.8 The outdoor sample locations are shown in **Figure 2-3**.

Figure 2-3 Outdoor Sampling Locations

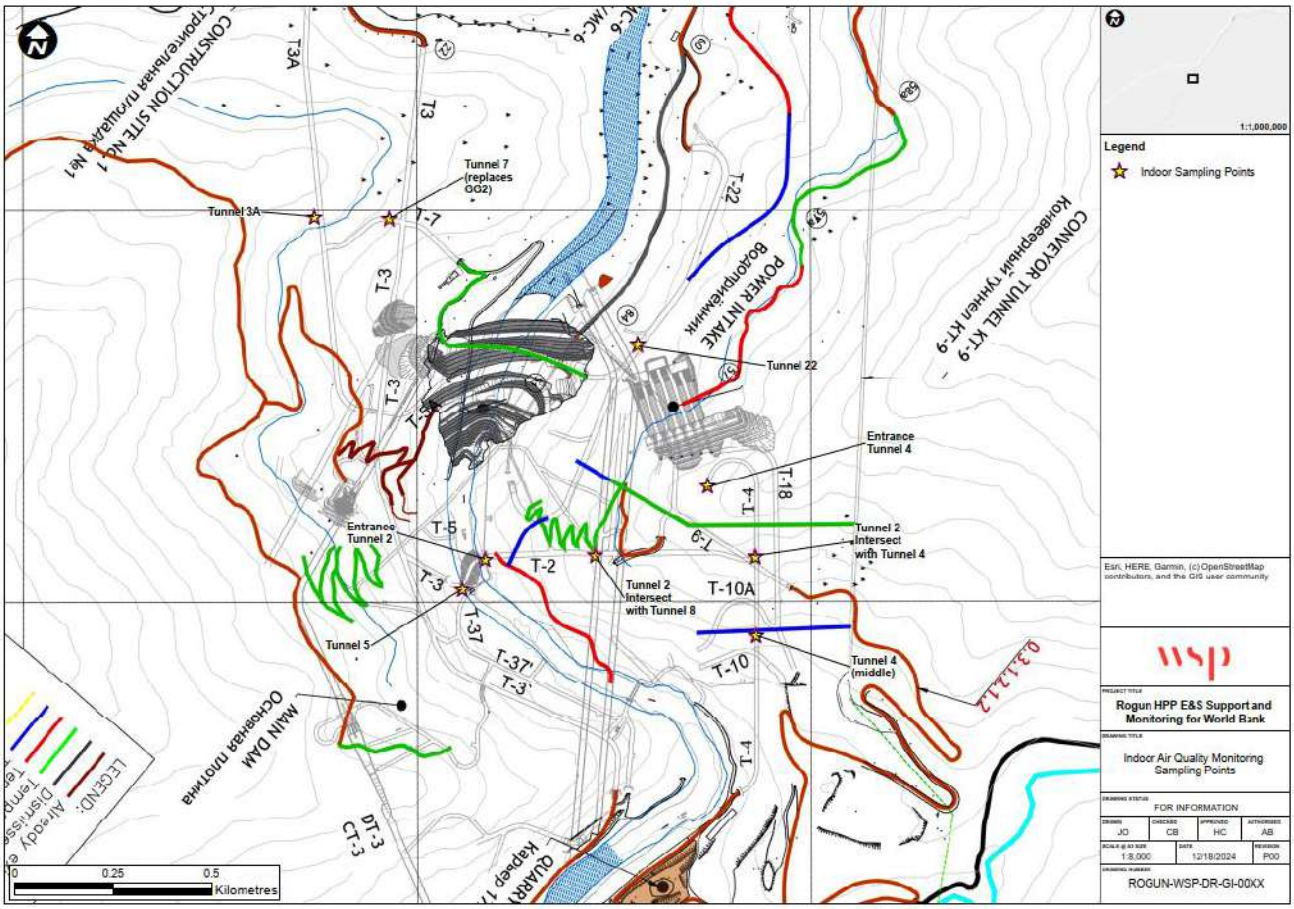


Indoor

- Tunnel 3A (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2).
- Entrance of Tunnel 4 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2);
- Tunnel 22 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2); and
- Tunnel 5 (CO, NO_2, NO, SO_2, H_2S, CH_4, C_3H_8 and SiO_2).

2.5.9 The indoor sample locations are shown in **Figure 2-4**.

Figure 2-4 Indoor Sampling Locations



MITIGATION CRITERIA

2.5.10 The mitigation criteria currently applied to the site are summarized in **Table 2-1**.

Table 2-1 – Mitigation Criteria (Air Quality)

Pollutant	Criterion	Units
Dust	6 (6,000)	mg/m^3 (µg/m^3)
Oxygen	19.5	%
CO_2	0.5	%
CO	17.5 (20.1)	ppm (µg/m^3)
NO_2	2.5 (4.7)	ppm (µg/m^3)
NO	5 (6.3)	ppm (µg/m^3)
SO_2	3.8 (10.0)	ppm (µg/m^3)
H_2S	7.2 (10.2)	ppm (µg/m^3)

Pollutant	Criterion	Units
CH_4	1	%
SiO_2	0.5	%
Wind speed	0.1	m/s
Radiation	1.37	µSv/h
Conversions between ppm and µg/m^3 assume standard air pressure of 1013 mb and ambient temperature of 25°C.		

2.5.11 The criteria are applied as indicators of elevated concentrations of pollutants to determine the need for mitigation beyond international best practice. They are not intended to be used as indicators of compliance or otherwise with the Law of the Republic of Tajikistan on the Protection of Atmospheric Air (2012) for which the Project Standards are defied in **Volume 1: Chapter 08: Air quality, of this ESIA**.

2.6 BASELINE DATA

SAMPLING PROGRAM (2023- PRESENT)

2.6.1 The sampling data are presented for the locations and pollutants where detection occurred for three or more months in the sample period.

Results

Outdoor Monitoring Sites

Upstream Cofferdam

Figure 2-5 - Upstream Cofferdam Dust

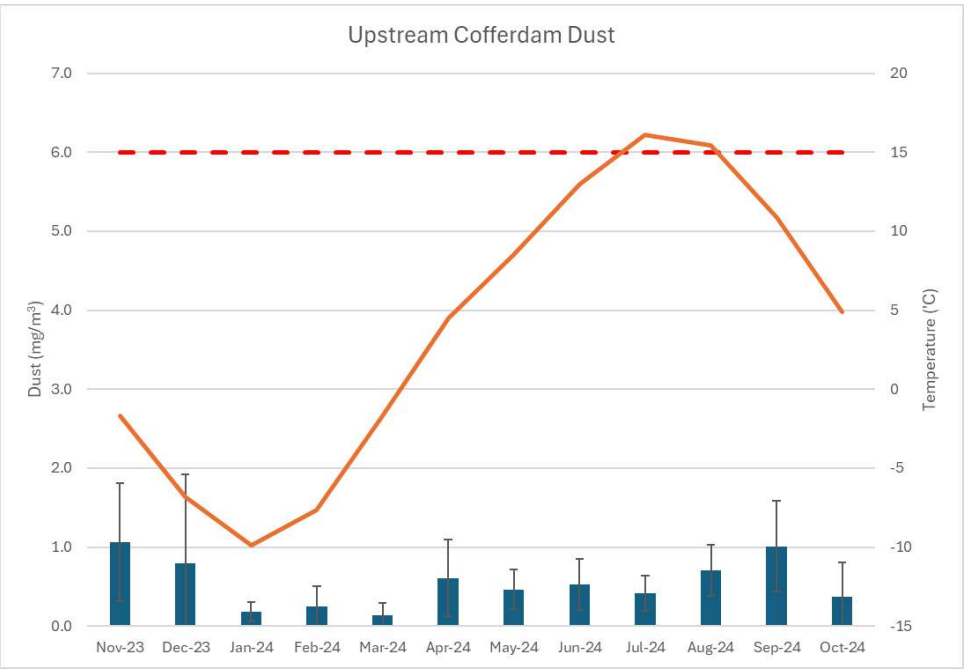


Figure 2-6 - Upstream Cofferdam Carbon Monoxide

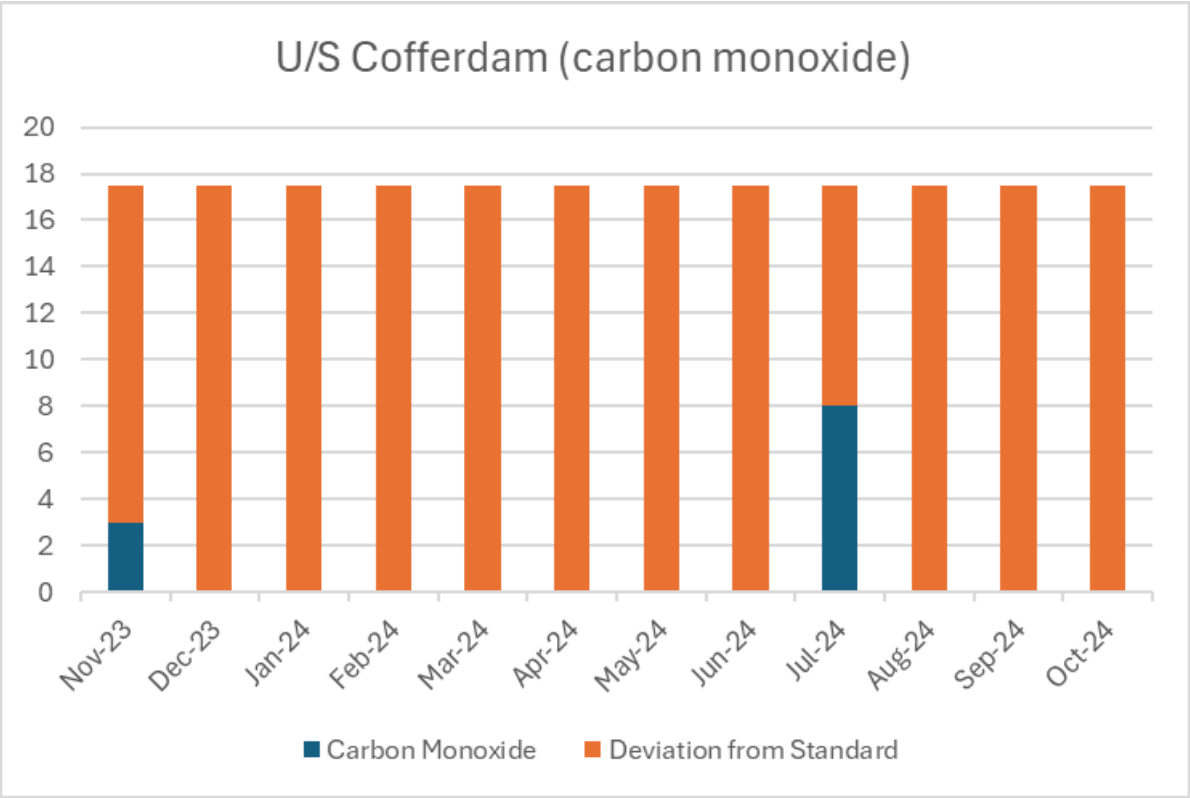


Figure 2-7 - Upstream Cofferdam Sulfur Dioxide

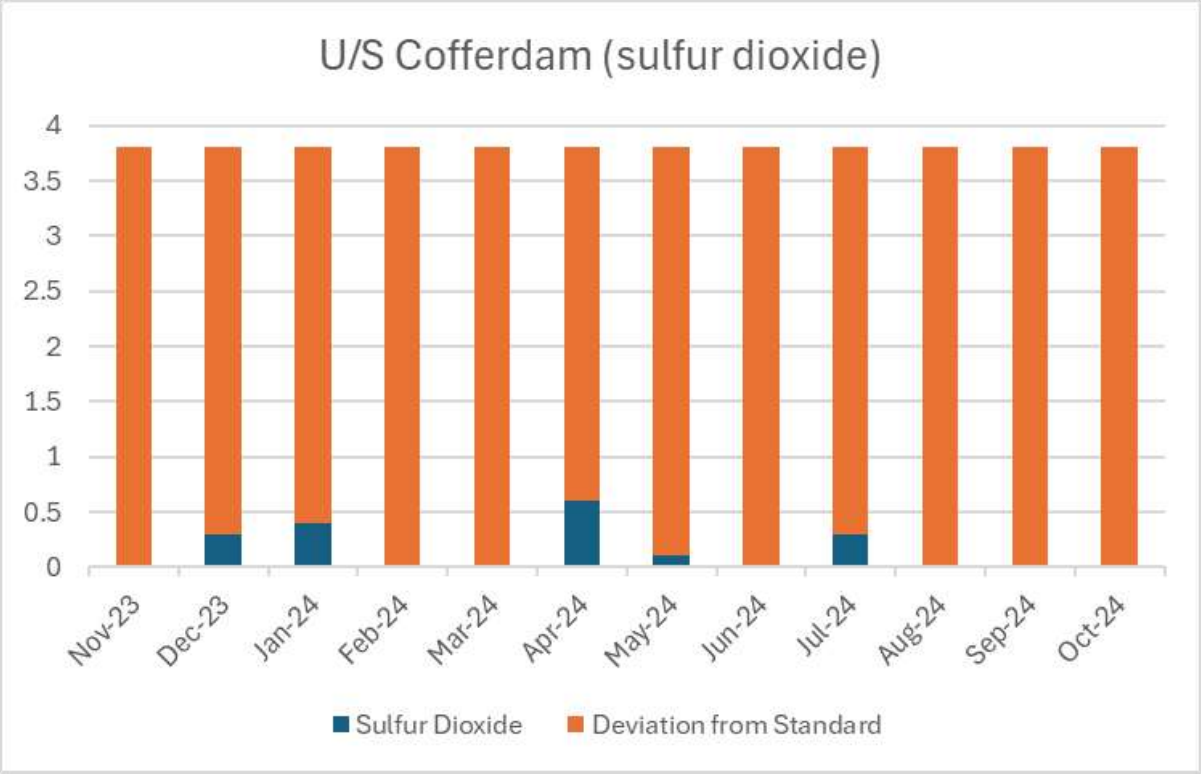


Figure 2-8 - Upstream Cofferdam Hydrogen Sulfide

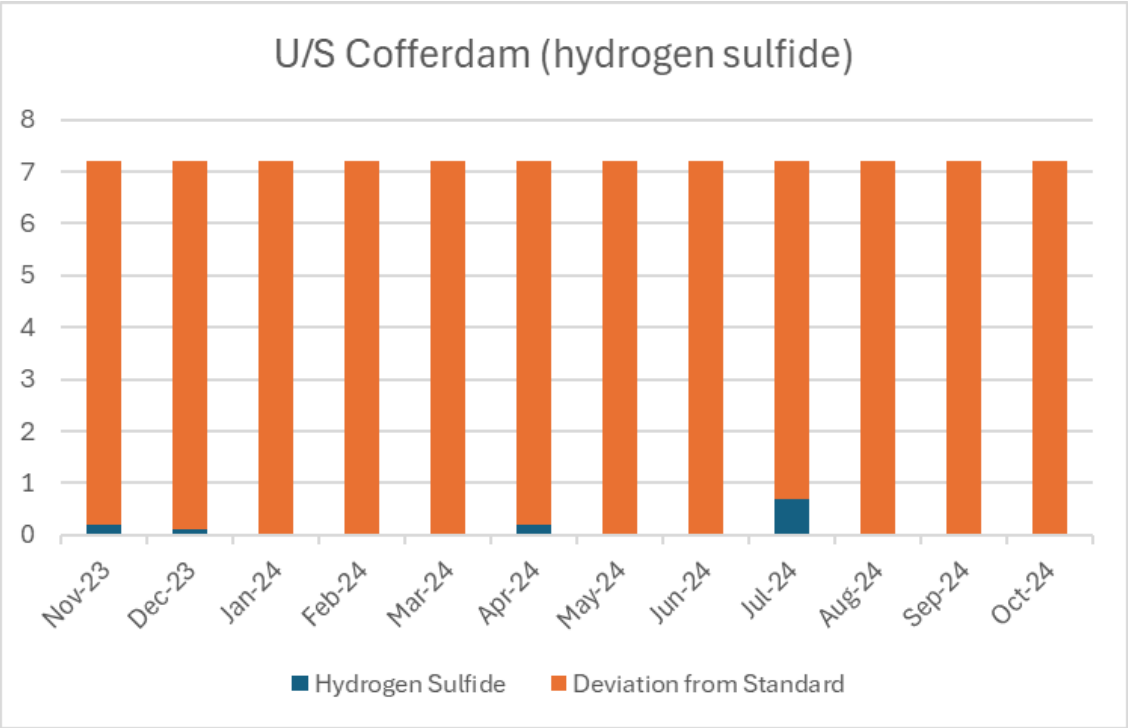
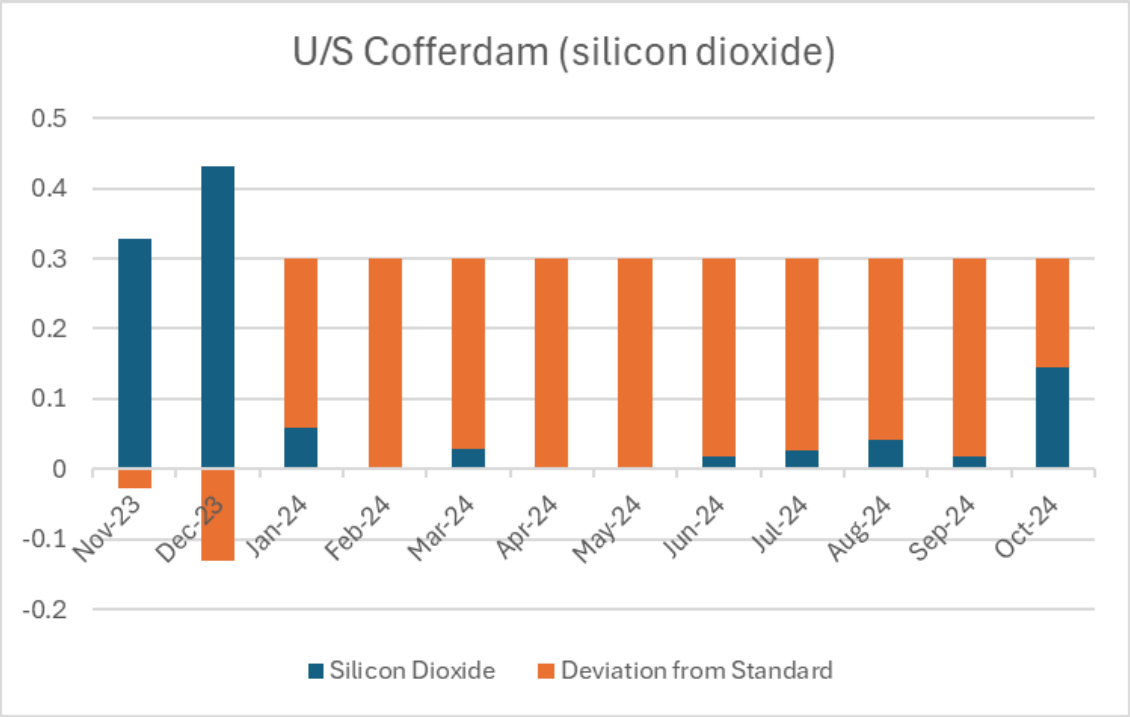


Figure 2-9 - Upstream Cofferdam Silicon Dioxide



Downstream Cofferdam

Figure 2-10 - Downstream Cofferdam Dust

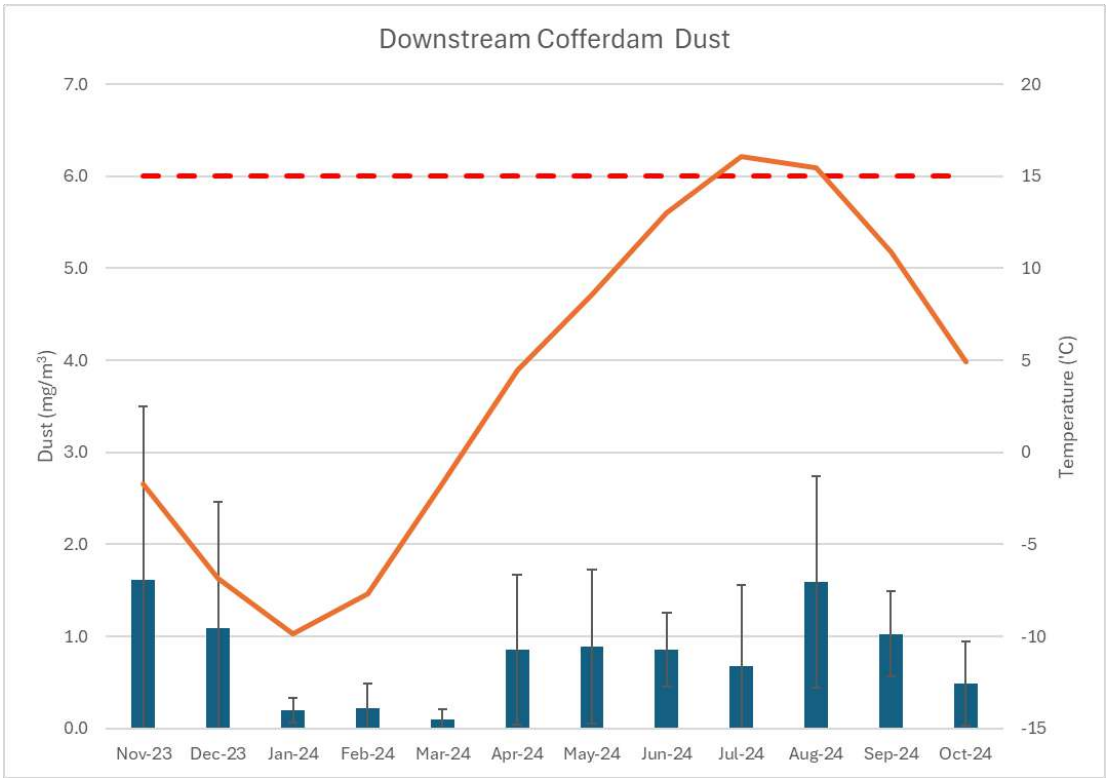


Figure 2-11 - Downstream Cofferdam Carbon Monoxide

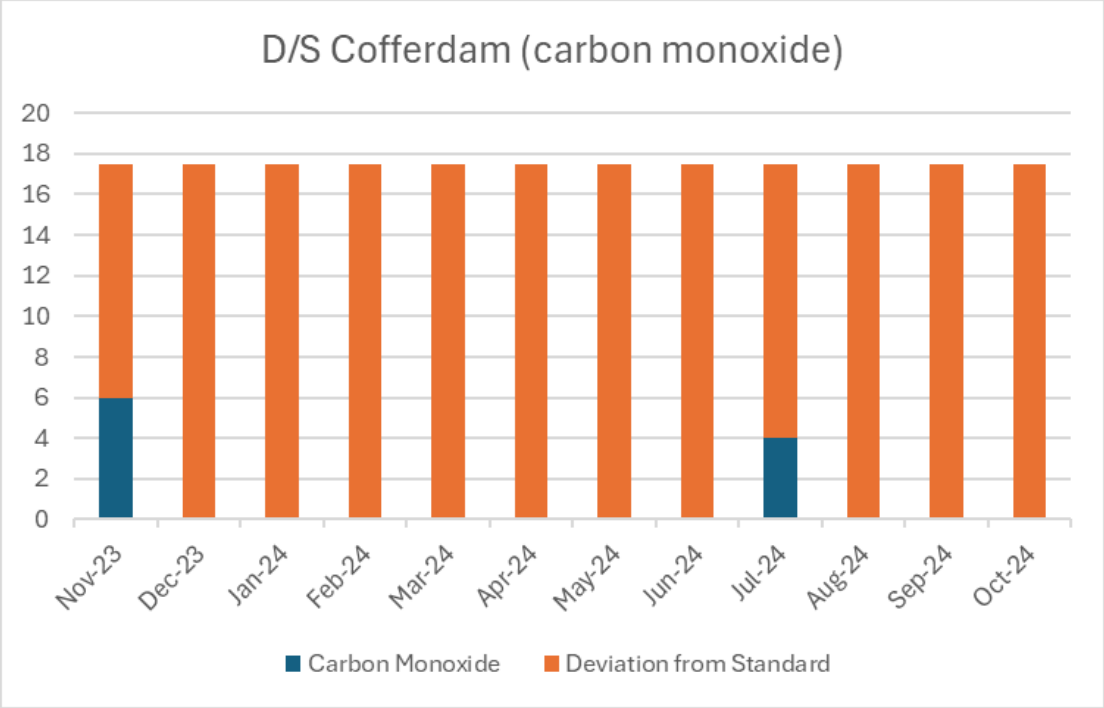


Figure 2-12 - Downstream Cofferdam Sulfur Dioxide

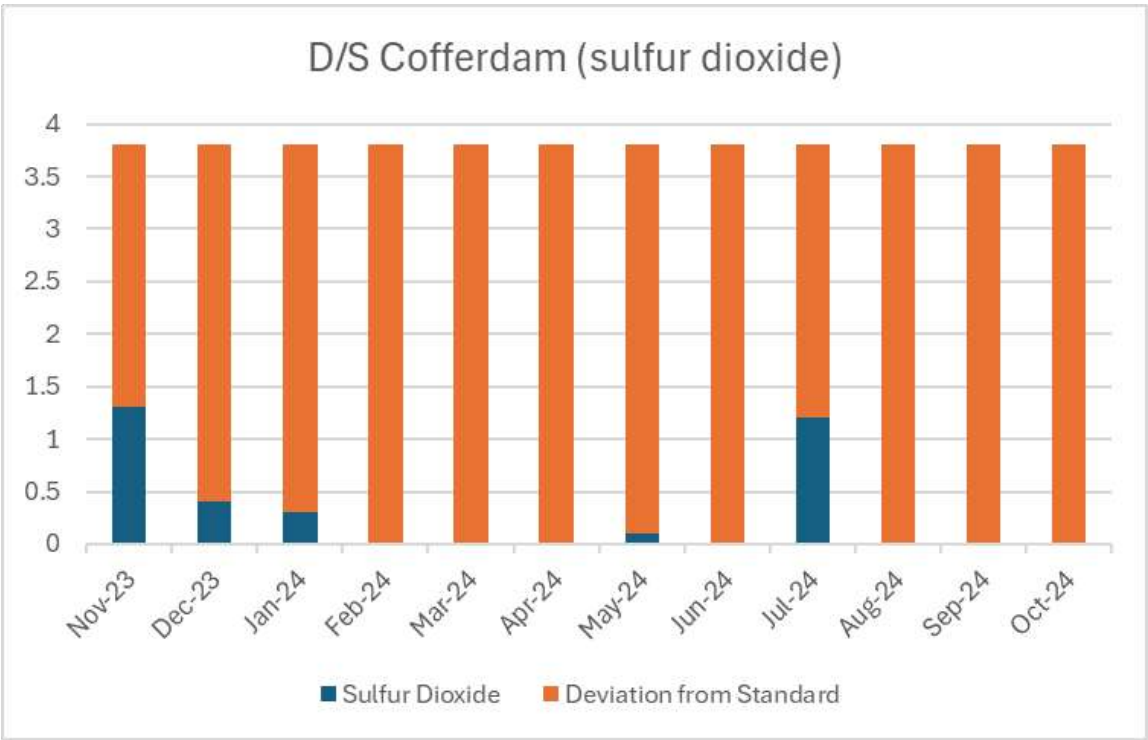


Figure 2-13 - Downstream Cofferdam Hydrogen Sulfide

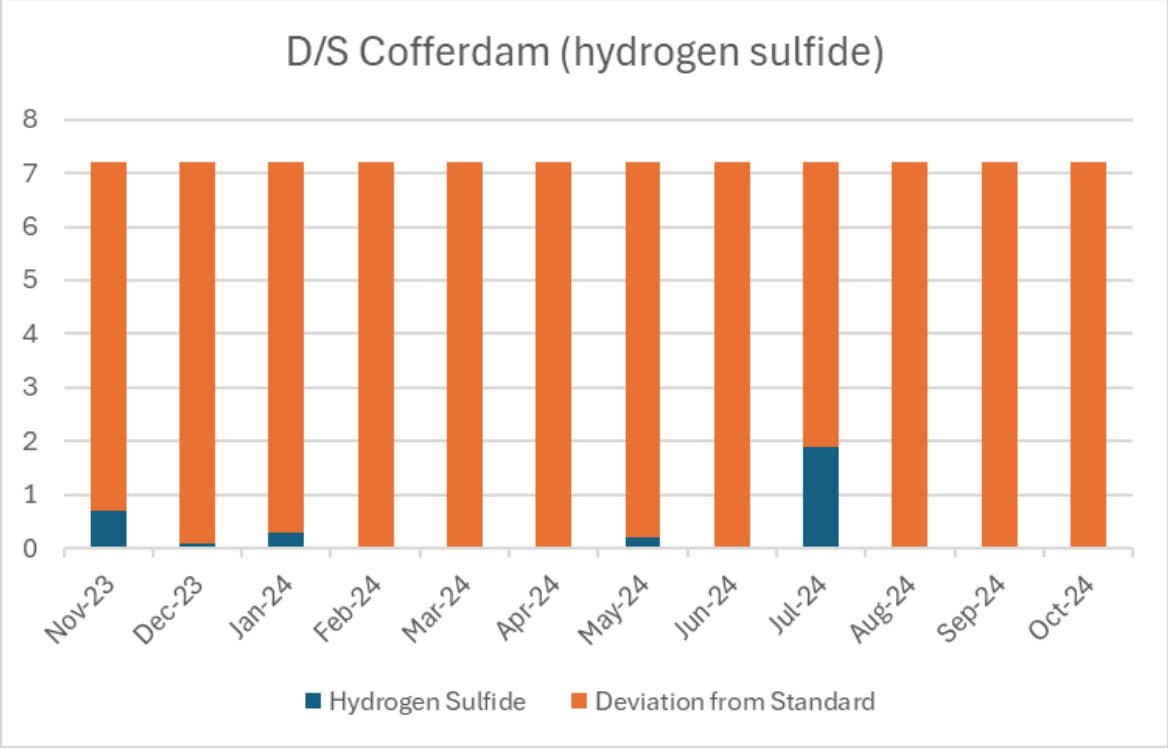
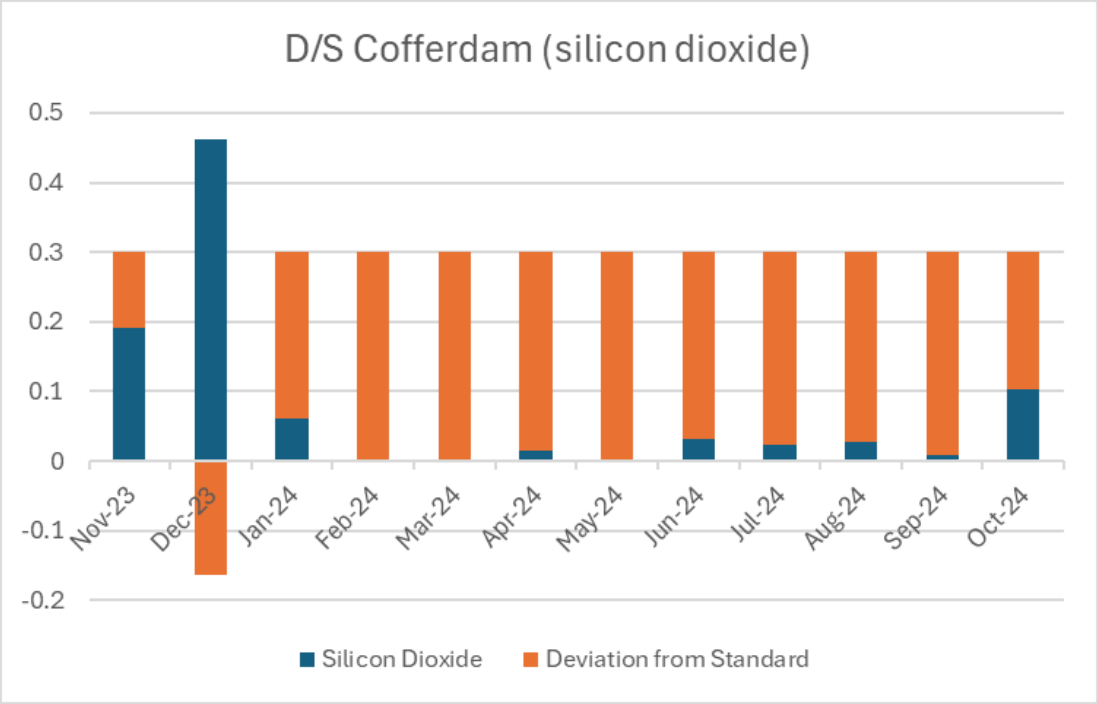
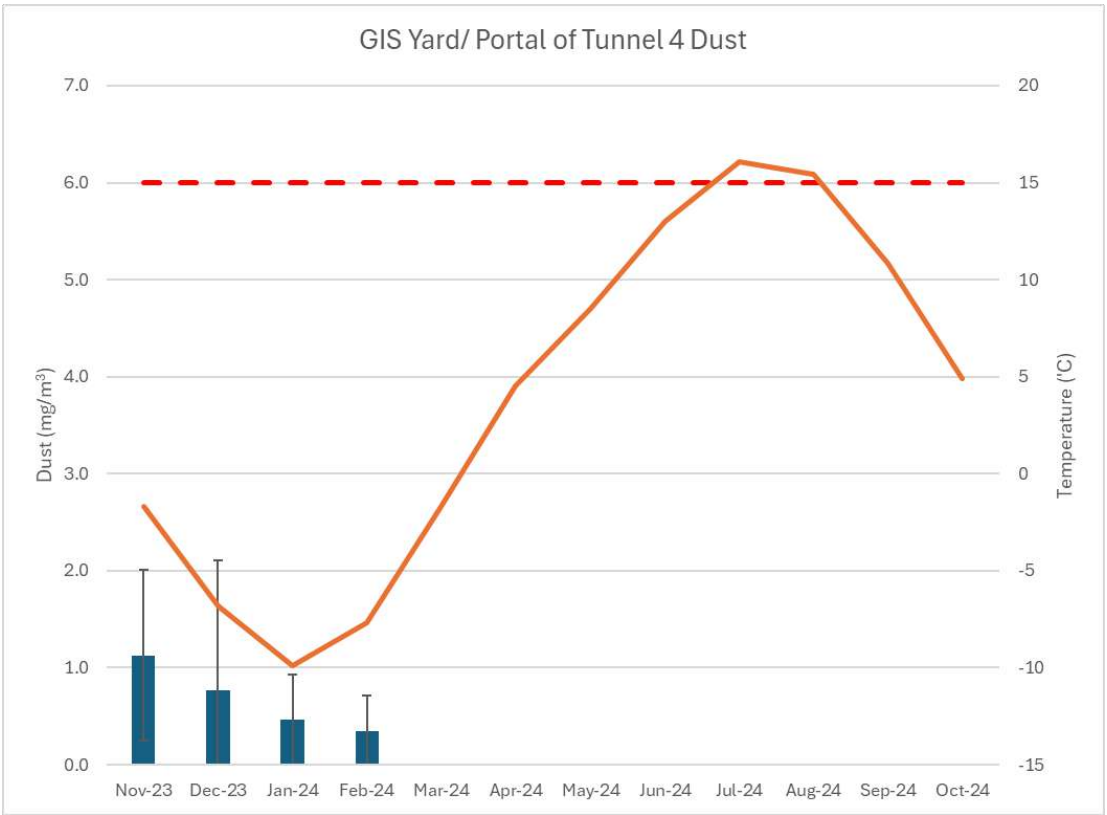


Figure 2-14 - Downstream Cofferdam Silicon Dioxide



GIS Yard (portal of Tunnel 4)

Figure 2-15 - GIS Yard (portal of Tunnel 4) Dust



Main Dam Core

Figure 2-16 - Main Dam Core Dust

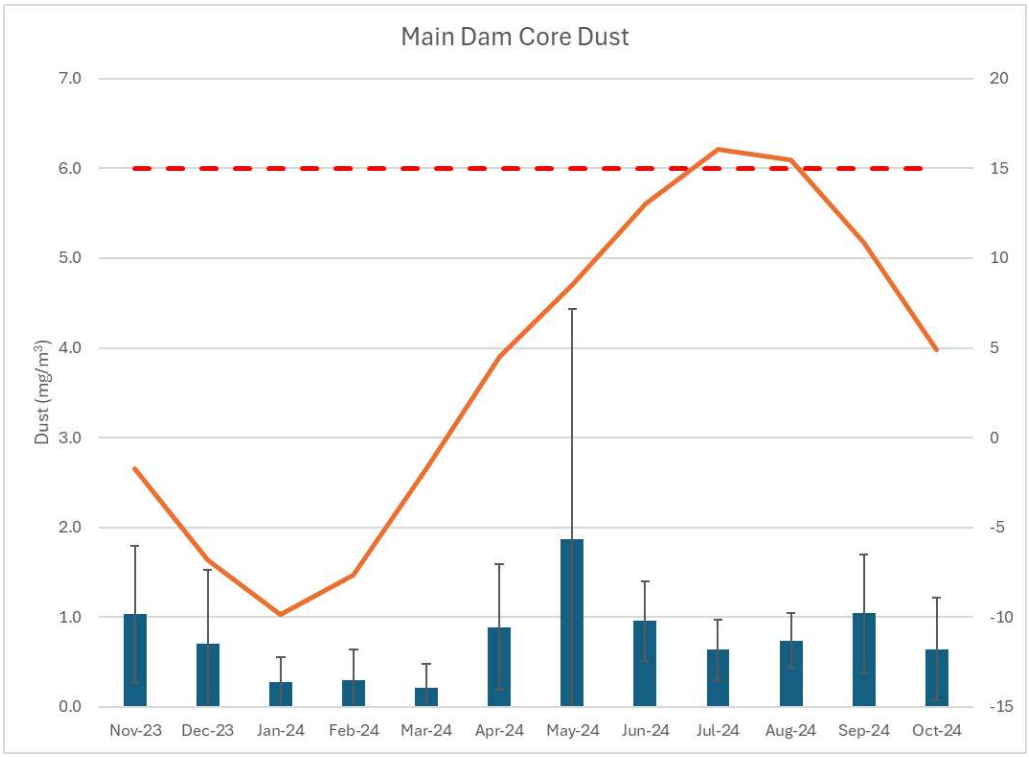


Figure 2-17 - Main Dam Core Nitrogen Dioxide

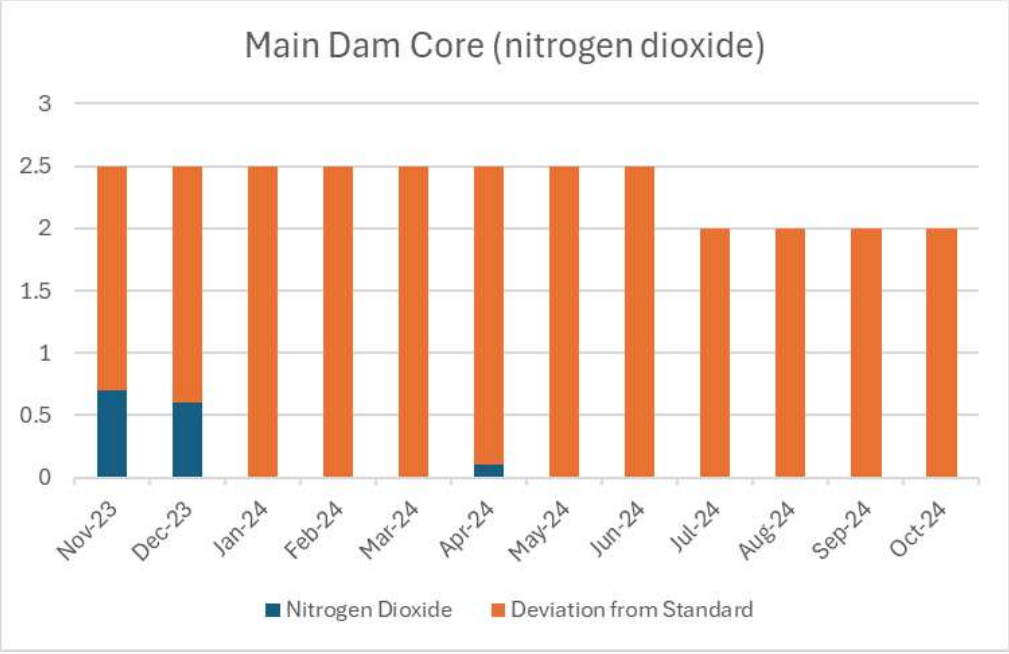


Figure 2-18 - Main Dam Core Nitrogen Oxide

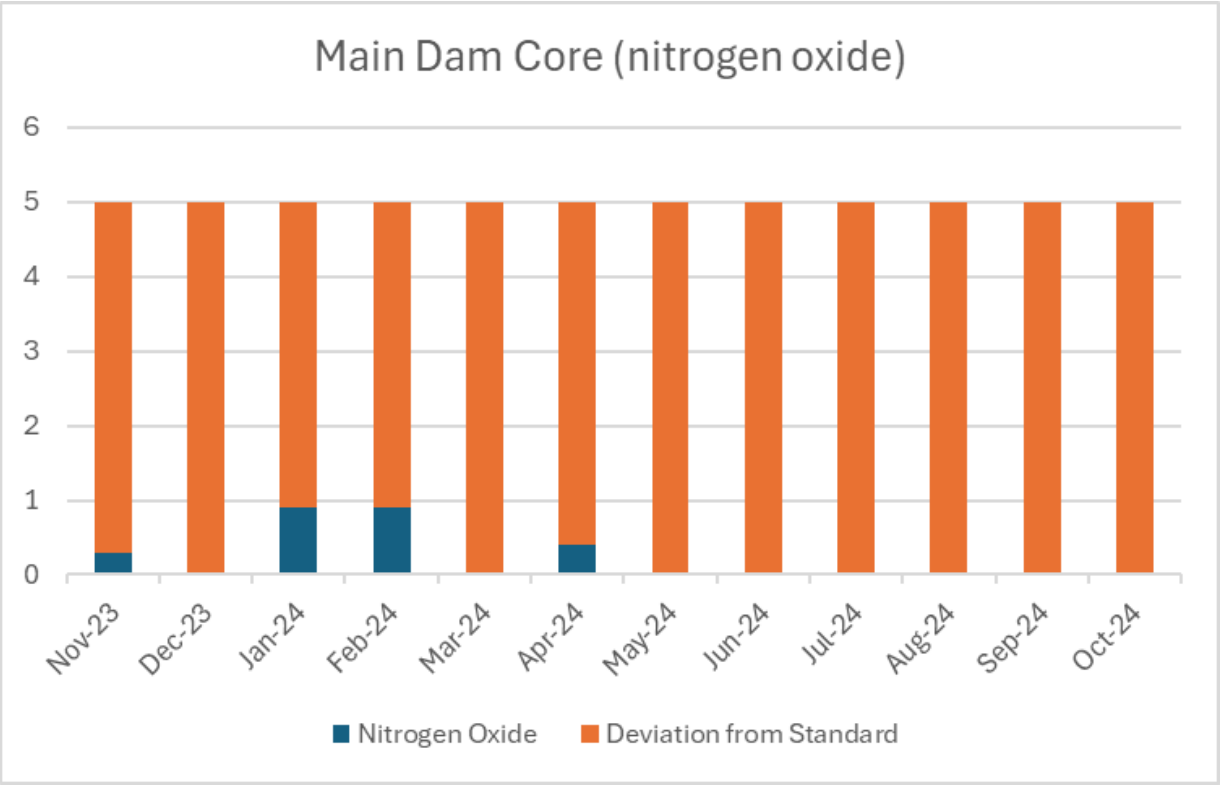


Figure 2-19 - Main Dam Core Sulfur Dioxide

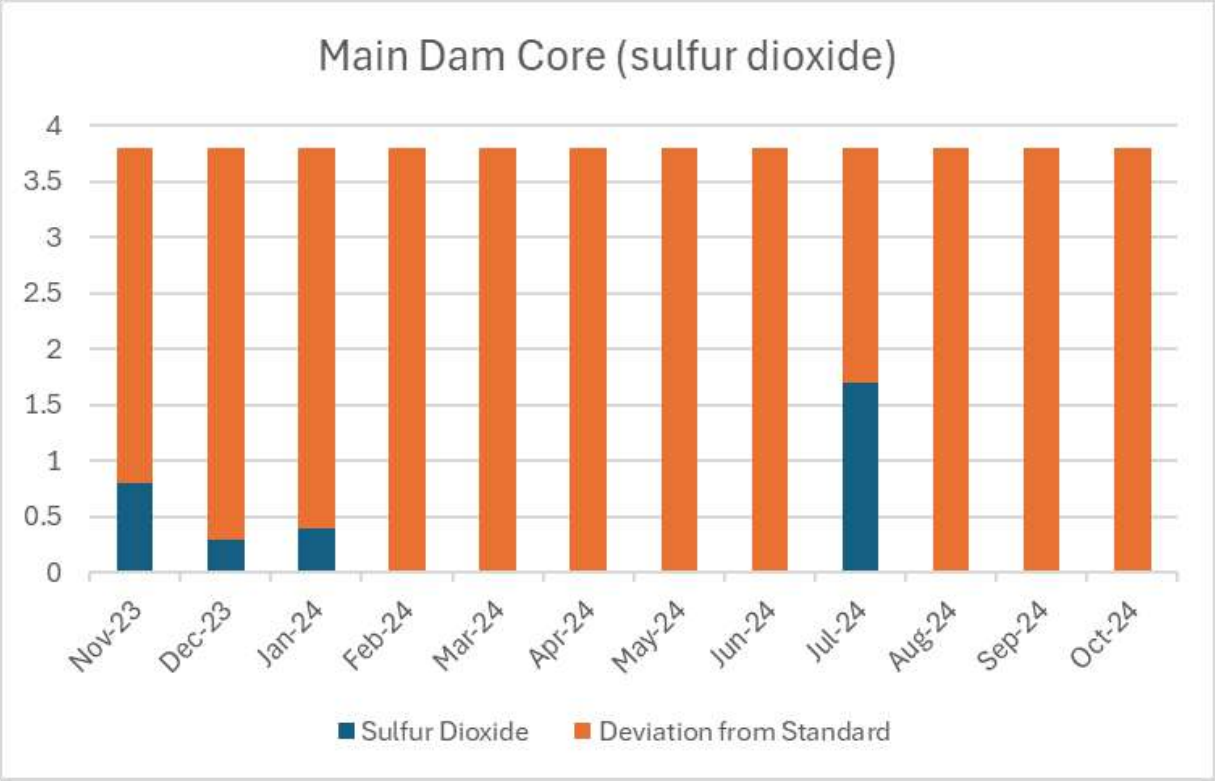


Figure 2-20 - Main Dam Core Hydrogen Sulfide

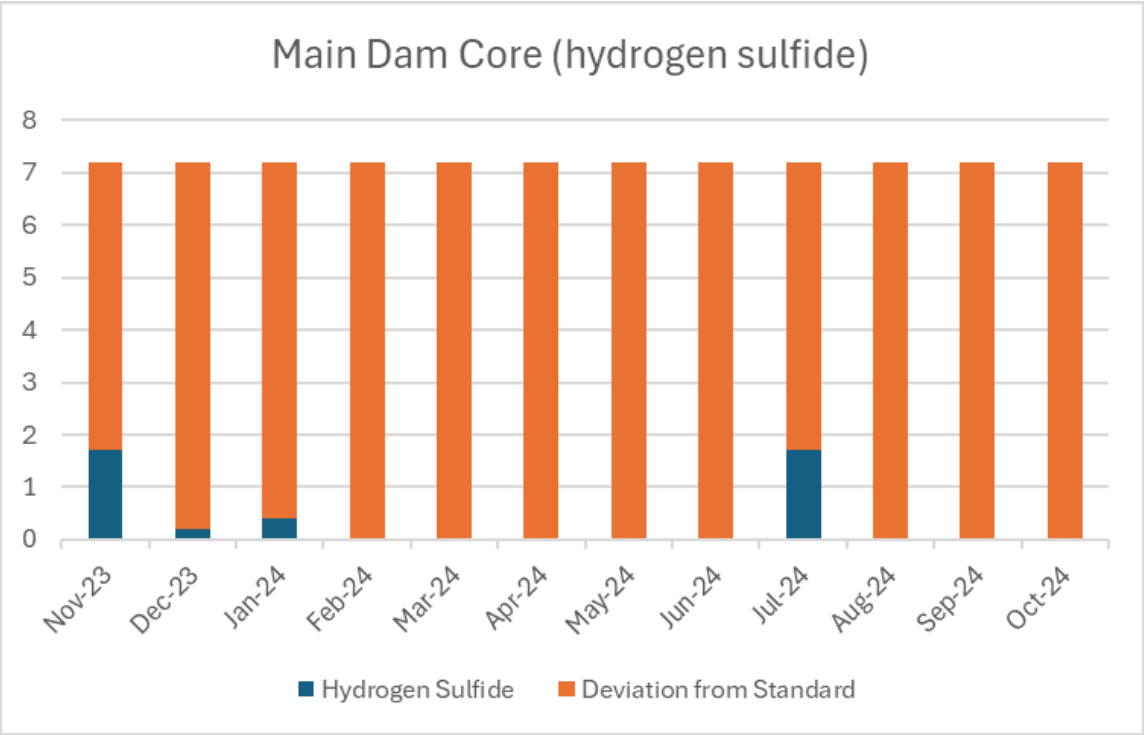
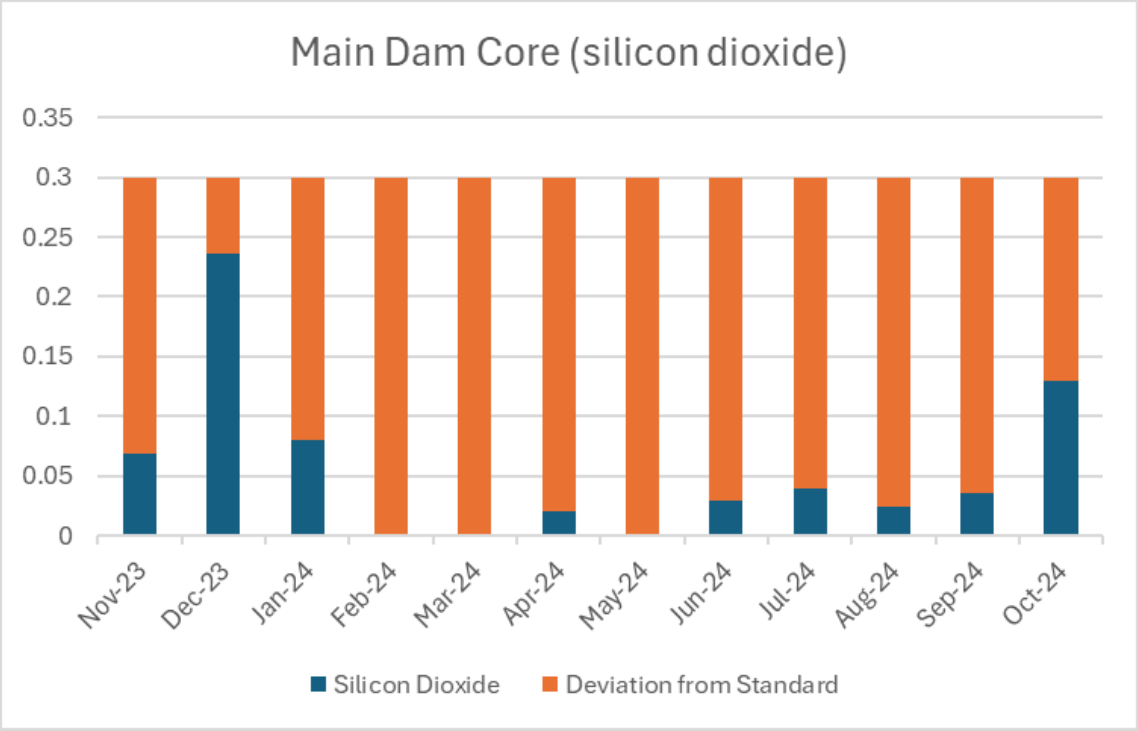
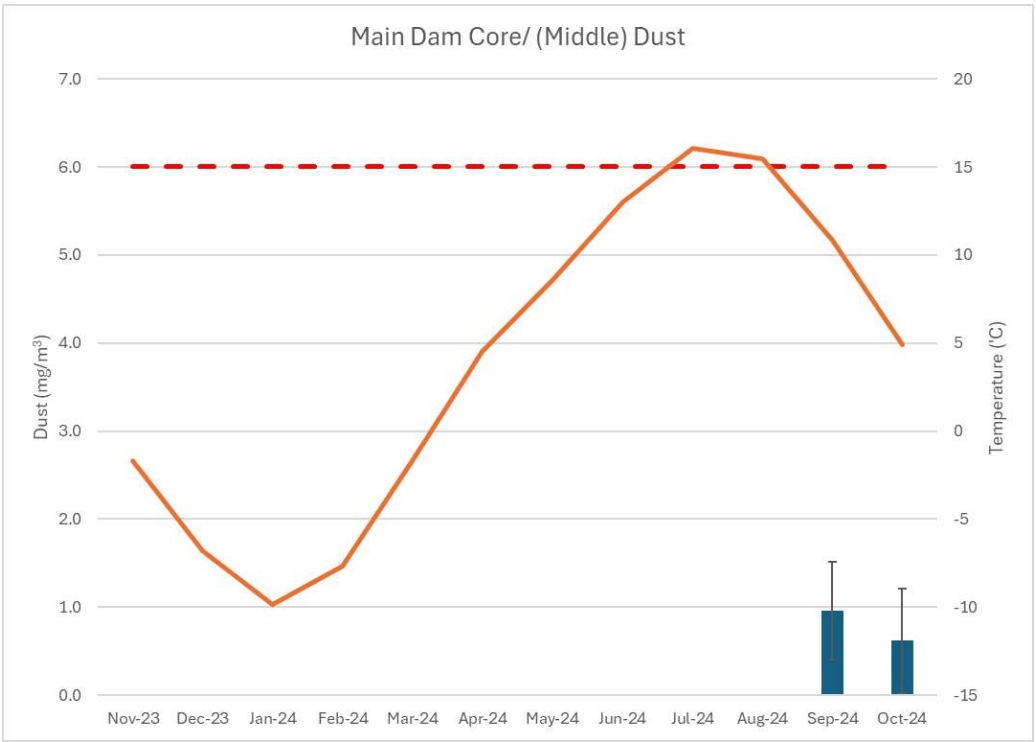


Figure 2-21 - Main Dam Core Silicon Dioxide



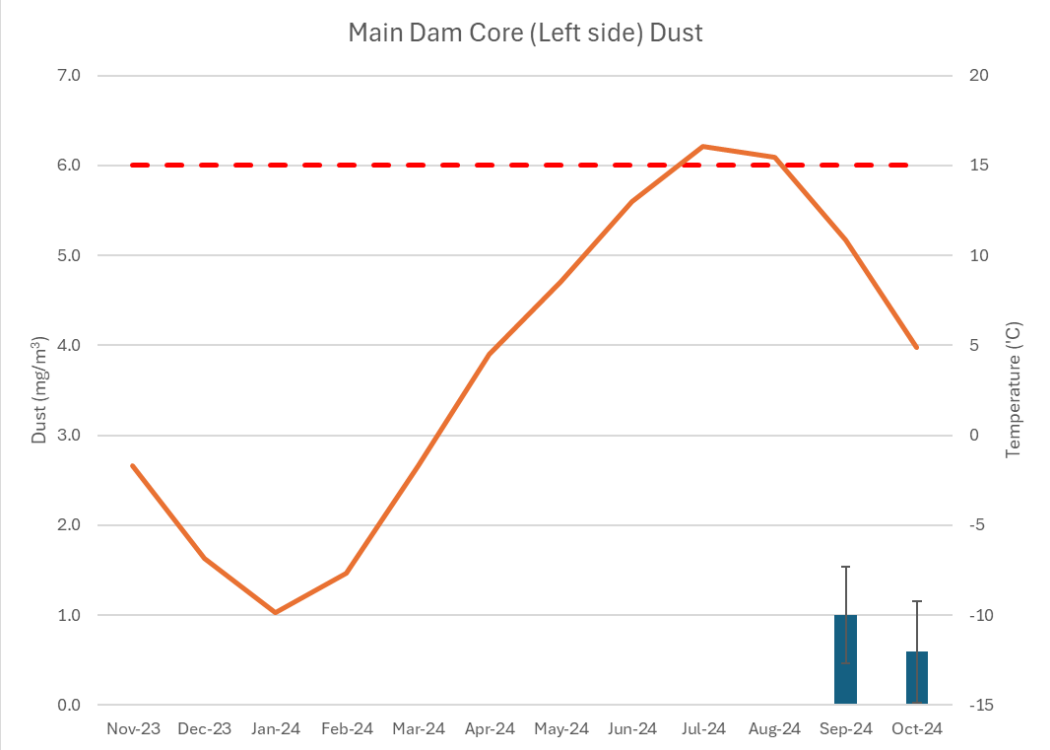
Main Dam Core (middle)

Figure 2-22 - Main Dam Core (Middle) Dust



Main Dam Core (left side)

Figure 2-23 - Main Dam Core (Left Side) Dust



Quarry No. 26

Figure 2-24 - Quarry No. 26 Sulfur Dioxide

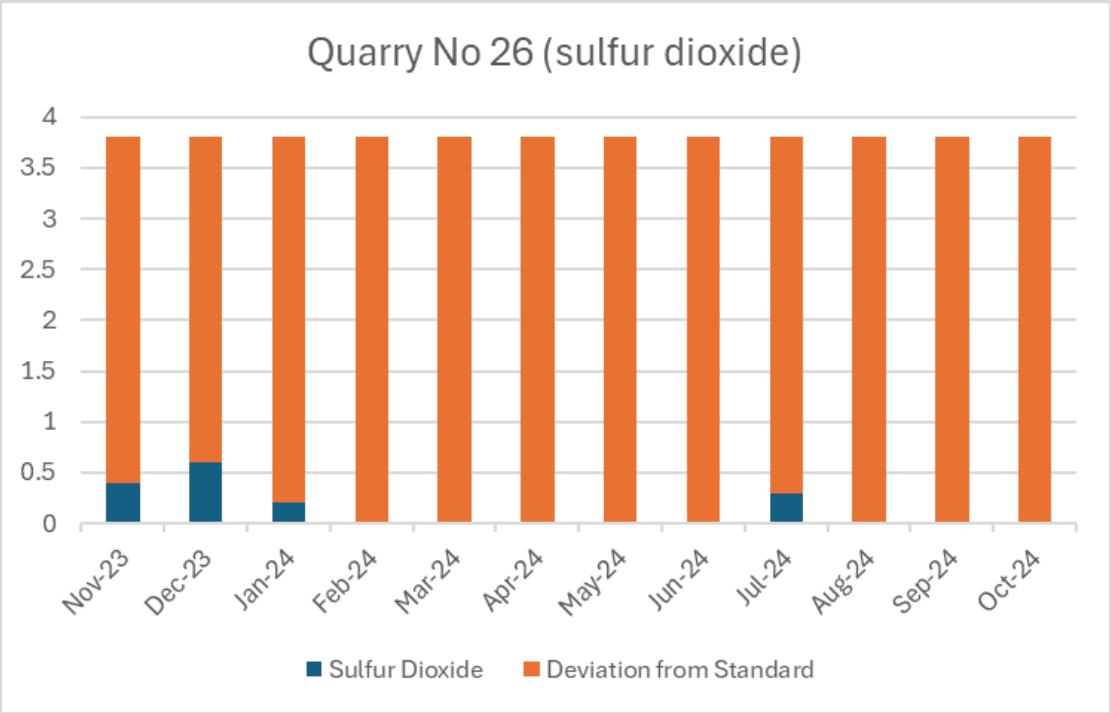


Figure 2-25 - Quarry No. 26 Hydrogen Sulfide

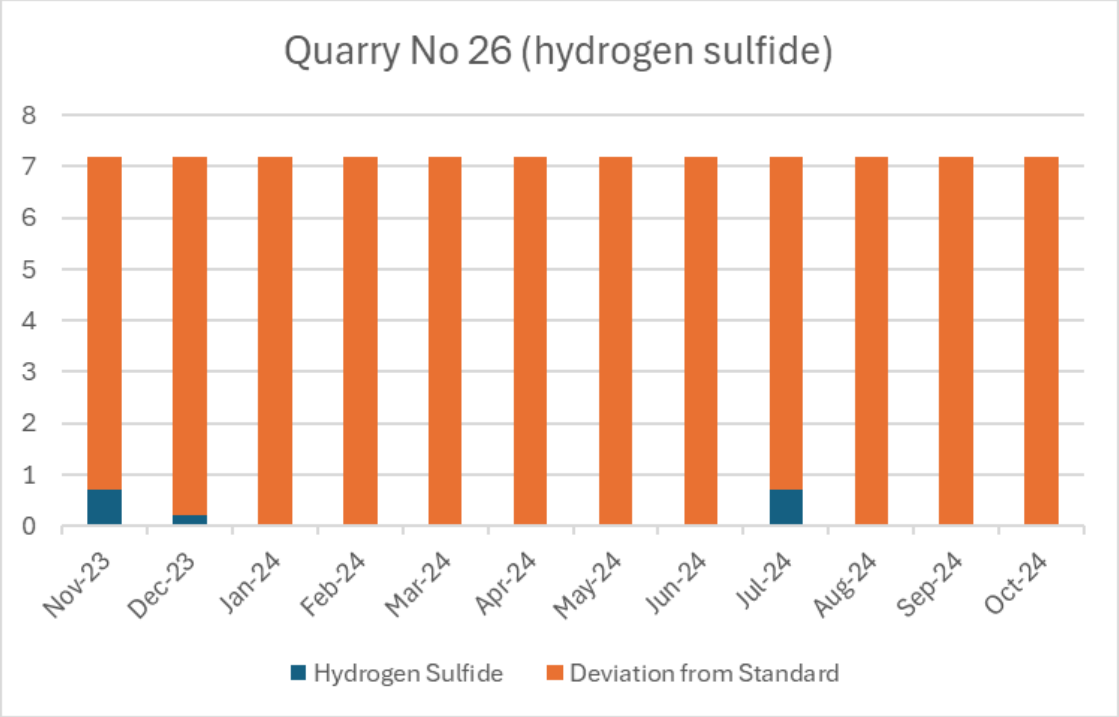
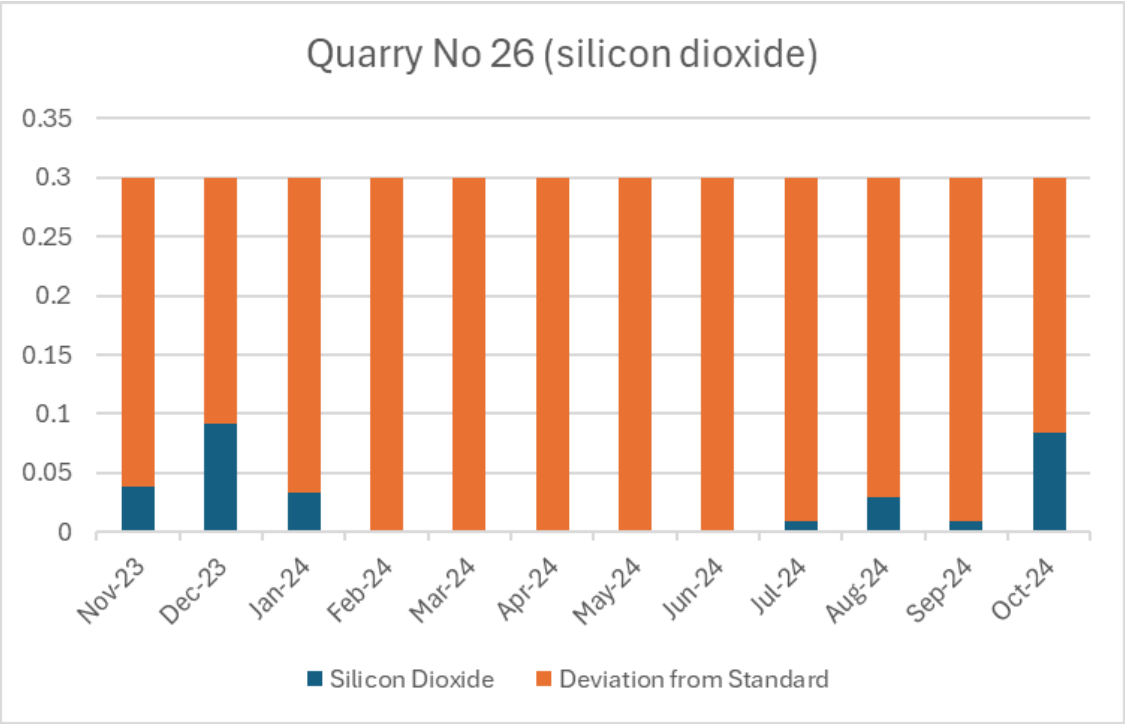


Figure 2-26 - Quarry No. 26 Silicon Dioxide



GG2

Figure 2-27 - GG2 Carbon Monoxide

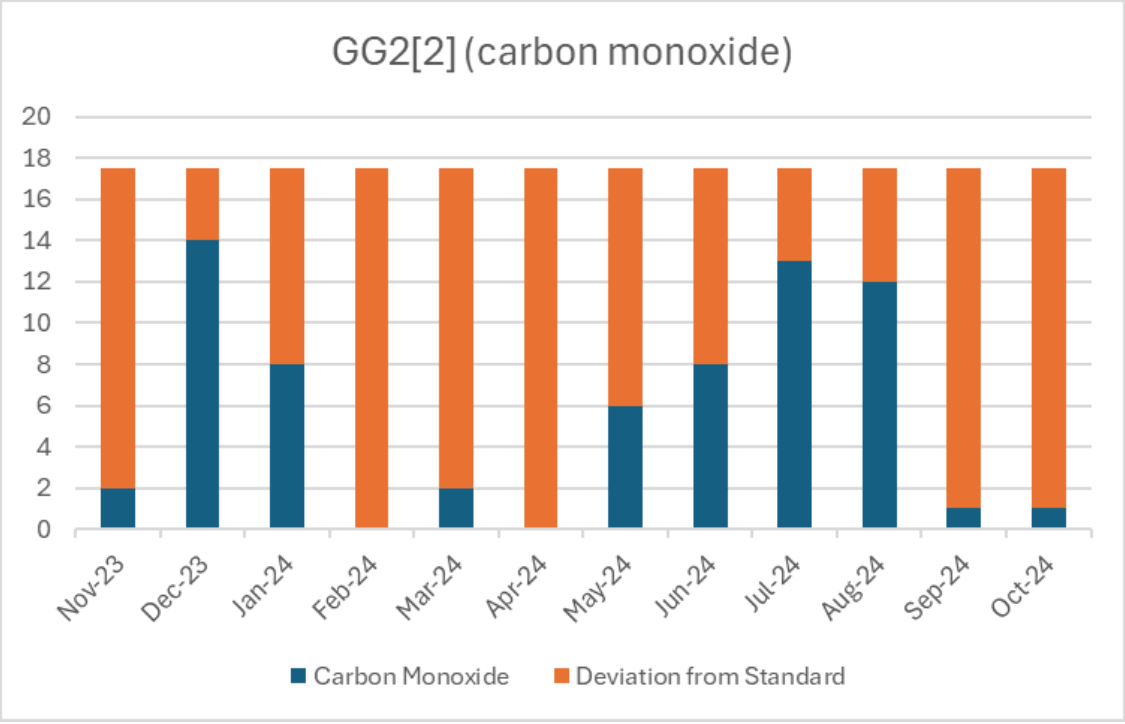


Figure 2-28 - GG2 Nitrogen Dioxide

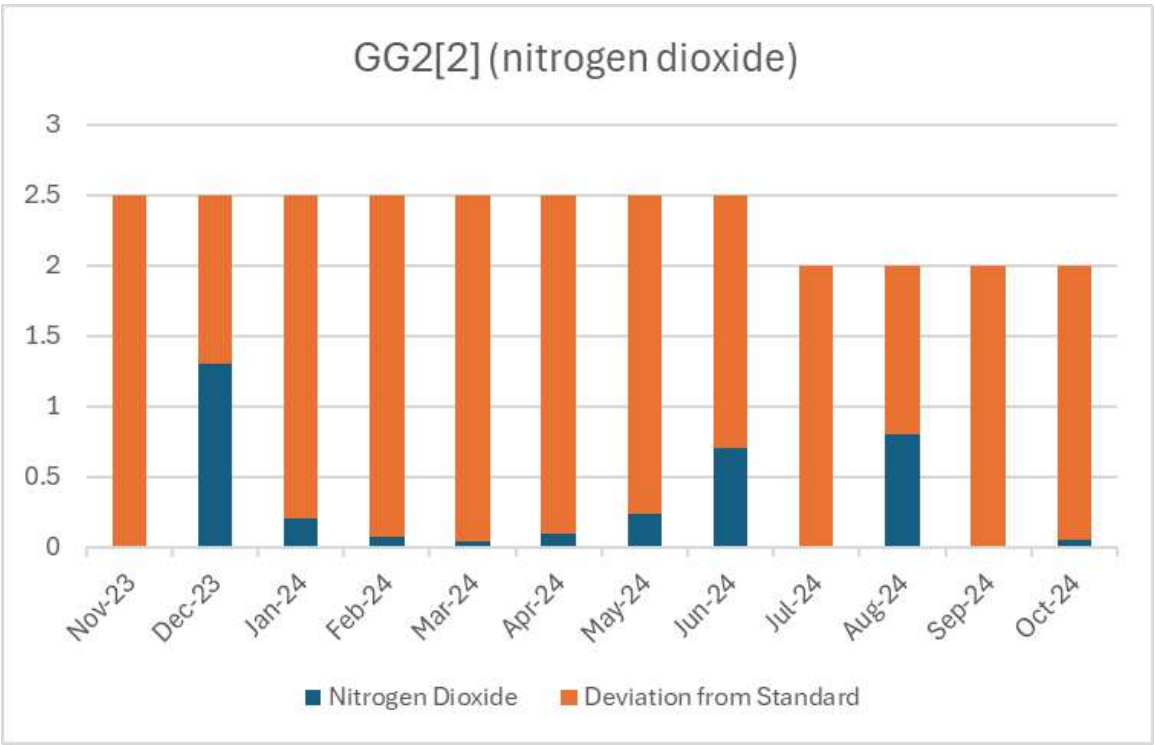


Figure 2-29 - GG2 Nitrogen Oxide

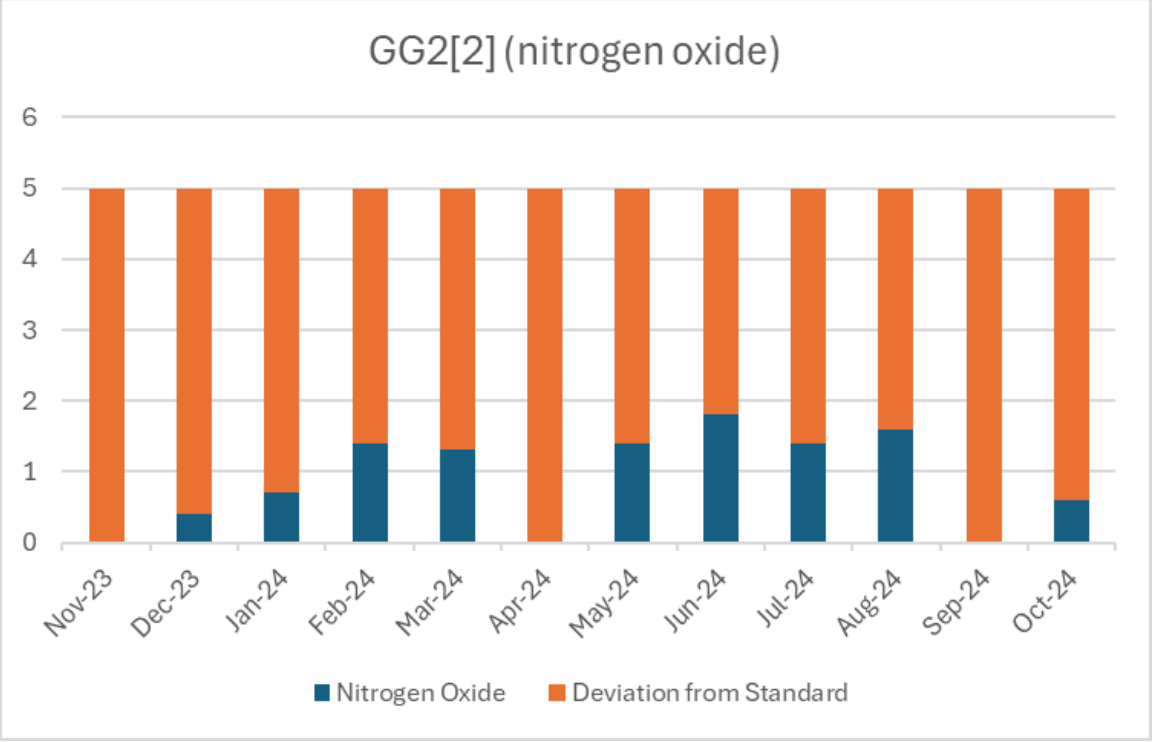


Figure 2-30 - GG2 Sulfur Dioxide

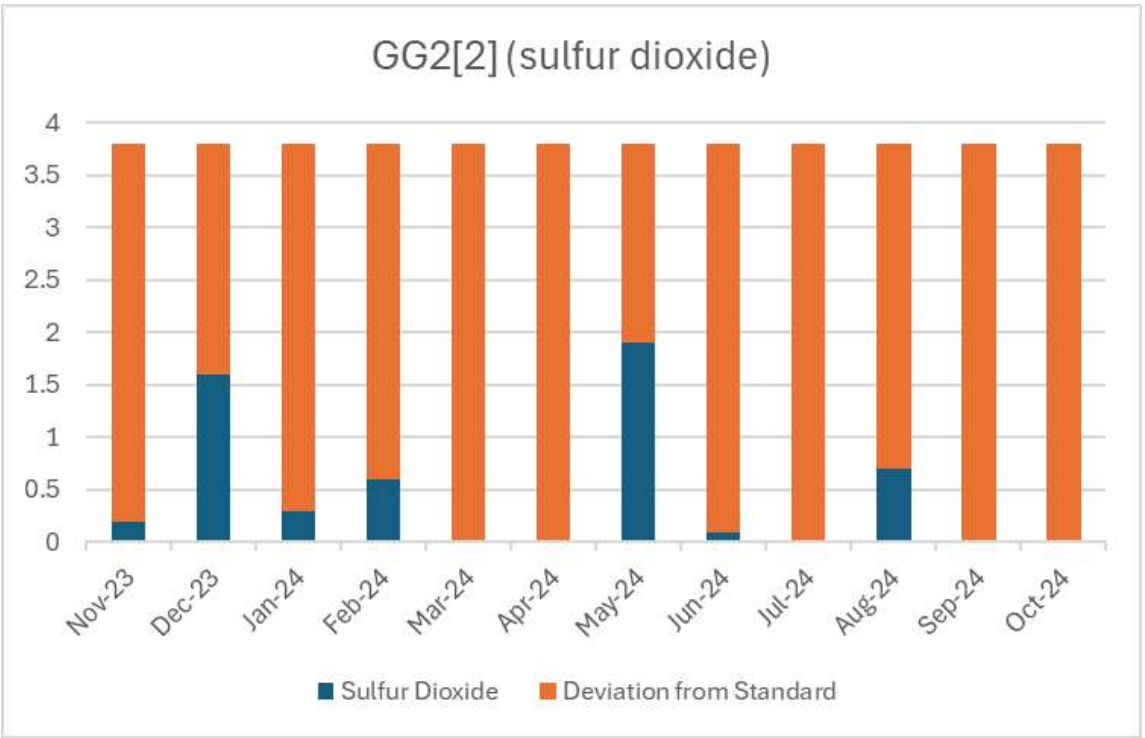


Figure 2-31 - GG2 Hydrogen Sulfide

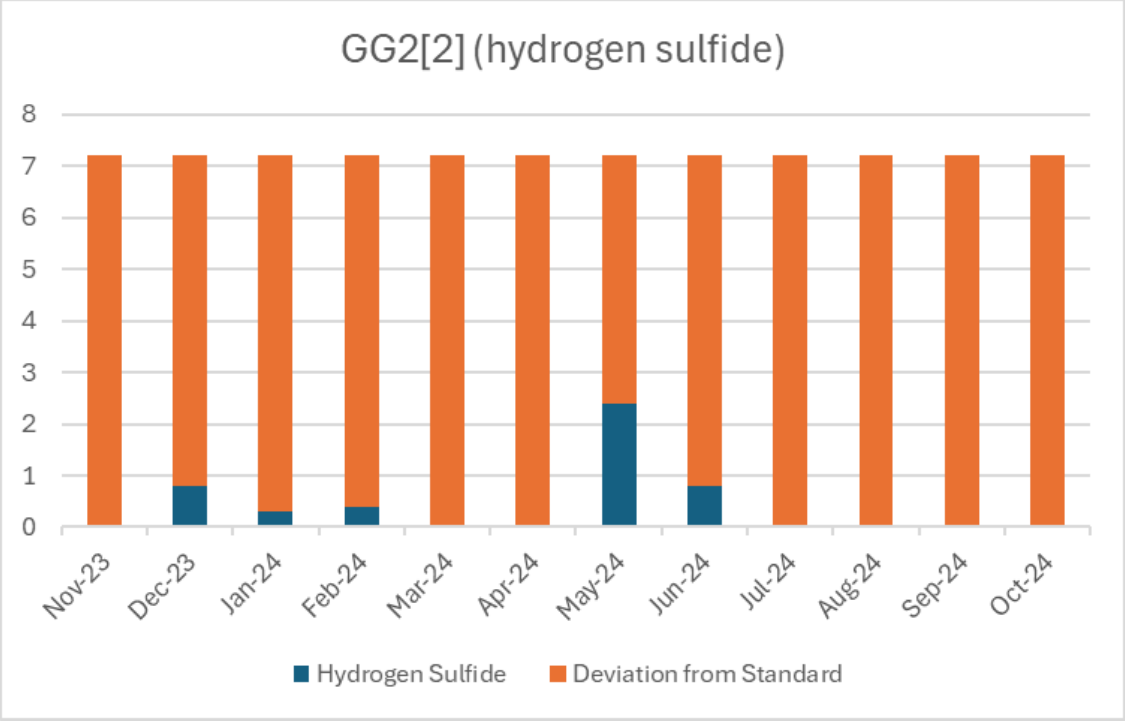


Figure 2-32 - GG2 Methane

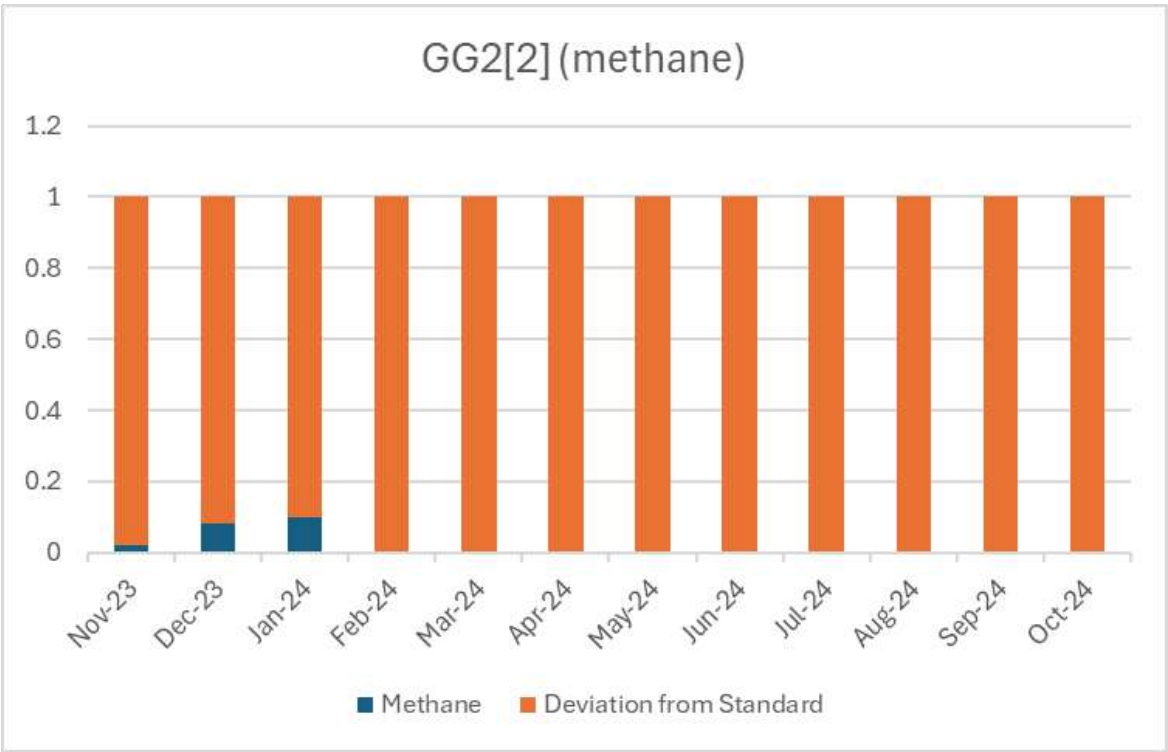
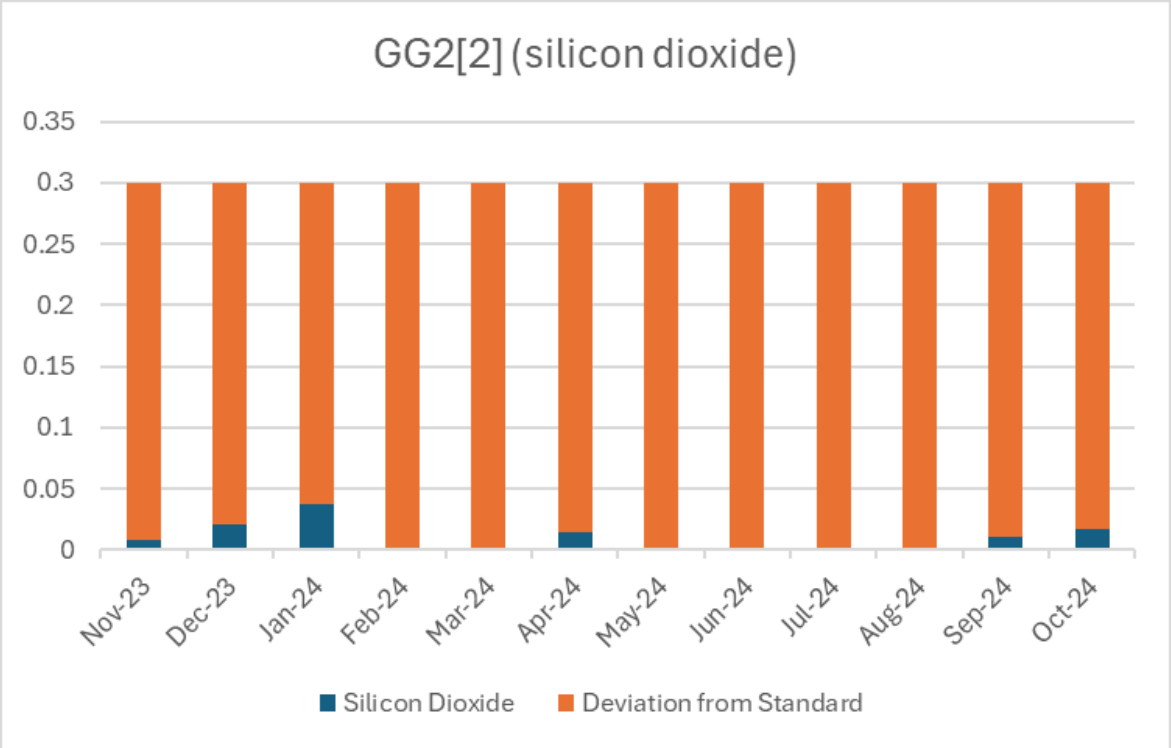


Figure 2-33 - GG2 Silicon Dioxide



Asphalt Plant

Figure 2-34 - Asphalt Plant Nitrogen Dioxide

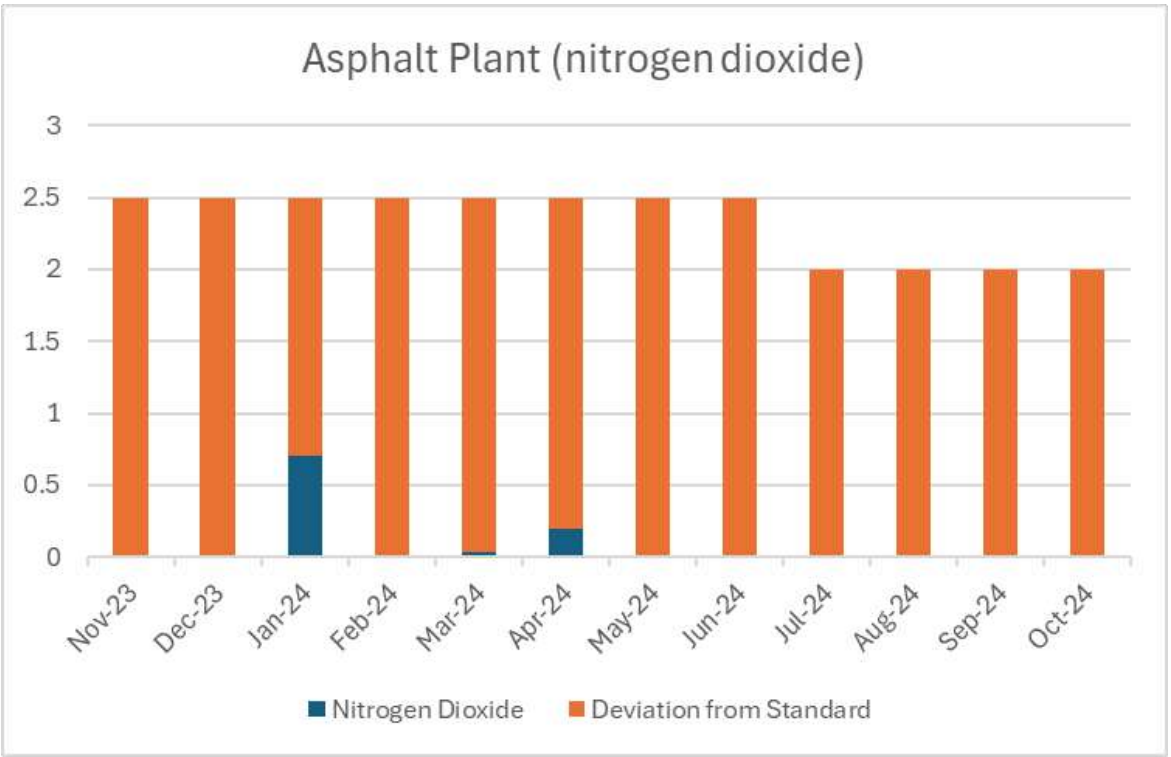


Figure 2-35 - Asphalt Plant Sulfur Dioxide

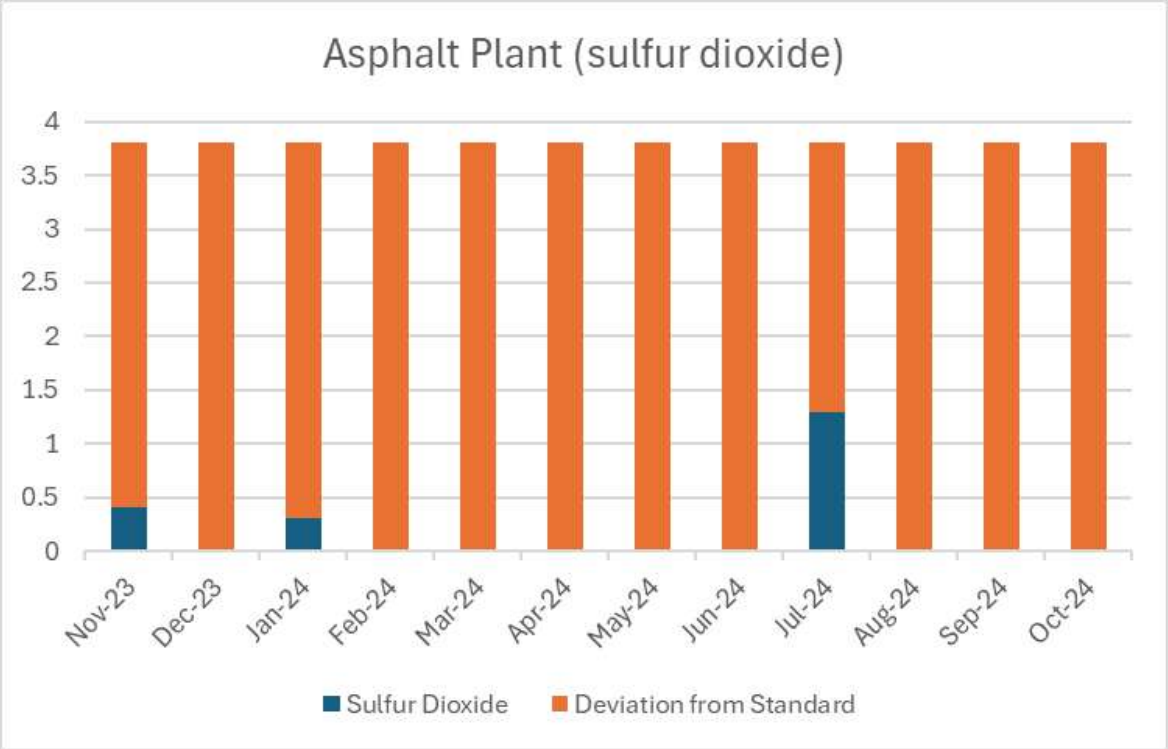
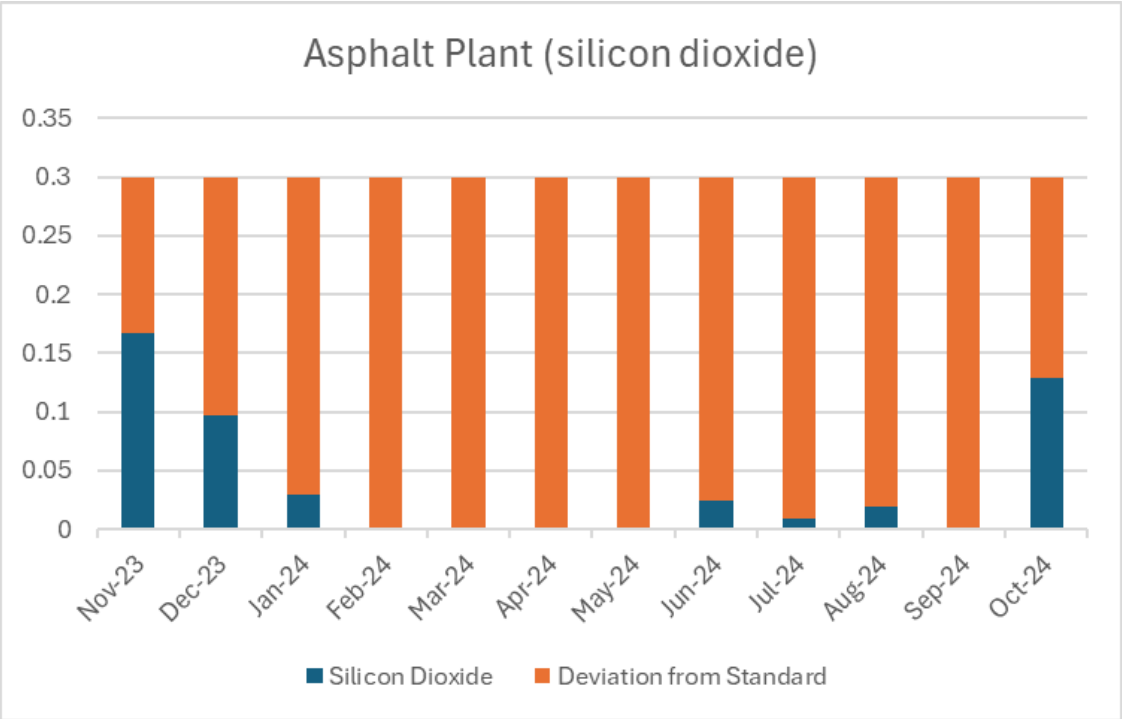


Figure 2-36 - Asphalt Plant Silicon Dioxide



CP-2

Figure 2-37 - CP-2 Sulfur Dioxide

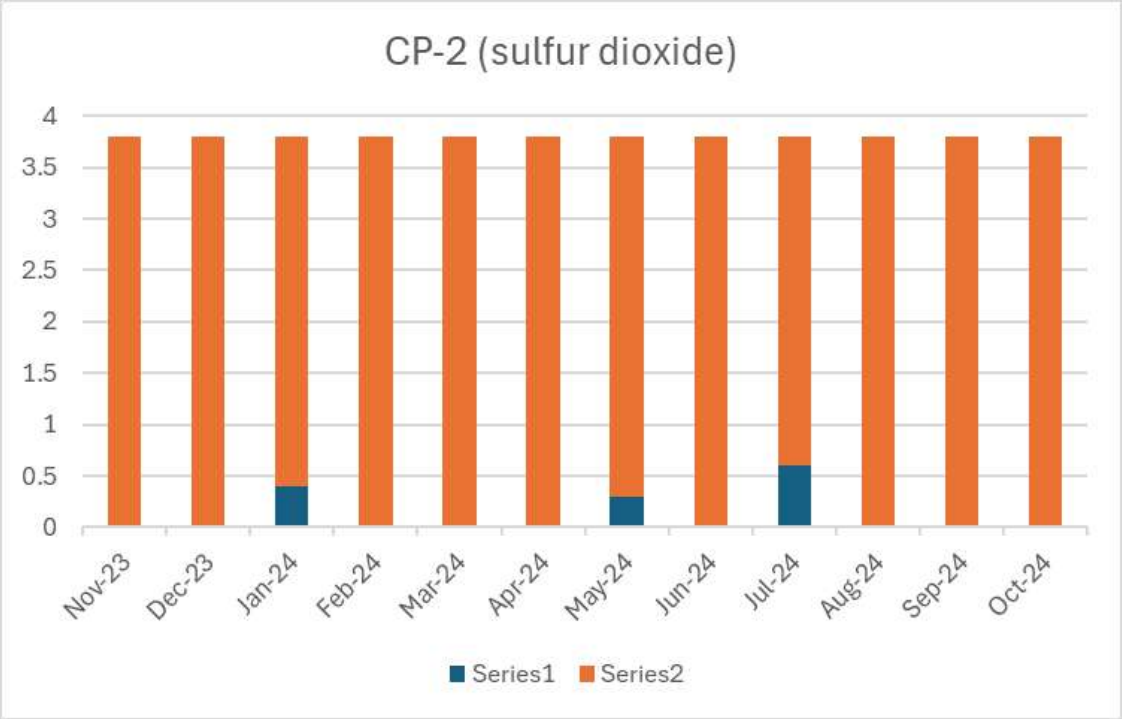
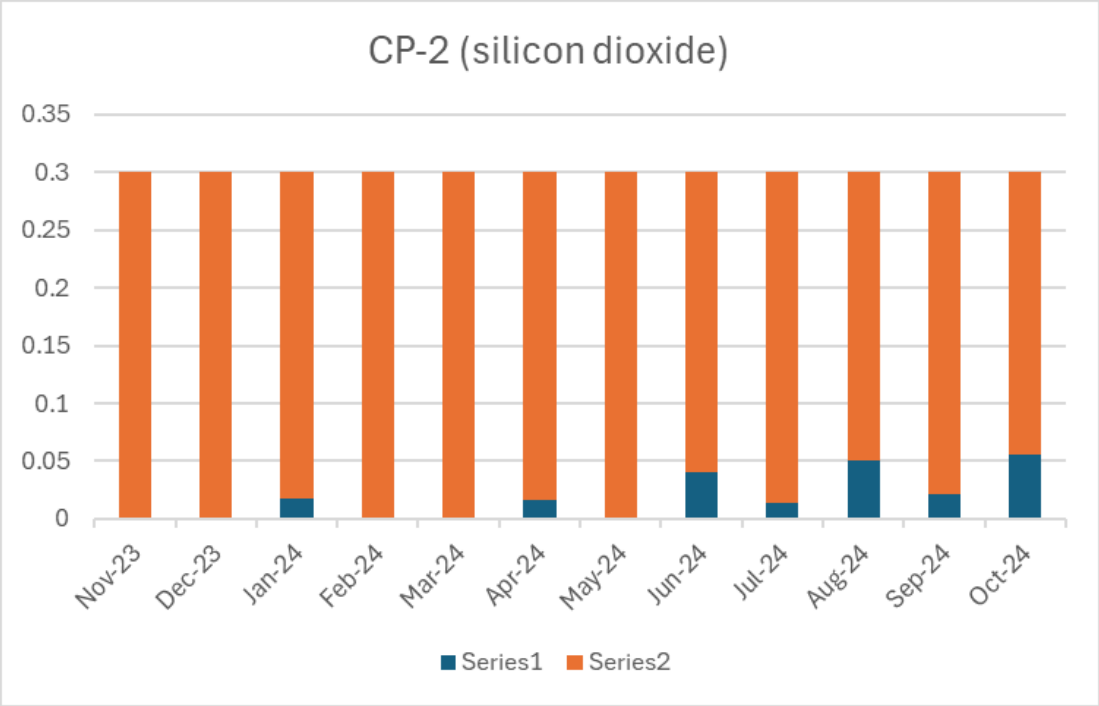
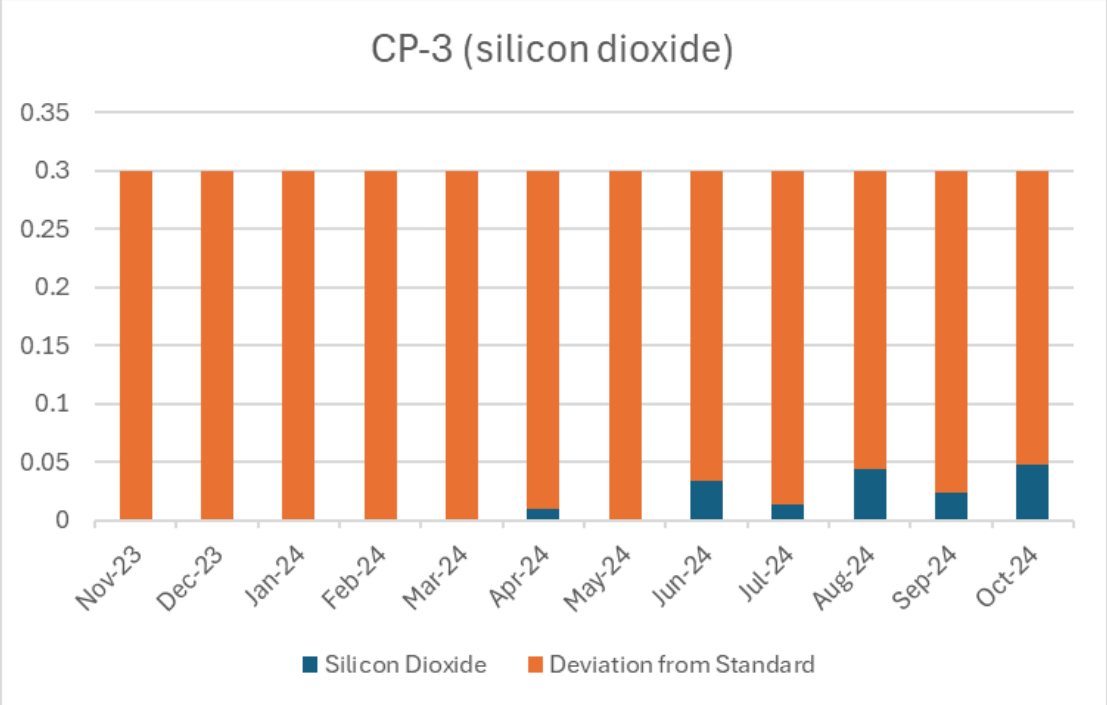


Figure 2-38 - CP-2 Silicon Dioxide



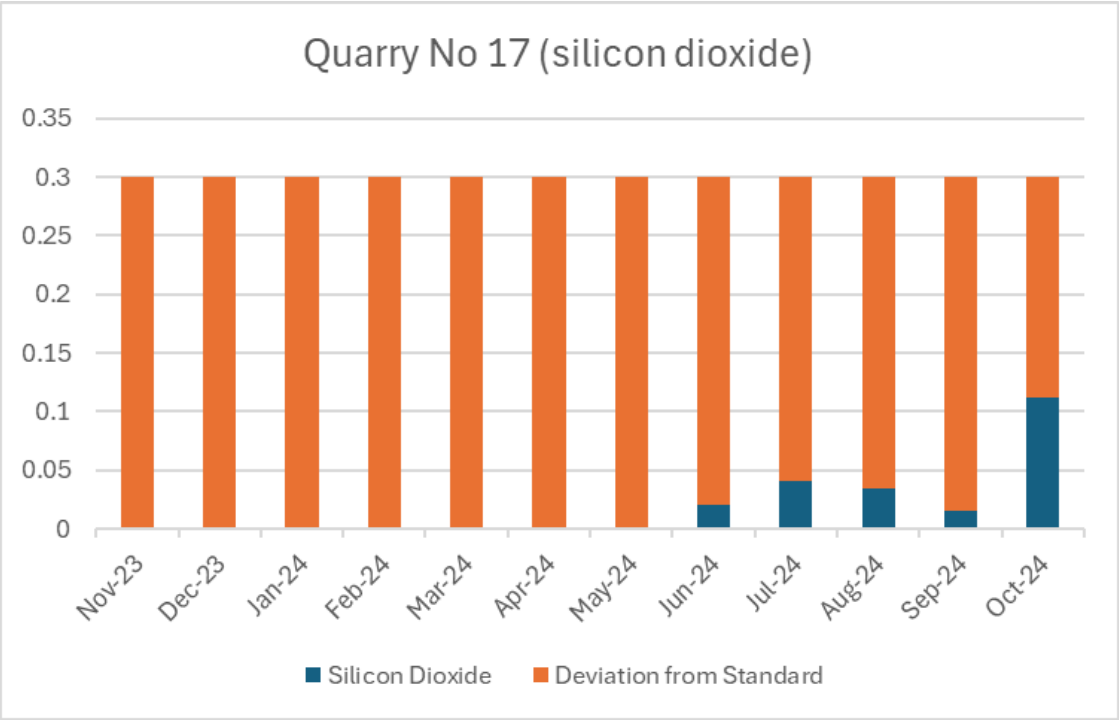
CP-3

Figure 2-39 - CP-2 Silicon Dioxide



Quarry No. 17

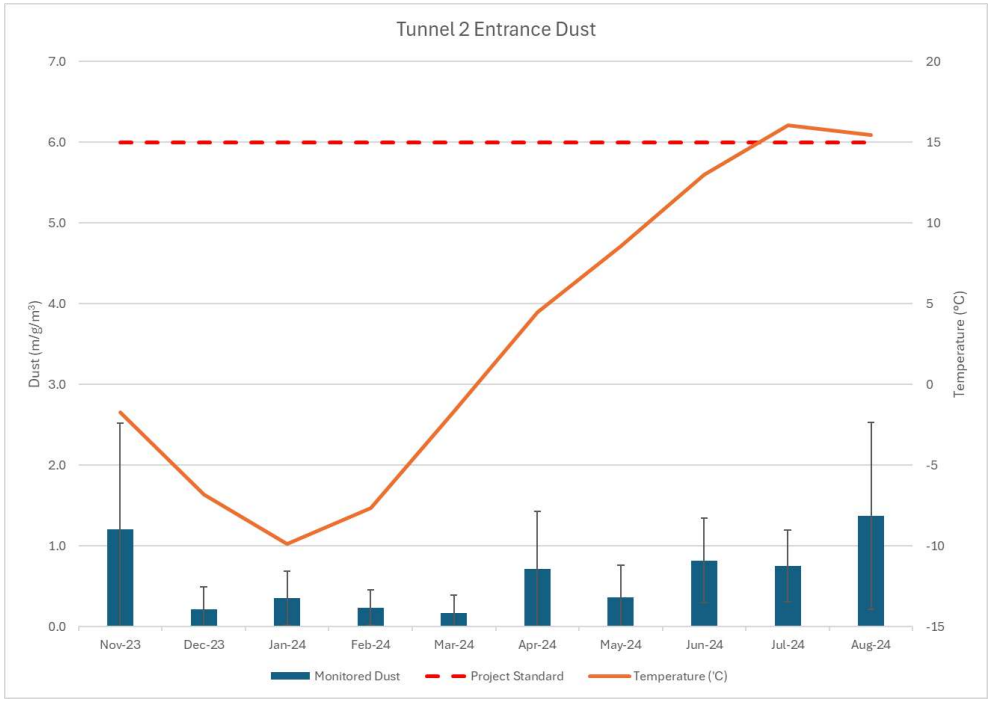
Figure 2-40 - Quarry No. 17 Silicon Dioxide



Indoor Monitoring Sites

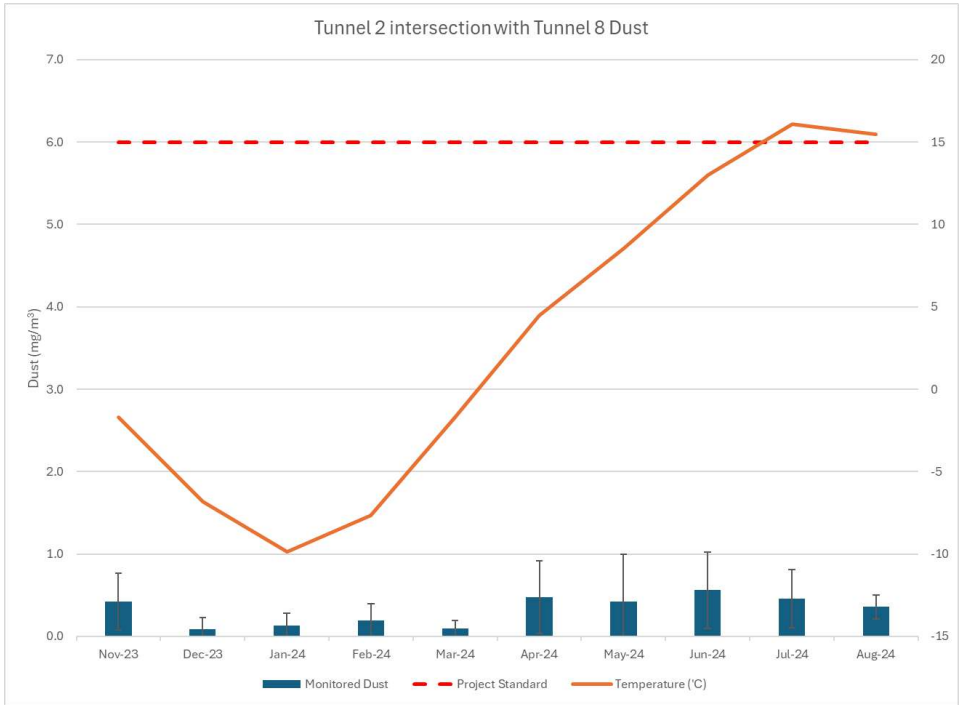
Tunnel 2 Entrance

Figure 2-41 - Tunnel 2 Entrance Dust



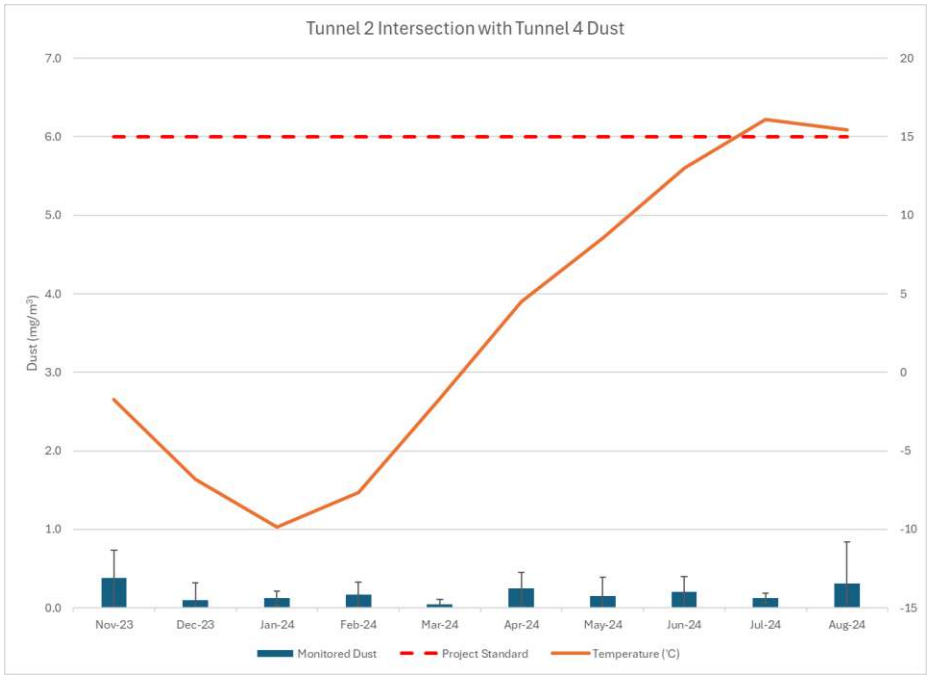
Tunnel 2 Intersection with Tunnel 8

Figure 2-42 - Intersection with Tunnel 8 Dust



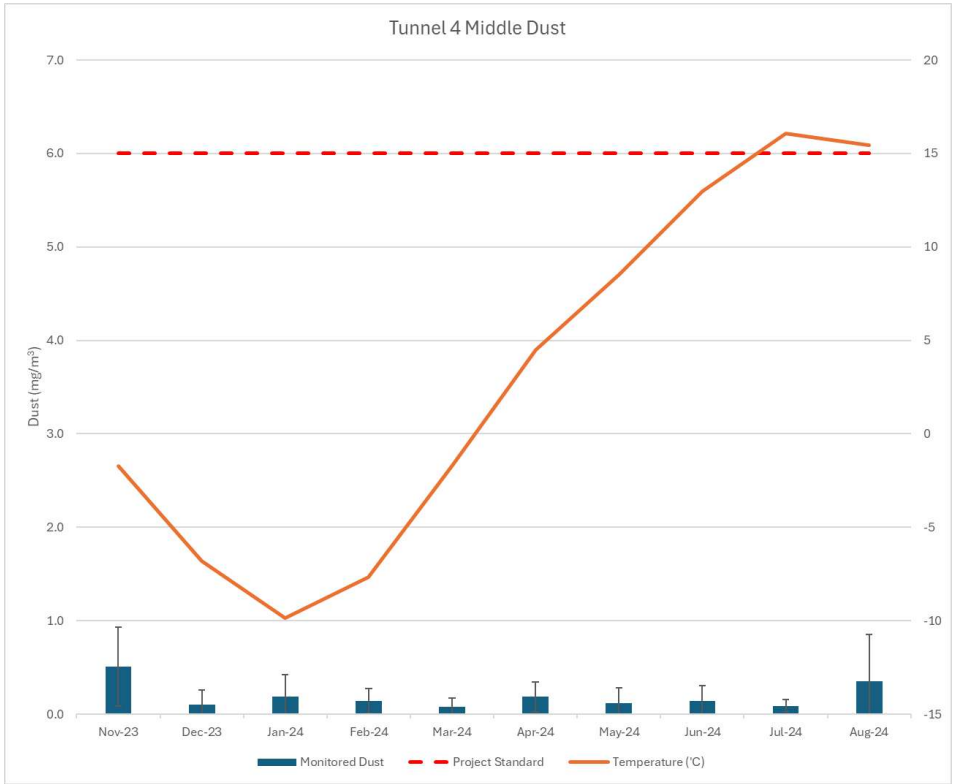
Tunnel 2 Intersection with Tunnel 4

Figure 2-43 - Intersection with Tunnel 4) Dust



Tunnel 4 Middle

Figure 2-44 - Tunnel 4 Middle Dust



Entrance of Tunnel 4

Figure 2-45 - Tunnel 4 Entrance Dust

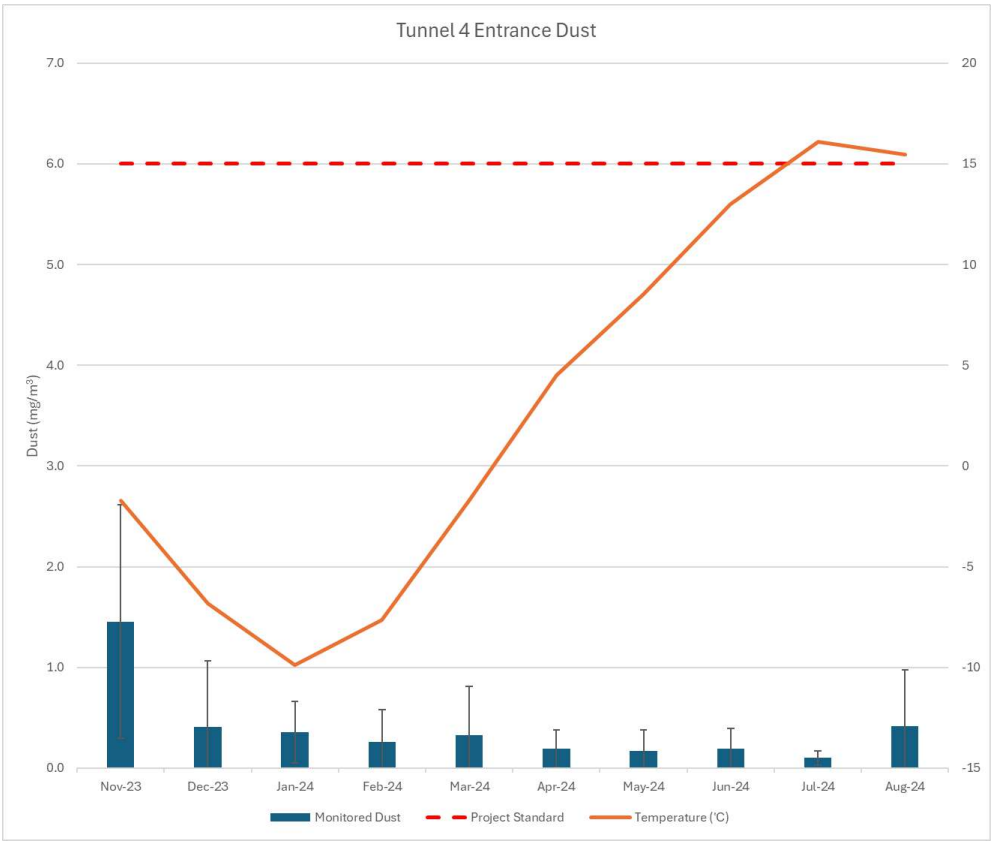


Figure 2-46 -Tunnel 4 Entrance Carbon Monoxide

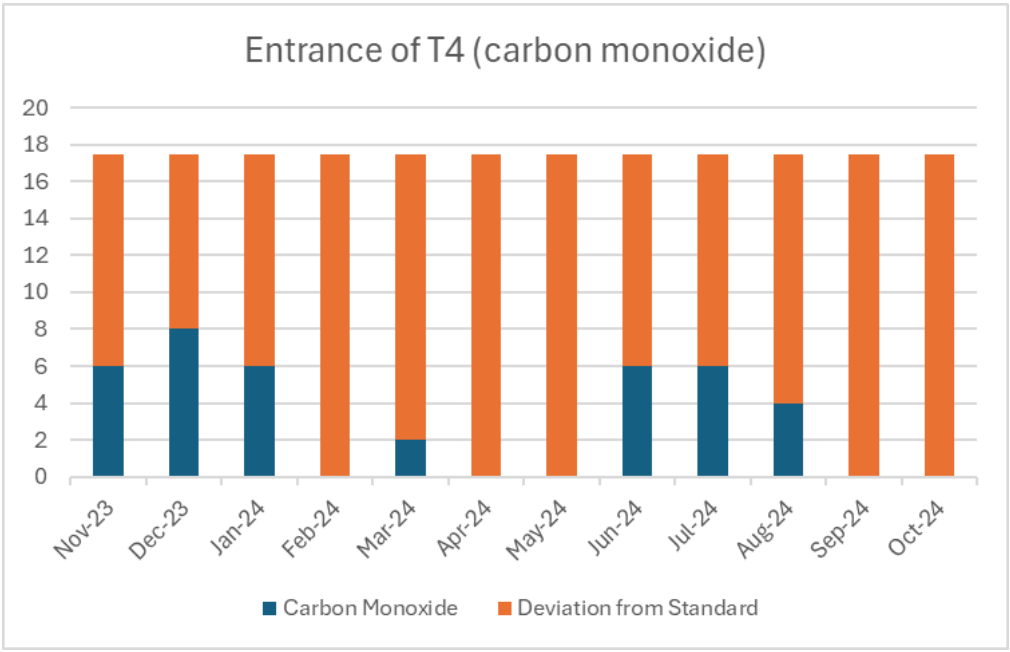


Figure 2-47 - Tunnel 4 Entrance Nitrogen Dioxide

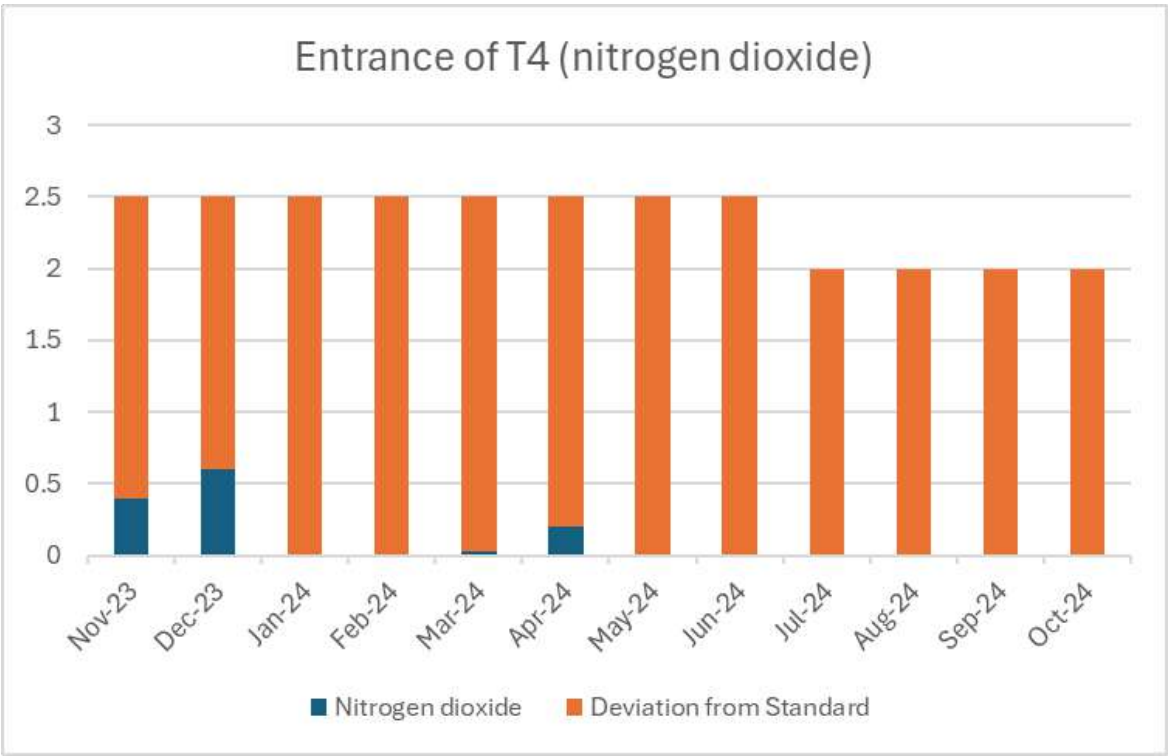


Figure 2-48 - Tunnel 4 Entrance Nitrogen Oxide

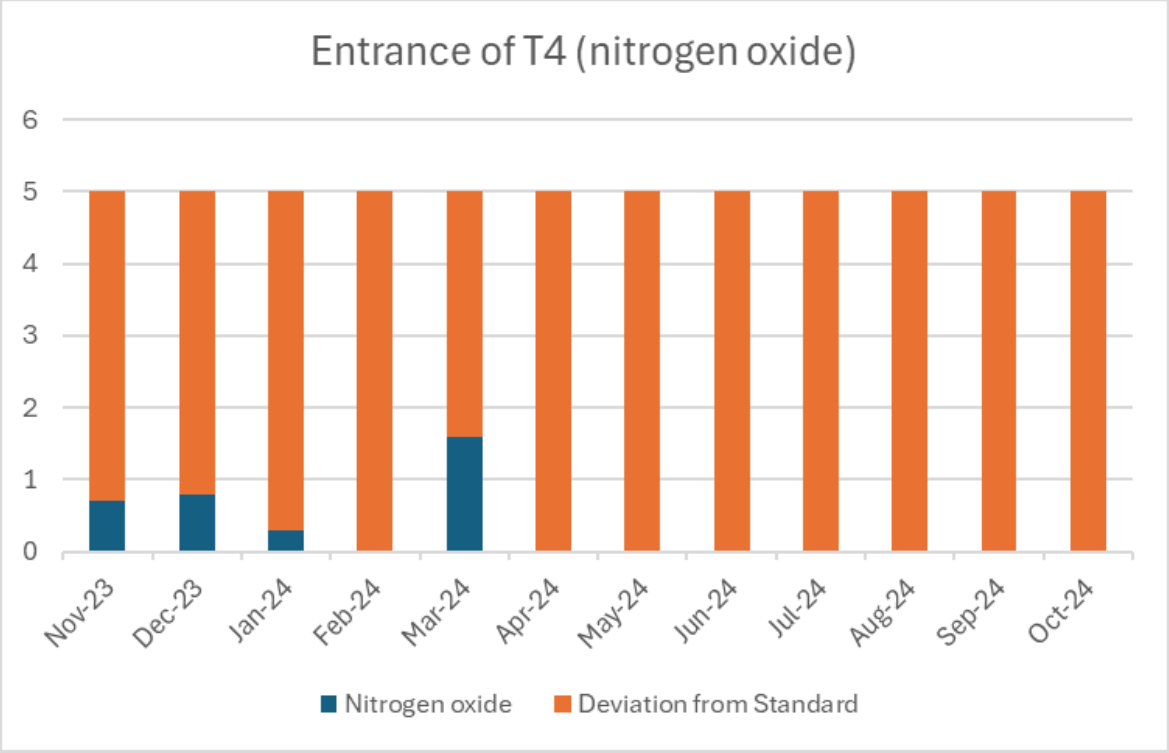


Figure 2-49 - Tunnel 4 Entrance Sulfur Dioxide

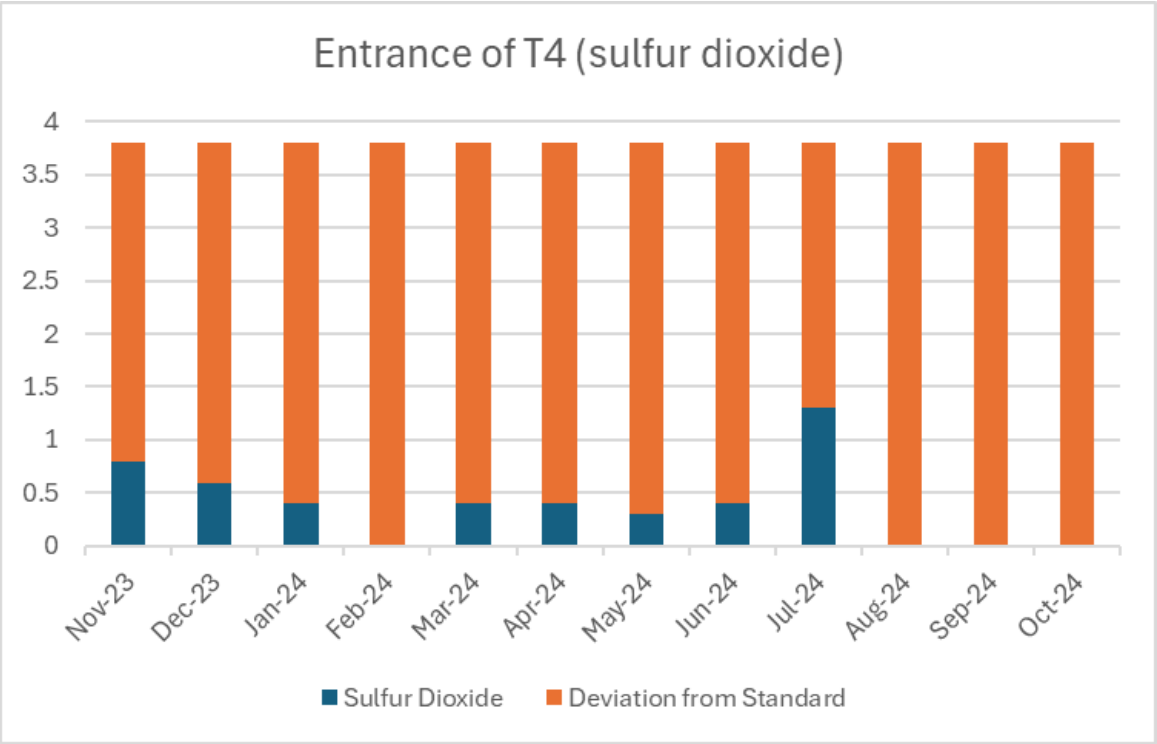


Figure 2-50 - Tunnel 4 Entrance Hydrogen Sulfide

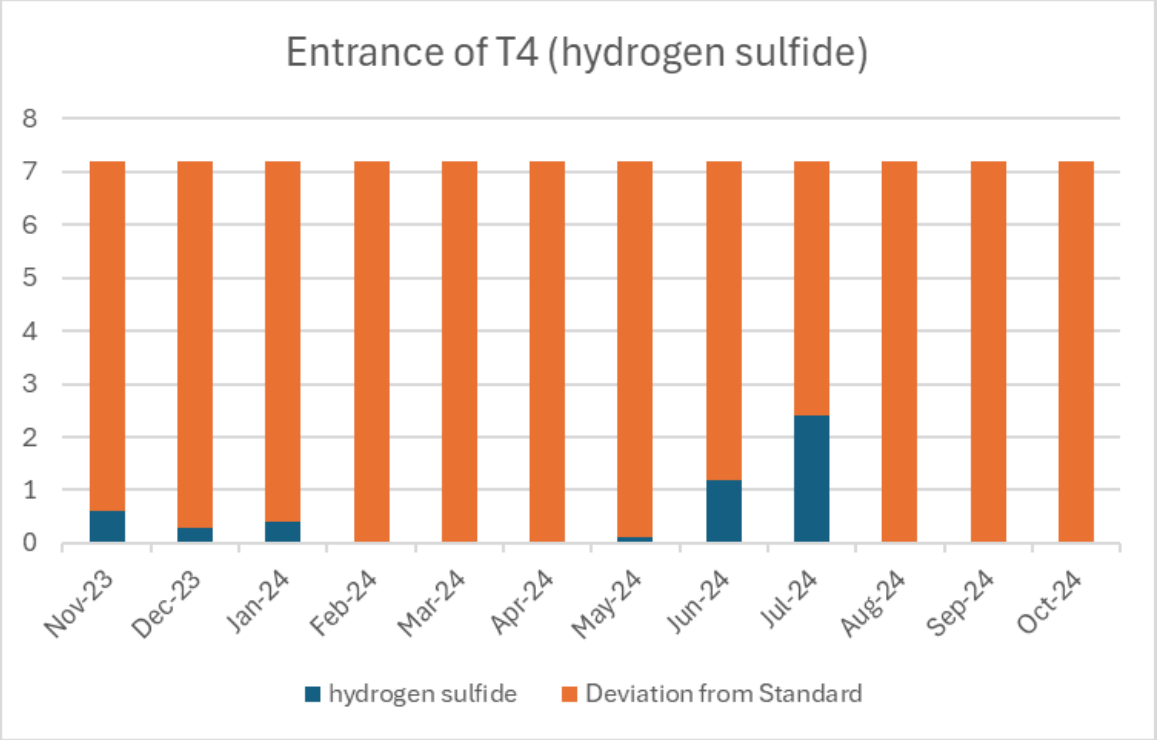


Figure 2-51 - Tunnel 4 Entrance Methane

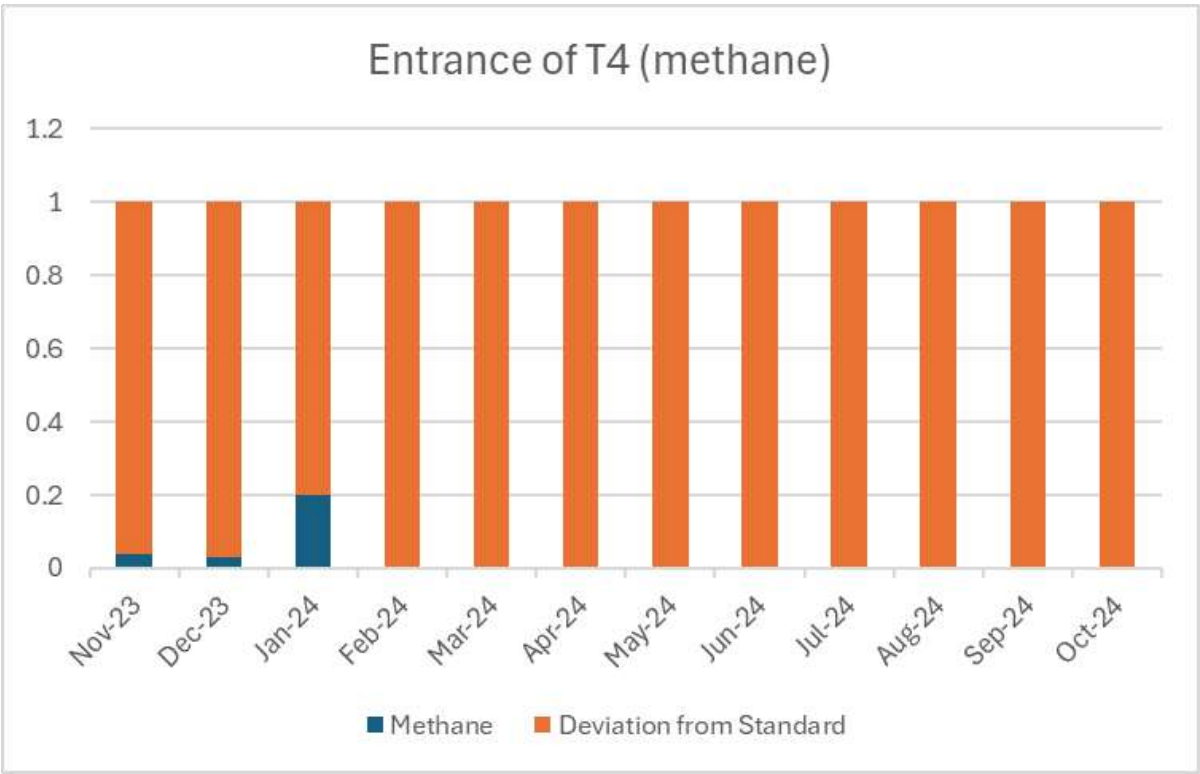
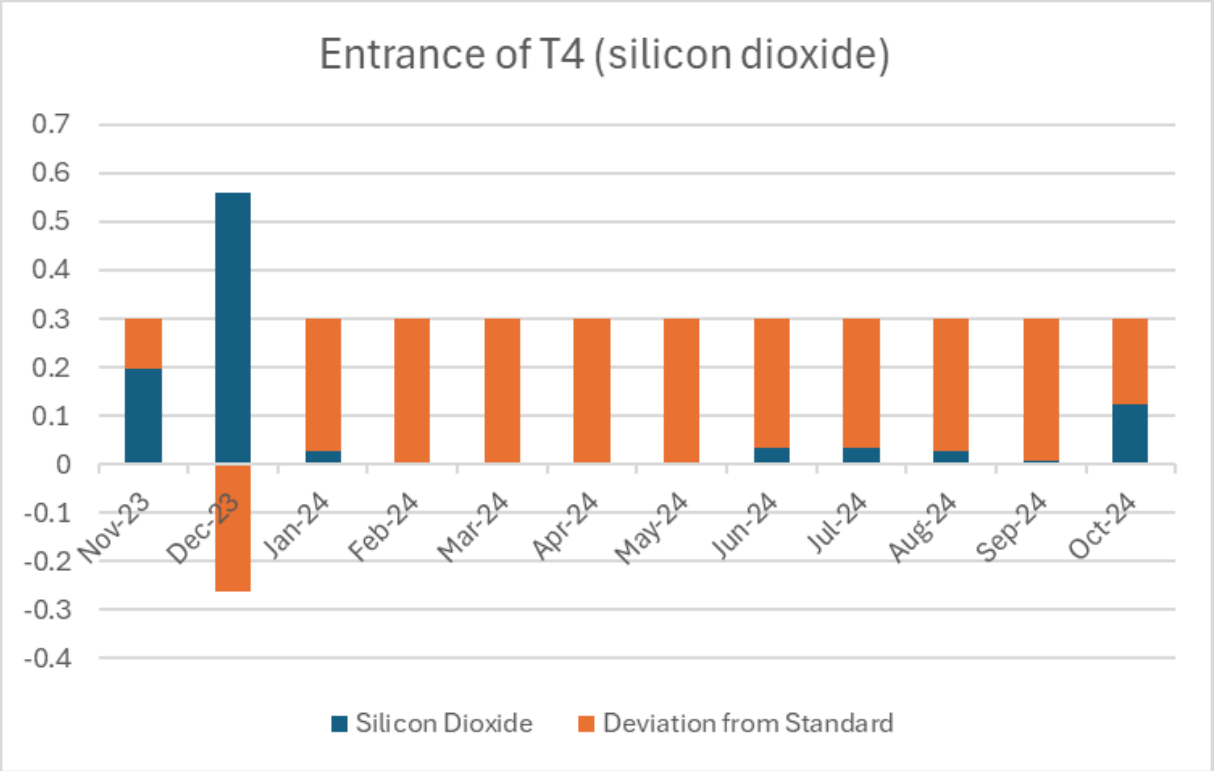
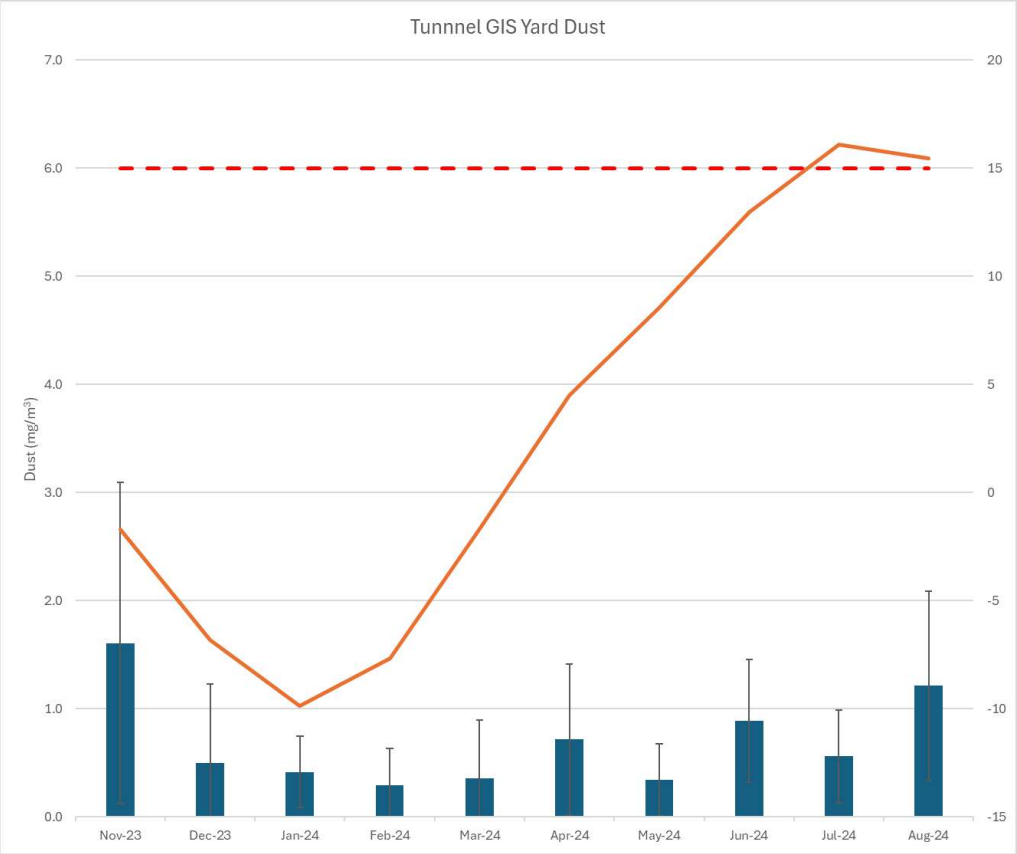


Figure 2-52 - Tunnel 4 Entrance Silicon Dioxide



Tunnel GIS Yard

Figure 2-53 - Tunnel GIS Yard Dust



Tunnel 3A

Figure 2-54 - Tunnel 3A Carbon Monoxide

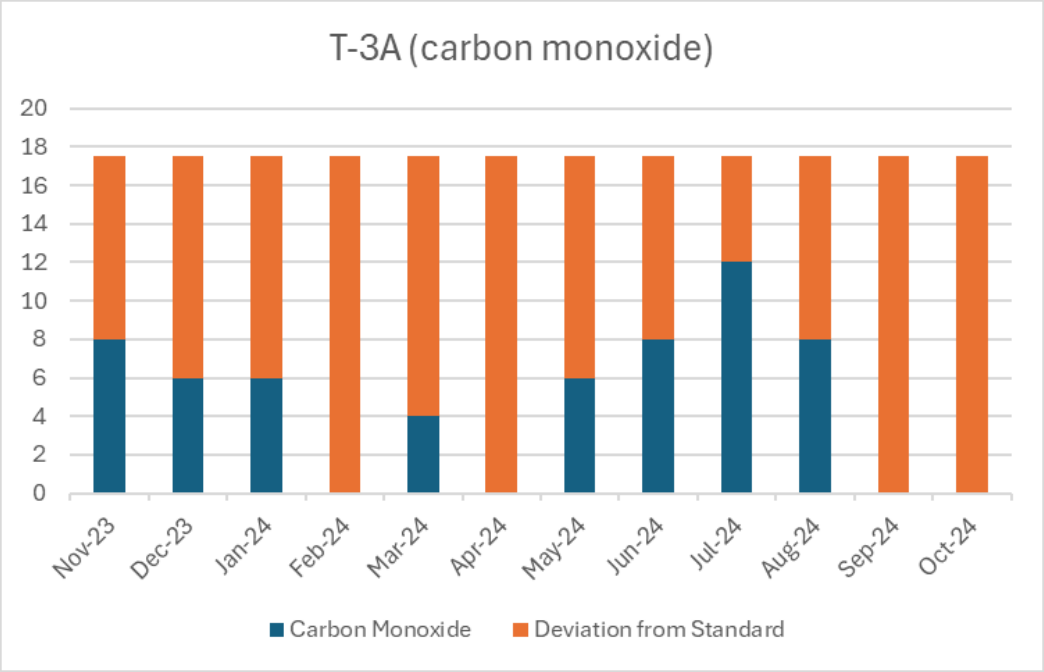


Figure 2-55 - Tunnel 3A Nitrogen Dioxide

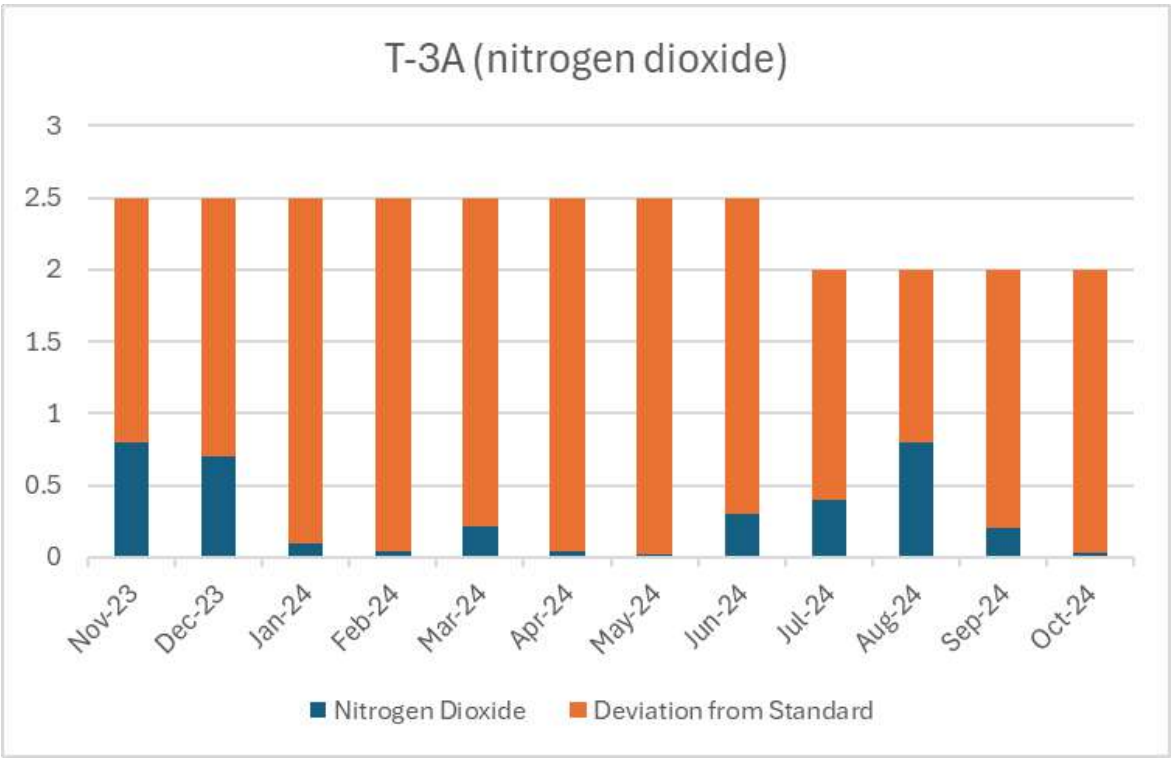


Figure 2-56 - Tunnel 3A Nitrogen Oxide

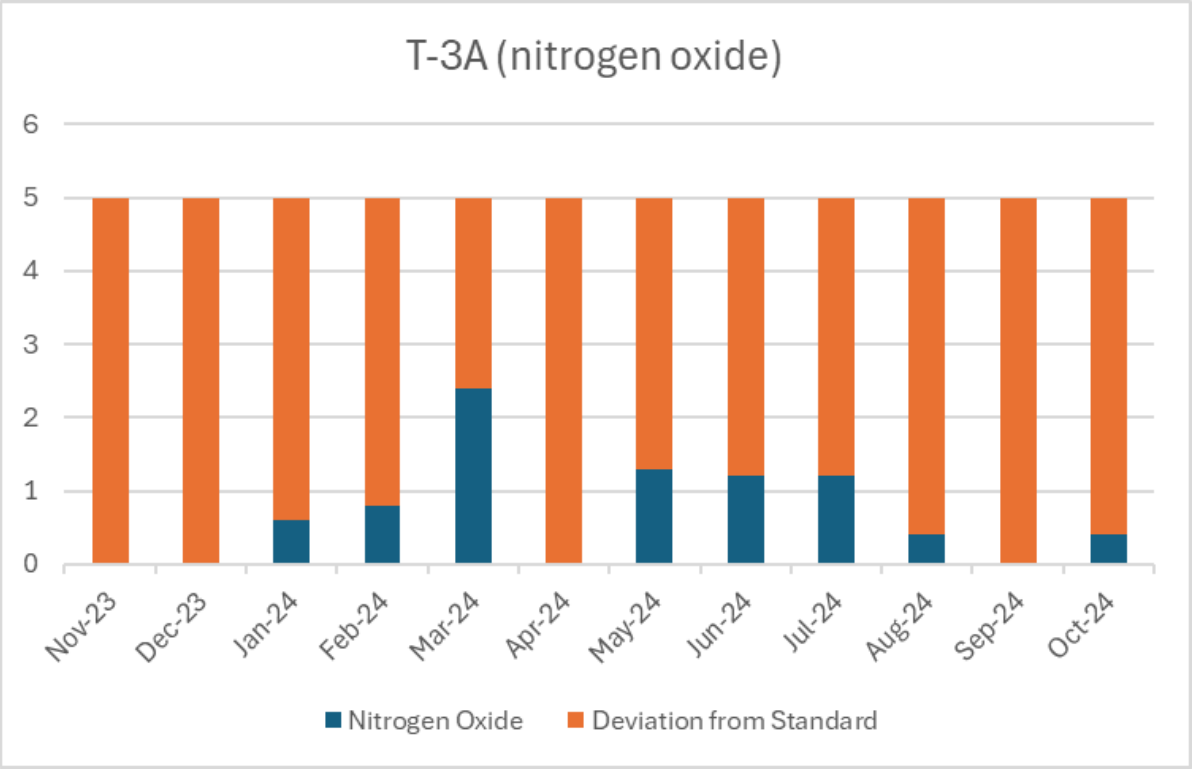


Figure 2-57 - Tunnel 3A Sulfur Dioxide

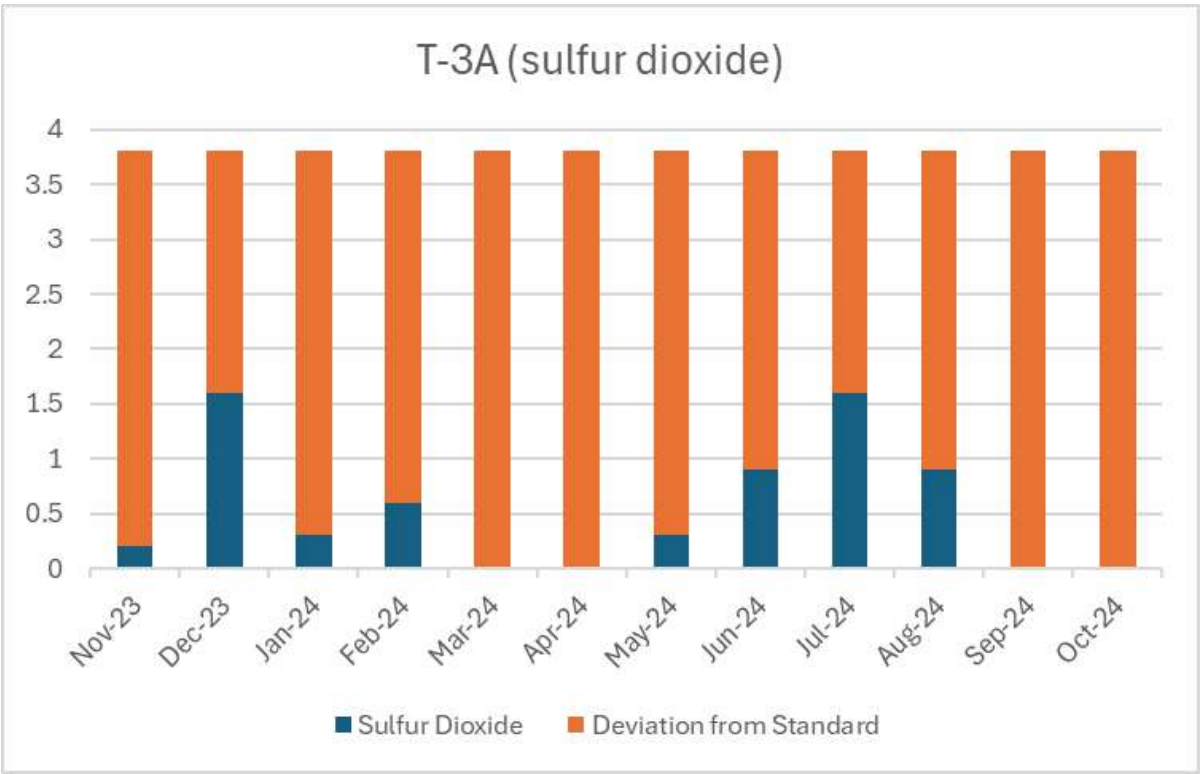


Figure 2-58 - Tunnel 3A Hydrogen Sulfide

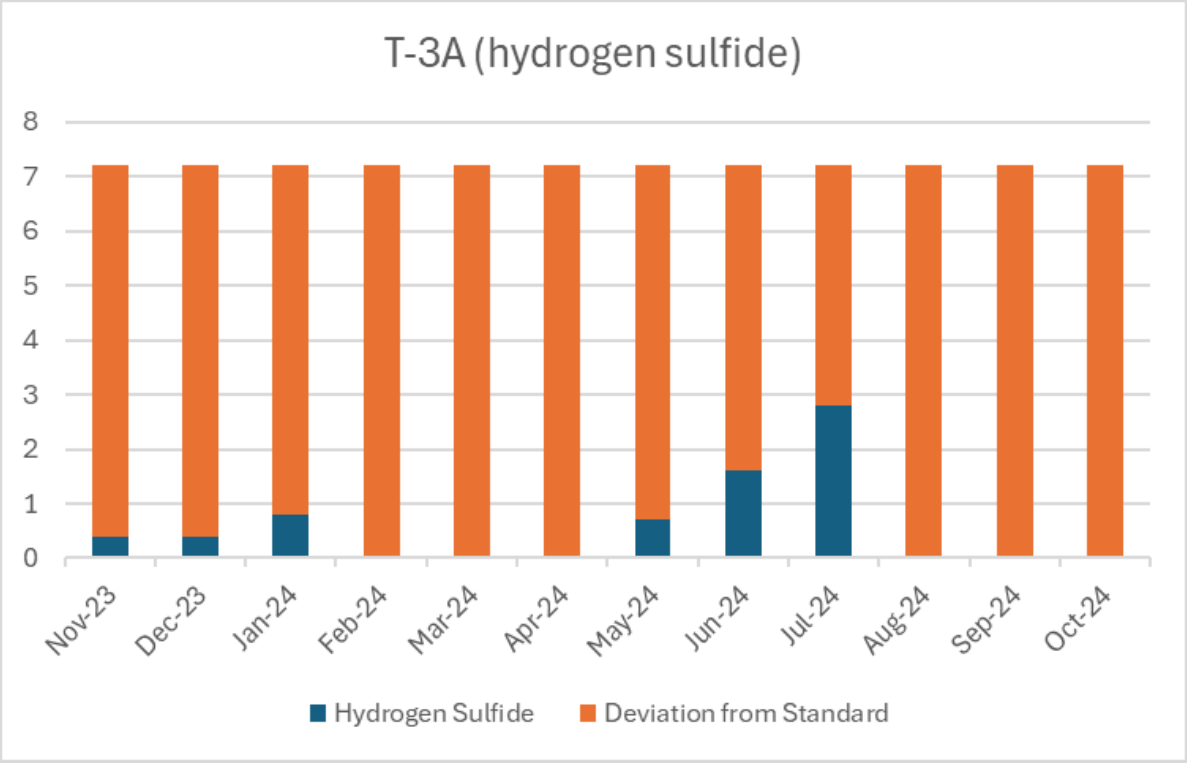


Figure 2-59 - Tunnel 3A Methane

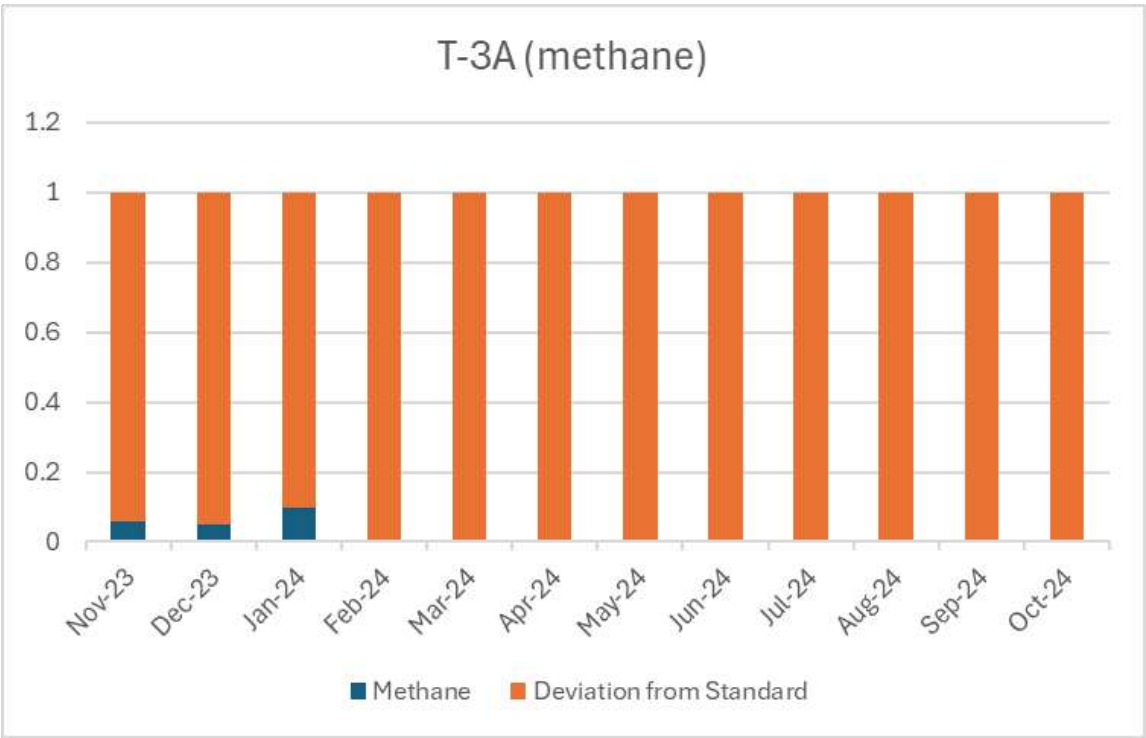
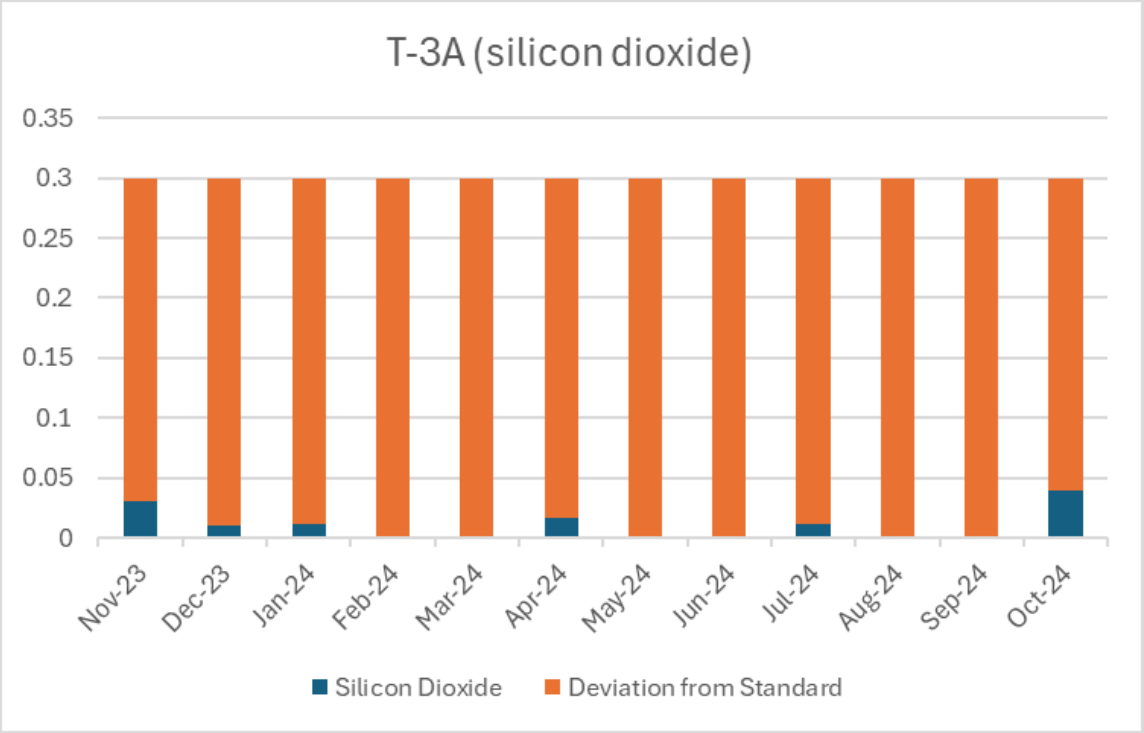


Figure 2-60 - Tunnel 3A Silicon Dioxide



Tunnel 22

Figure 2-61 - Tunnel 22 Carbon Monoxide

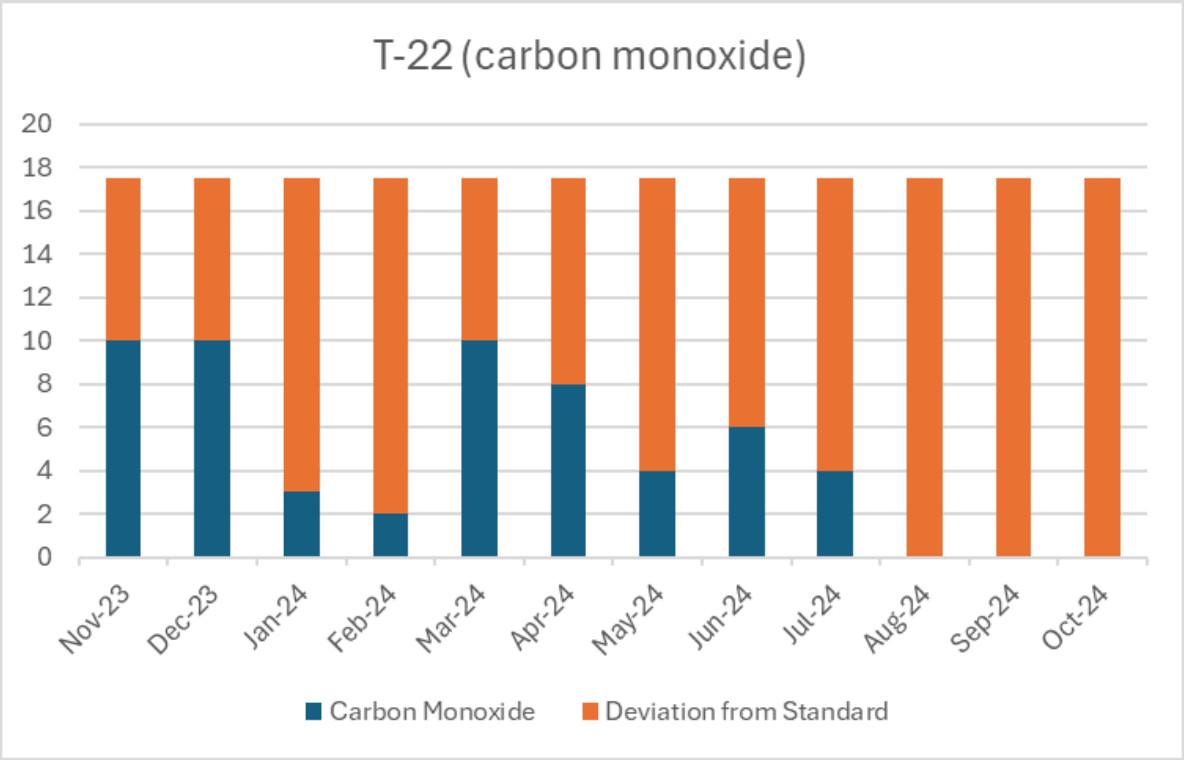


Figure 2-62 - Tunnel 22 Nitrogen Dioxide

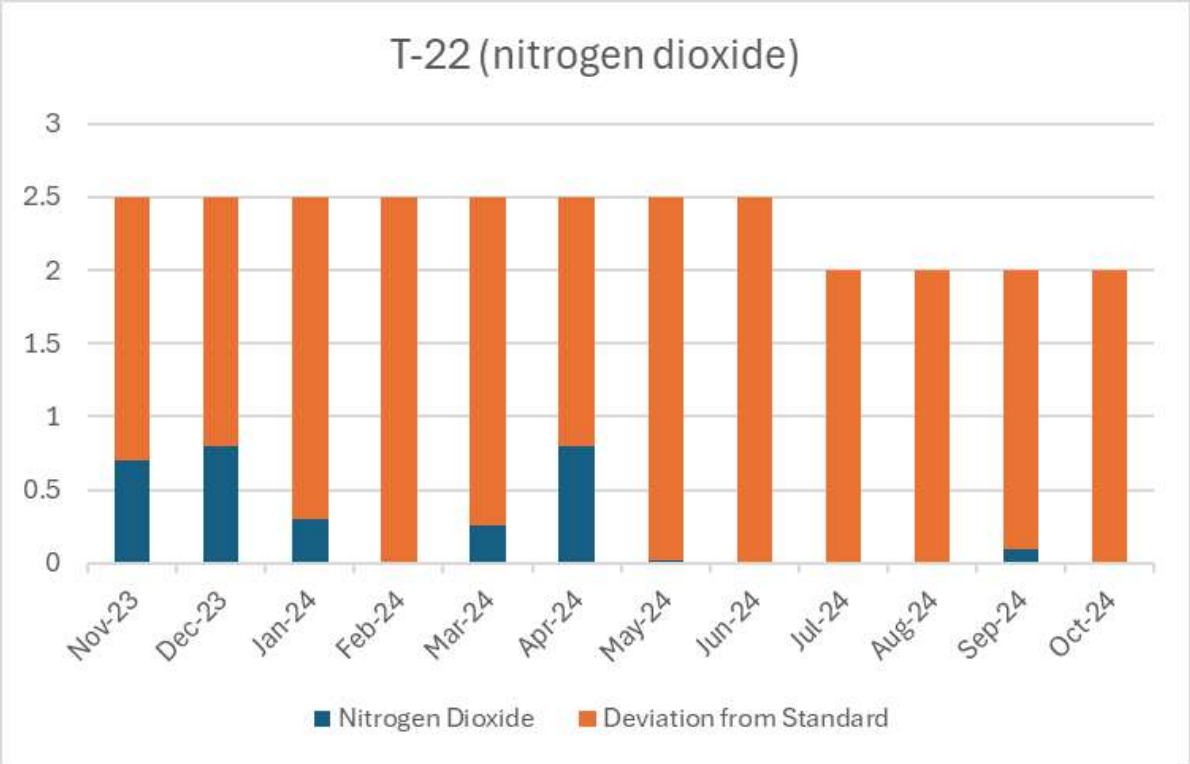


Figure 2-63 - Tunnel 22 Nitrogen Dioxide

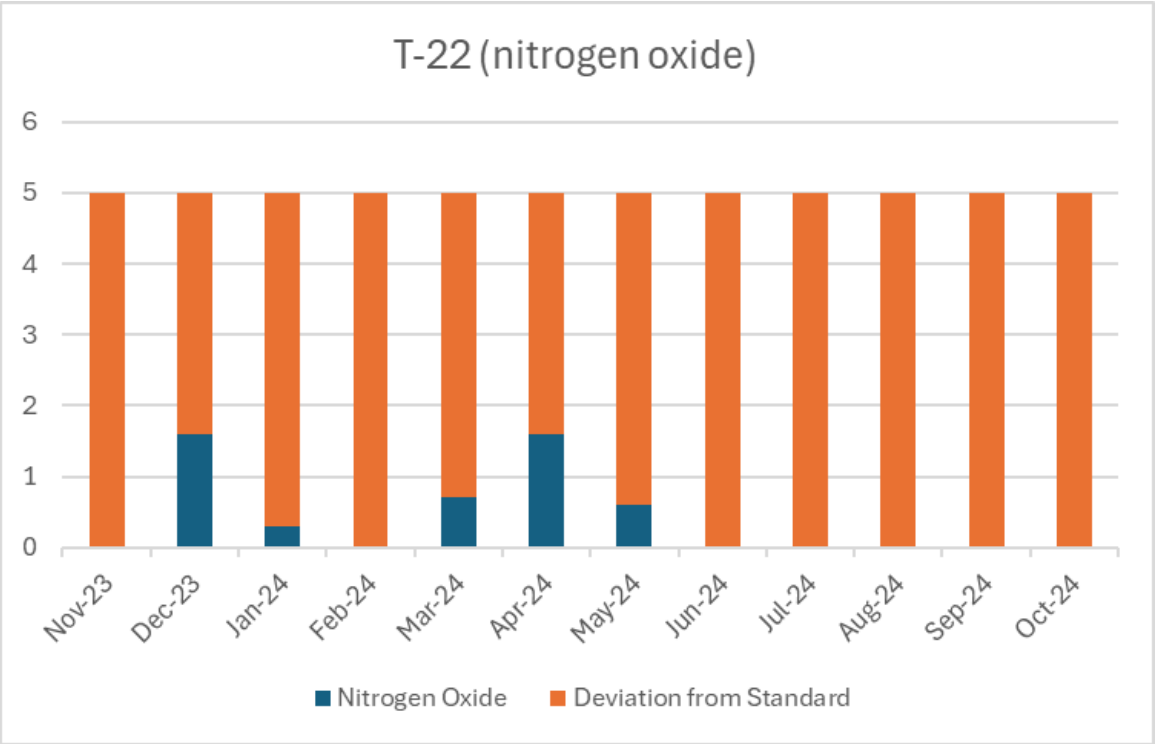


Figure 2-64 - Tunnel 22 Silicon Dioxide

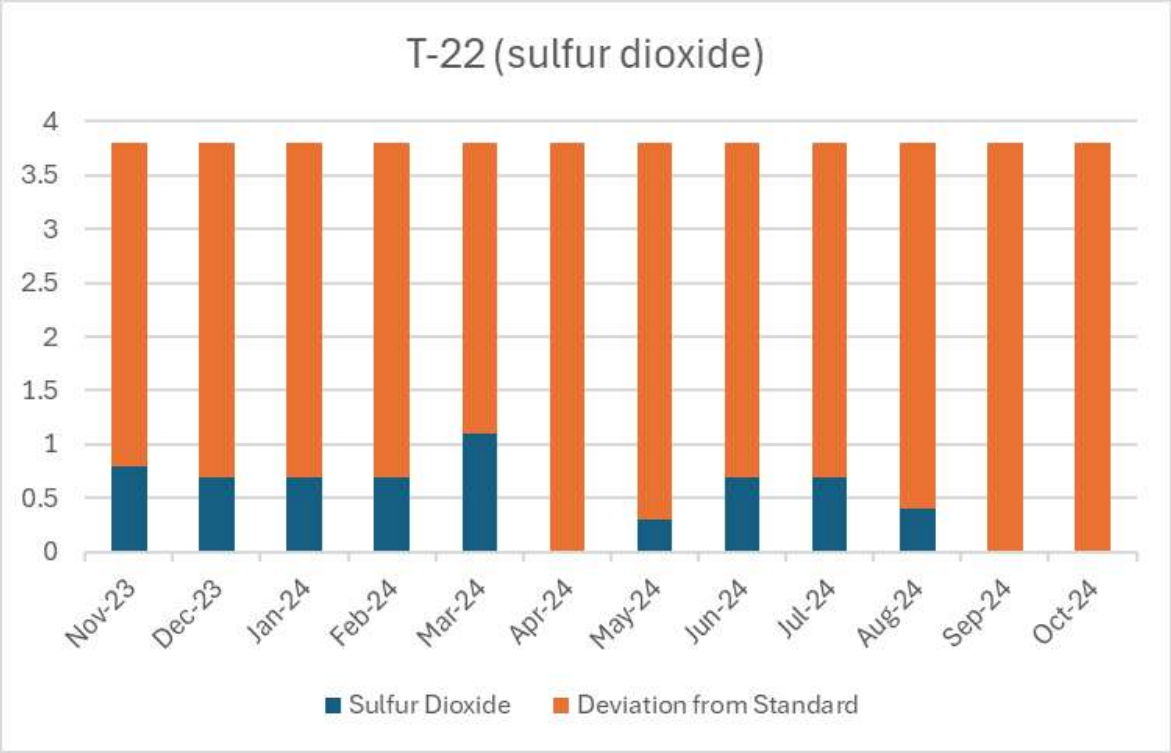


Figure 2-65 - Tunnel 22 Hydrogen Sulfide

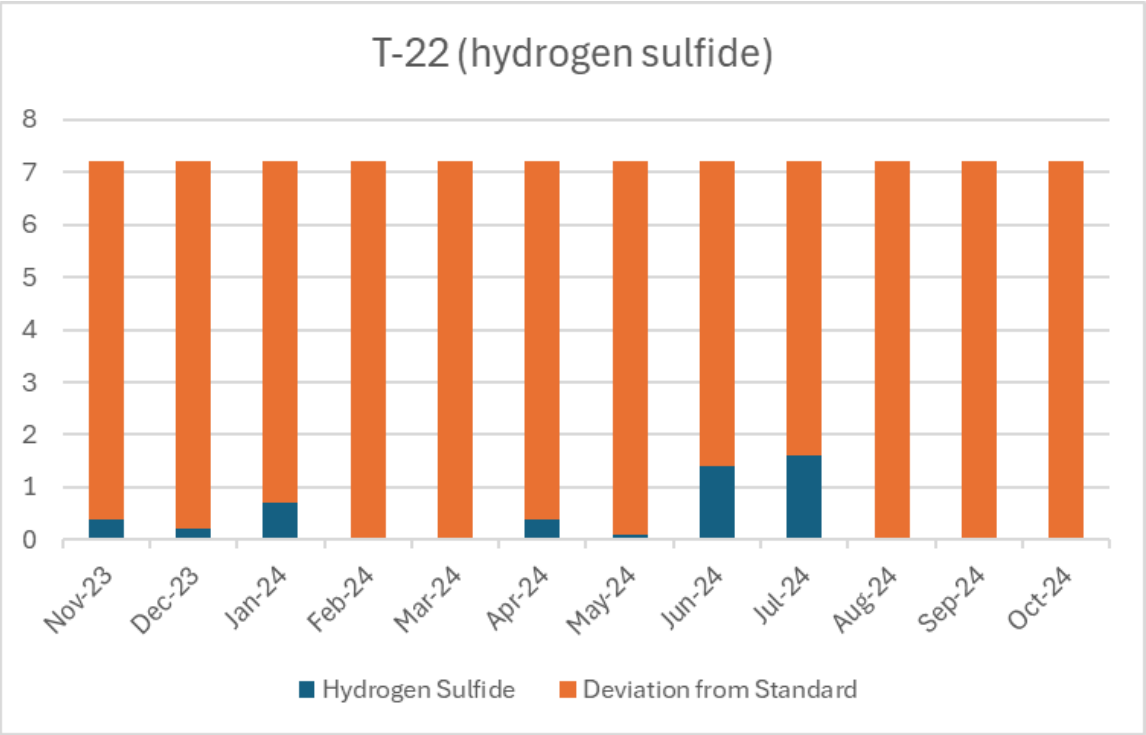


Figure 2-66 - Tunnel 22 Methane

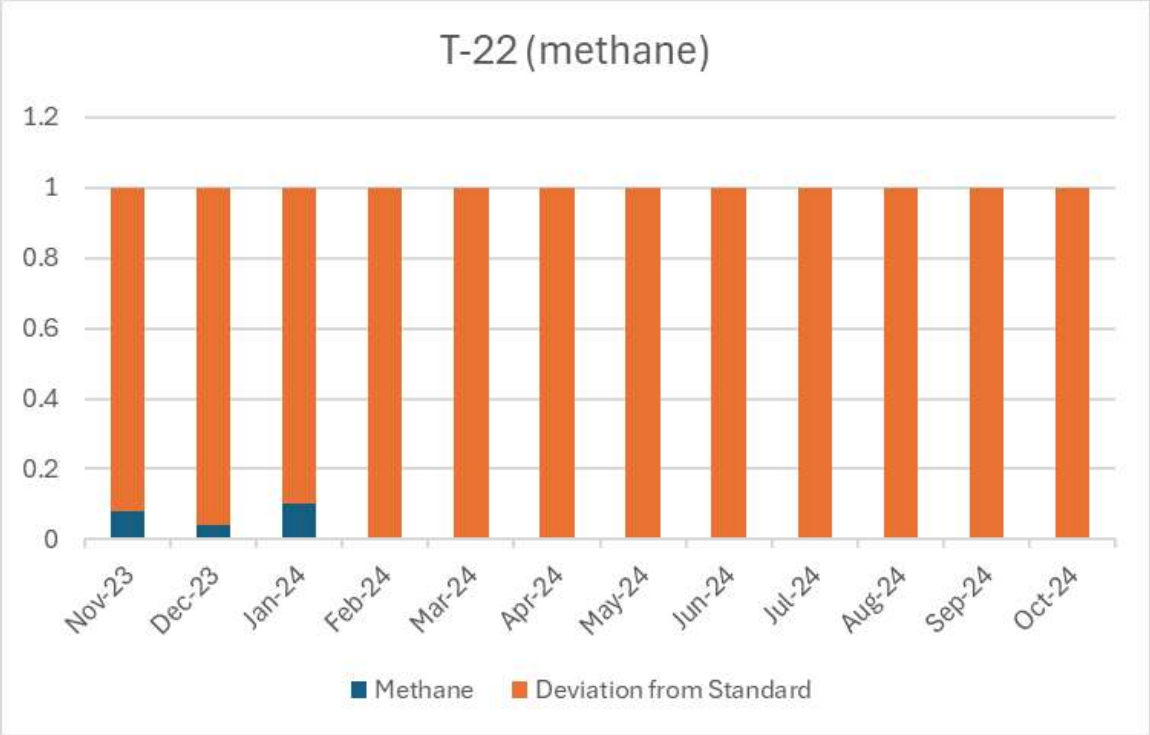
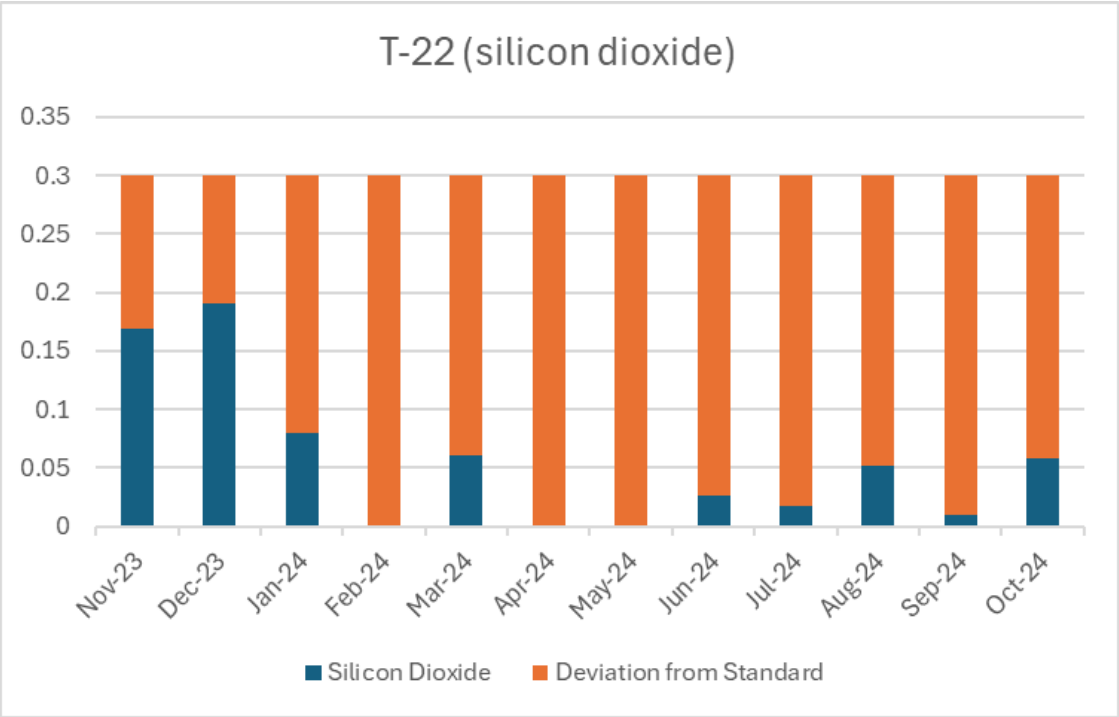


Figure 2-67 - Tunnel 22 Silicon Dioxide



Tunnel 5

Figure 2-68 - Tunnel 5 Carbon Monoxide

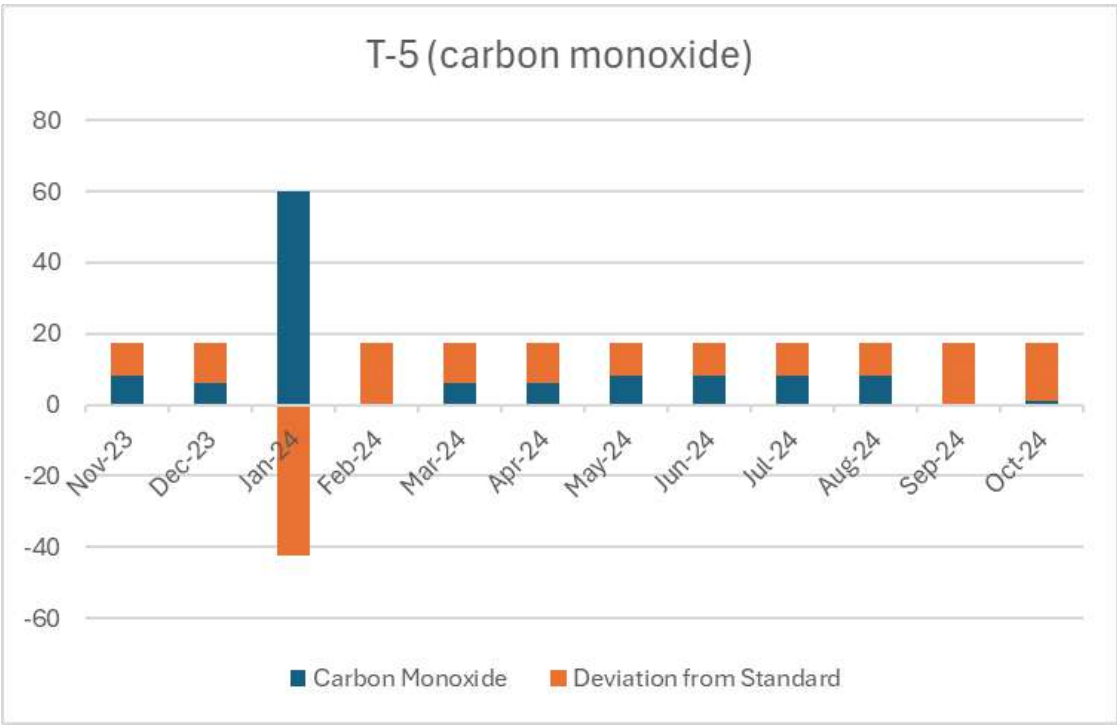


Figure 2-69 - Tunnel 5 Nitrogen Dioxide

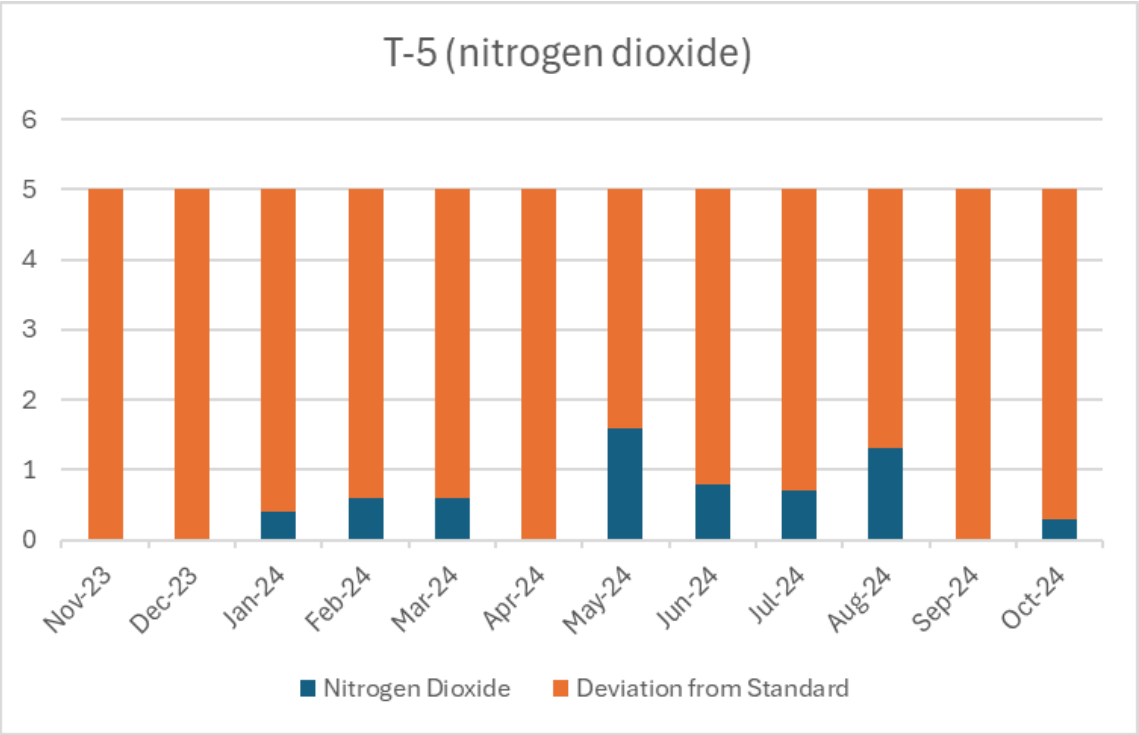


Figure 2-70 - Tunnel 5 Nitrogen Dioxide

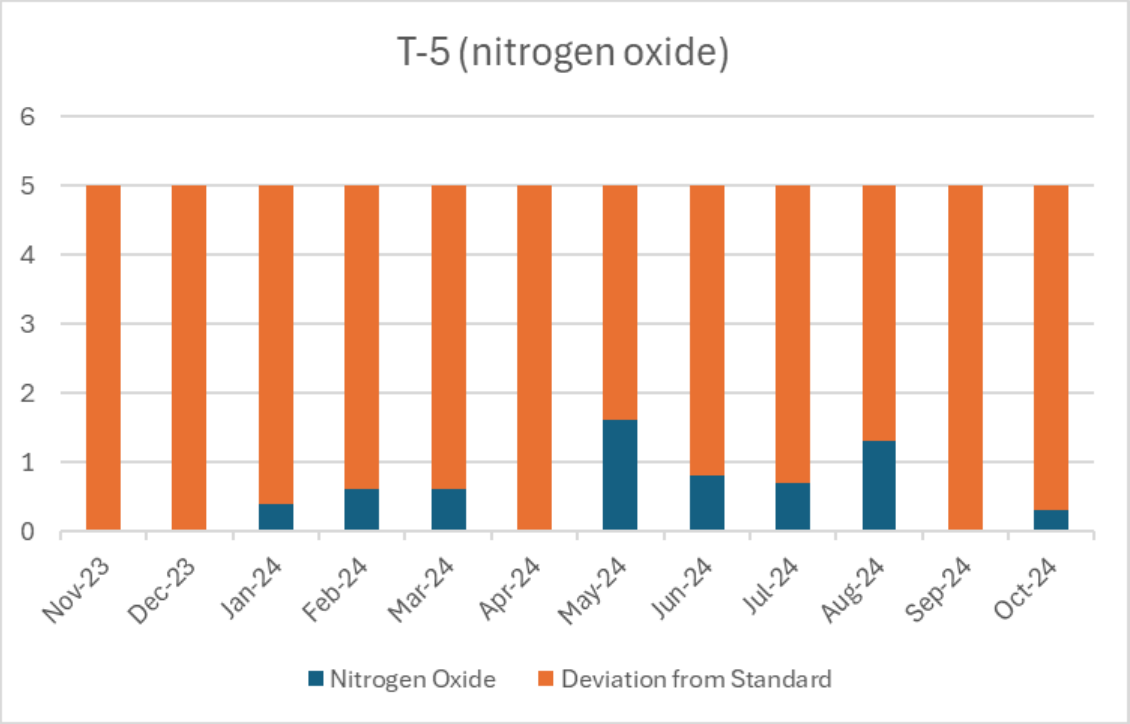


Figure 2-71 - Tunnel 5 Sulfur Dioxide

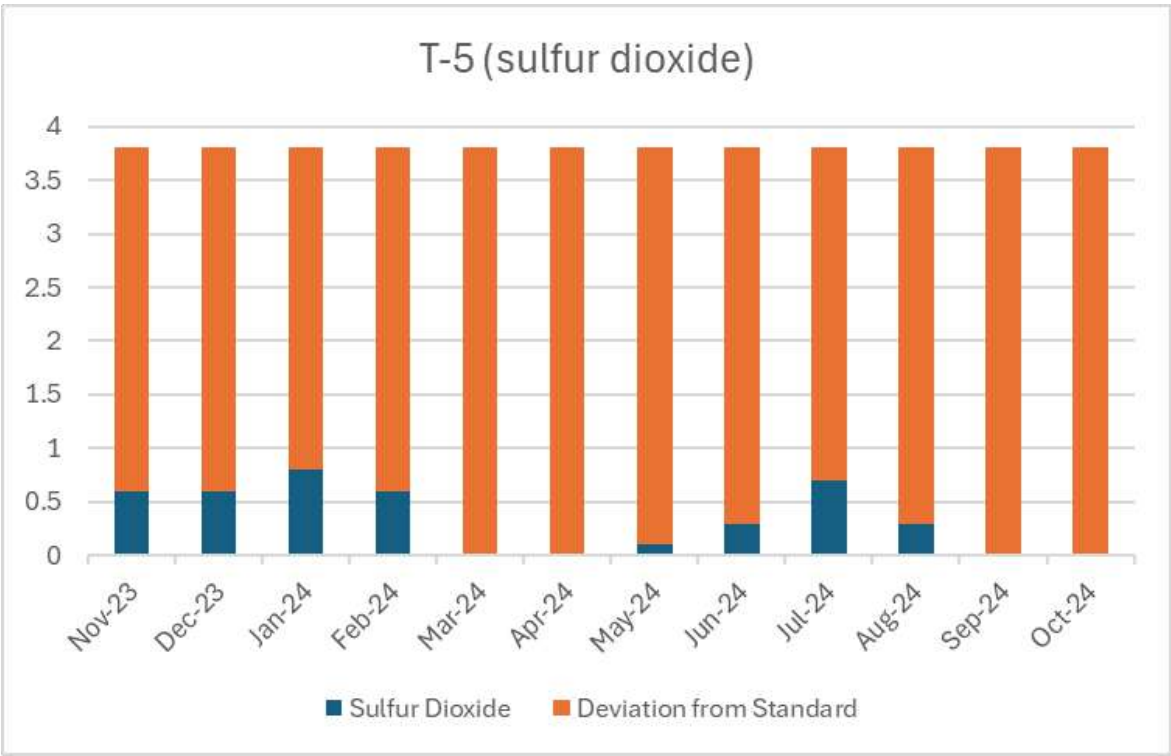


Figure 2-72 - Tunnel 5 Hydrogen Sulfide

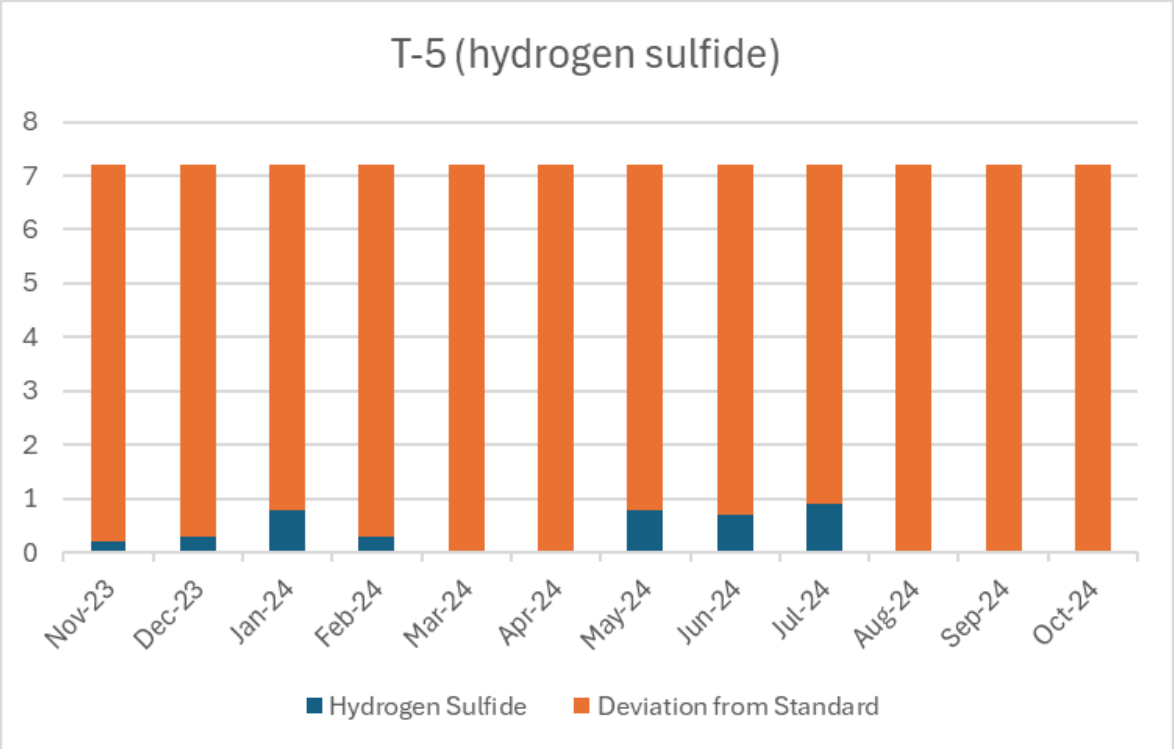


Figure 2-73 - Tunnel 5 Yard Methane

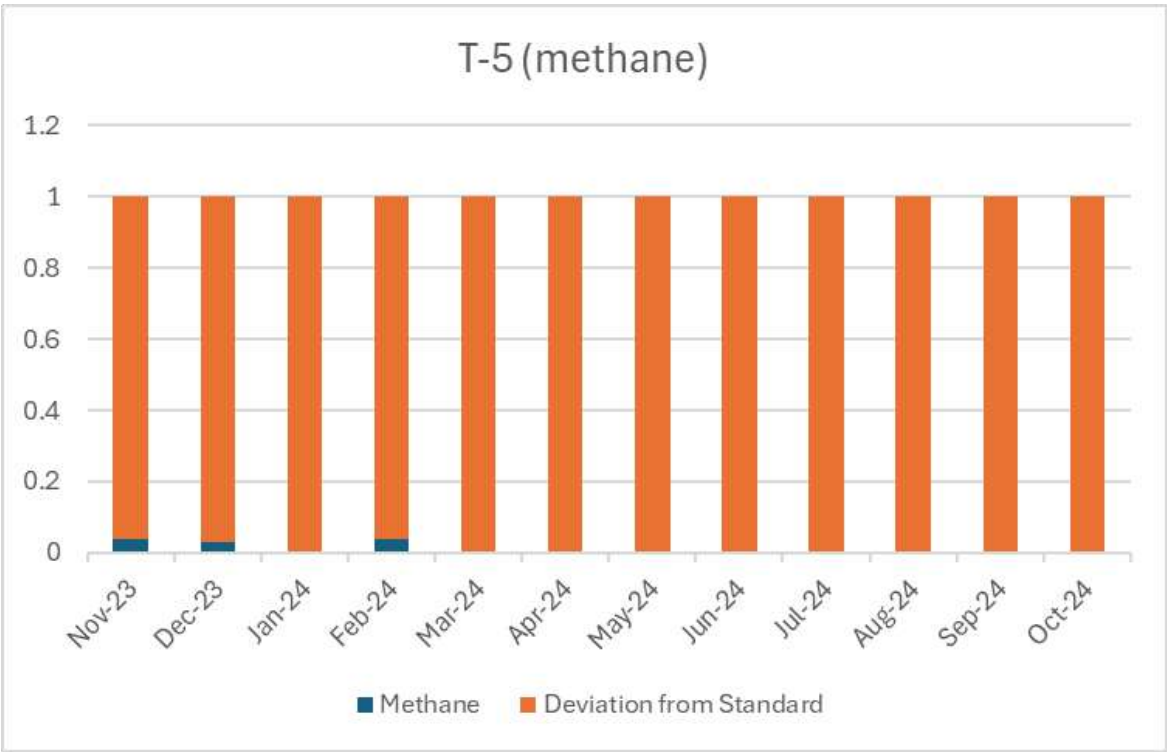
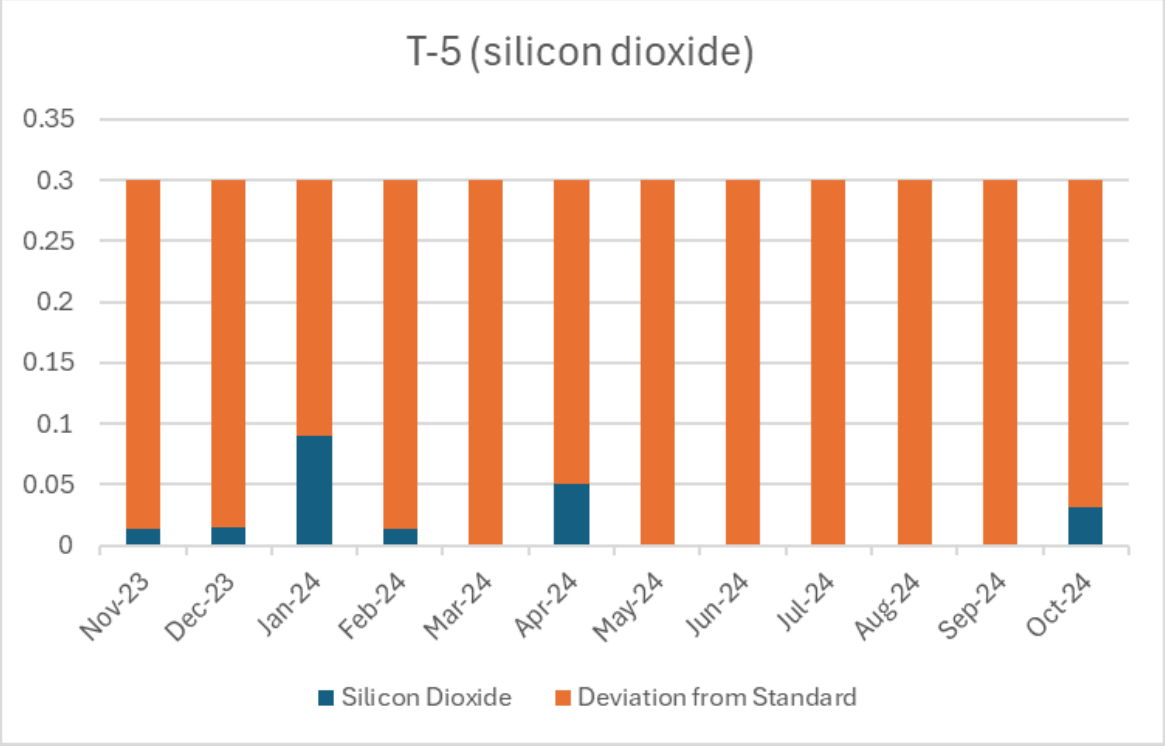


Figure 2-74 - Tunnel 5 Silicon Dioxide



Summary

2.6.2 A summary of pollutant detection (✓) and exceedances of the Project Standards by spot measurements (✓) at each monitoring location is shown in **Table 2-2.**

Table 2-2 – Pollutant Detection By Location (-- denotes no sample taken)

Location	Out/In	Dust	CO	NO_2	NO	SO_2	H_2S	CH_4	C_3H_8	SiO_2
Upstream Cofferdam	Out	✓	✓			✓	✓			✓
Downstream Cofferdam	Out	✓	✓			✓	✓			✓
GIS Yard (portal of Tunnel 4)	Out	✓								
Main Dam Core	Out	✓		✓	✓	✓	✓			✓
Main Dam Core (middle)	Out	✓								
Main Dam Core (left side)	Out	✓								
Quarry No. 26	Out	--				✓	✓			✓
GG2	Out	--	✓	✓	✓	✓	✓	✓		✓
Asphalt Plant	Out	--		✓						✓
CP-2	Out	--					✓			✓
CP-3	Out	--								✓
Quarry No. 17	Out	--								✓
Tunnel 2 Entrance	In	✓	--	--	--	--	--	--	--	--

Location	Out/In	Dust	CO	NO_2	NO	SO_2	H_2S	CH_4	C_3H_8	SiO_2
Tunnel 2 Intersection with Tunnel 8	In	✓	--	--	--	--	--	--	--	--
Tunnel 2 Intersection with Tunnel 4	In	✓	--	--	--	--	--	--	--	--
Tunnel 4 Middle	In	✓	--	--	--	--	--	--	--	--
Entrance of Tunnel 4	In	✓	✓	✓	✓	✓	✓	✓		✓
Tunnel GIS Yard	In	✓	--	--	--	--	--	--	--	--
Tunnel 3A	In	--	✓	✓	✓	✓	✓	✓		✓
Tunnel 22	In	--	✓	✓	✓	✓	✓	✓		✓
Tunnel 5	In	--	✓	✓	✓	✓	✓	✓		✓

2.6.3 The monitoring data collected for the period November 2023 and October 2024 indicate the presence of dust at all sampled locations inside and outside the tunnels. Outside the tunnels, the highest spot samples were taken upstream and downstream of the cofferdam and the main dam core outside winter when temperatures are higher. Inside the tunnels, the highest samples were taken in the tunnel 2 entrance and tunnel GIS yard. There were no exceedances of the dust criterion in the sampling period.

2.6.4 Pollutant species produced by fuel combustion (CO, NO_2, NO and SO_2) were detected at the cofferdam, main dam core, quarry no. 26, GGT and the asphalt plant. However, no exceedances of the mitigation criteria were detected.

2.6.5 The pollutants H_2S and SiO_2 have been detected outside and crucially indoors. Exceedances of the carbon monoxide silica dioxide mitigation criterion indicate elevated levels of this pollutant were present in the sampling period.

SITE AUDIT (2023)

2.6.6 WSP completed an independent site audit in May 2023 to assess the routine monitoring program compliance with international best practice, and the veracity of the results.

2.6.7 During the audit, a series of air quality spot samples of particulate matter (PM10) were collected. These were taken using a hand-held light-scattering laser photometer that provided real-time aerosol mass concentrations.

2.6.8 Figure 2-74 and the sampling results in Table 2-3.

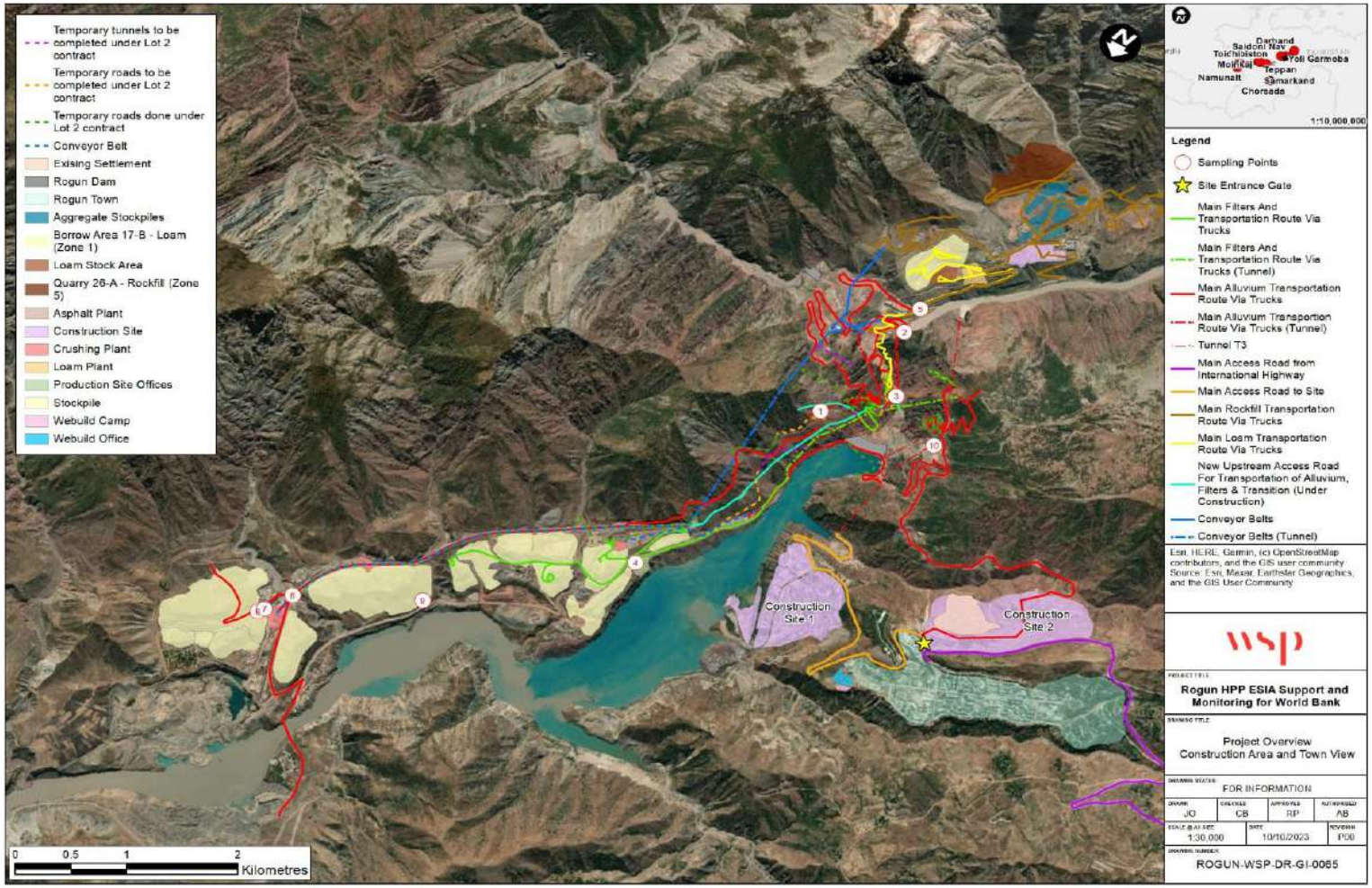


Figure 2-75 - On -Site Spot Sampling Locations

Results

Visual Inspection

2.6.9 A visual assessment of the site described both in previous audits and various site visits provides the following additional context (see Figure 2-76 to Figure 2-80)

- The construction area on the left bank generates significant dust, which is visible as a cloud above the site when viewed from a distance.
- 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 above-ground roads are unpaved, and watering of road appears to be inconsistent across the site, with left bank roads better (but not adequately) watered, but the Lot 3 right bank access road to the site being 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 exposed materials nevertheless appear to be a relatively minor contributor to fugitive dust across the site.
- The existing conveyor belt transporting materials from the upstream stockpile and primary crusher to the dam site is covered and generates little dust It has replaced a fleet of dump trucks, thus reducing traffic and dust by a significant amount in recent years.
- An 8-9km covered conveyor (called the ‘flying belt’) has been constructed to takes materials from the downstream quarry and stockpiles to the dam site. This led to a reduction in fugitive dust and exhaust emissions by reducing the number of vehicles required to transport materials.
- Fugitive dust and particulates are generated by underground vehicles, contributing to very poor air quality in the tunnels. In many locations, there is poor or no mechanical ventilation. In underground roads where daylight is not visible, and where no natural ventilation is possible, visible dust is present despite water ingress into tunnels from pipe work and other sources, which would be expected to have a mitigating effect (see Error! Reference source not found.).
- A high intensity of diesel-powered vehicle movement in the tunnels continue to emit $PM_{2.5}$, NO_2 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.

2.6.10 Visible dust generation above ground and the deep haze underground demonstrate that more comprehensive management is required to improve current conditions at the site, and in particular to 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.

Table 2-3 - Spot Sampling Results

Sample Point	Date and Sampling Period	Location	Nearby Activities/Sources Observed	Monitored PM_{10} Concentration (mg/m^3)		AQS a (mg/m^3)	OEL (mg/m^3)
				Average (15-min)	Peak		
1	02/05/2023 09:24 - 09:39	Underground works area, Pit 5	Welding (10m), construction of tunnel supports (10m), generators (10m), haulage (30m)	0.1	0.2	0.045 (24-hour) 0.015 (annual)	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
2	02/05/2023 09:57 - 10:12	Above Ground DT1 Outlet Downstream	Haulage trucks (within 10m)	0.05	--	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
3	02/05/2023 10:15 - 10:30	Downstream, Coffer Dam	Batching of concrete Haulage, Aggregate piles/stacking (all 200m below)	0.03	--	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
4	02/05/2023 10:45 – 11:00	On-Site Laboratory	None	0.01	--	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
5	02/05/2023 11:36 - 11:51	Roadside, Near Reservoir	Haulage trucks (within 10m)	0.05	0.4	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)

Sample Point	Date and Sampling Period	Location	Nearby Activities/Sources Observed	Monitored PM_{10} Concentration (mg/m^3)		AQS a (mg/m^3)	OEL (mg/m^3)
				Average (15-min)	Peak		
6	02/05/2023 12:12 - 12:27	Adjacent Crushing Plant/Background	None	0.04	--	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
7	02/05/2023 15:30 - 15:45	Adjacent Crushing Plant	Crushing Plant Active (within 20m)	0.06	--	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
8	02/05/2023 15:47 - 16:02	Adjacent Conveyor Belt	Conveyor Belt (10m), Aggregate (10m), Stockpiles (80m), Haulage Route (100m, below)	0.08	0.2	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
9	02/05/2023 16:05 - 16:20	Haulage Route	Haulage trucks (within 10m)	0.04	3.0	--	6 (silica dust, 15-minutes) 0.05 (diesel exhaust)
10	02/05/2023 16:28 - 16:43	Underground Tunnel DT4	Tunnel access. Haulage trucks (20m) (air venting in place)	--	0.18	--	6 (silica dust, 15-minutes)
			Excavation works. Diggers and hand (10m) (damping undertaken)	--	0.15		

Sample Point	Date and Sampling Period	Location	Nearby Activities/Sources Observed	Monitored PM_{10} Concentration (mg/m^3)		AQS a (mg/m^3)	OEL (mg/m^3)
				Average (15-min)	Peak		
Background (Workers Residence)	03/05/2023 09:00 - 09:30	Within workers compound	None	0.08	--	0.045 (24-hour) 0.015 (annual)	--
Background (Hotel)	03/05/2023 09:45 - 10:00	Hotel Grounds, Rogun Town	None	0.06	--	0.045 (24-hour) 0.015 (annual)	--

a WHO (2021) Air Quality Guidelines (World Health Organization, 2021) - New World Health Organization (WHO) Global Air Quality Guidelines (AQGs) provide clear evidence of the damage air pollution inflicts on human health, at even lower concentrations than previously understood. The guidelines recommend new air quality levels to protect the health of populations, by reducing levels of key air pollutants, some of which also contribute to climate change.

b Russian Federation Occupational safety standards system. General sanitary requirements for working zone air GOST 12.1.005-88 (Russian Federation, 2005) - Interstate standard from the Russian Federation for the acceptable concentrations of various substances in the ambient air of working environments. Occupational exposure to air pollutants, used in the absence of Tajik occupational exposure limits.

Figure 2-76 - On Site Observations of Visible Dust from Construction Activities.



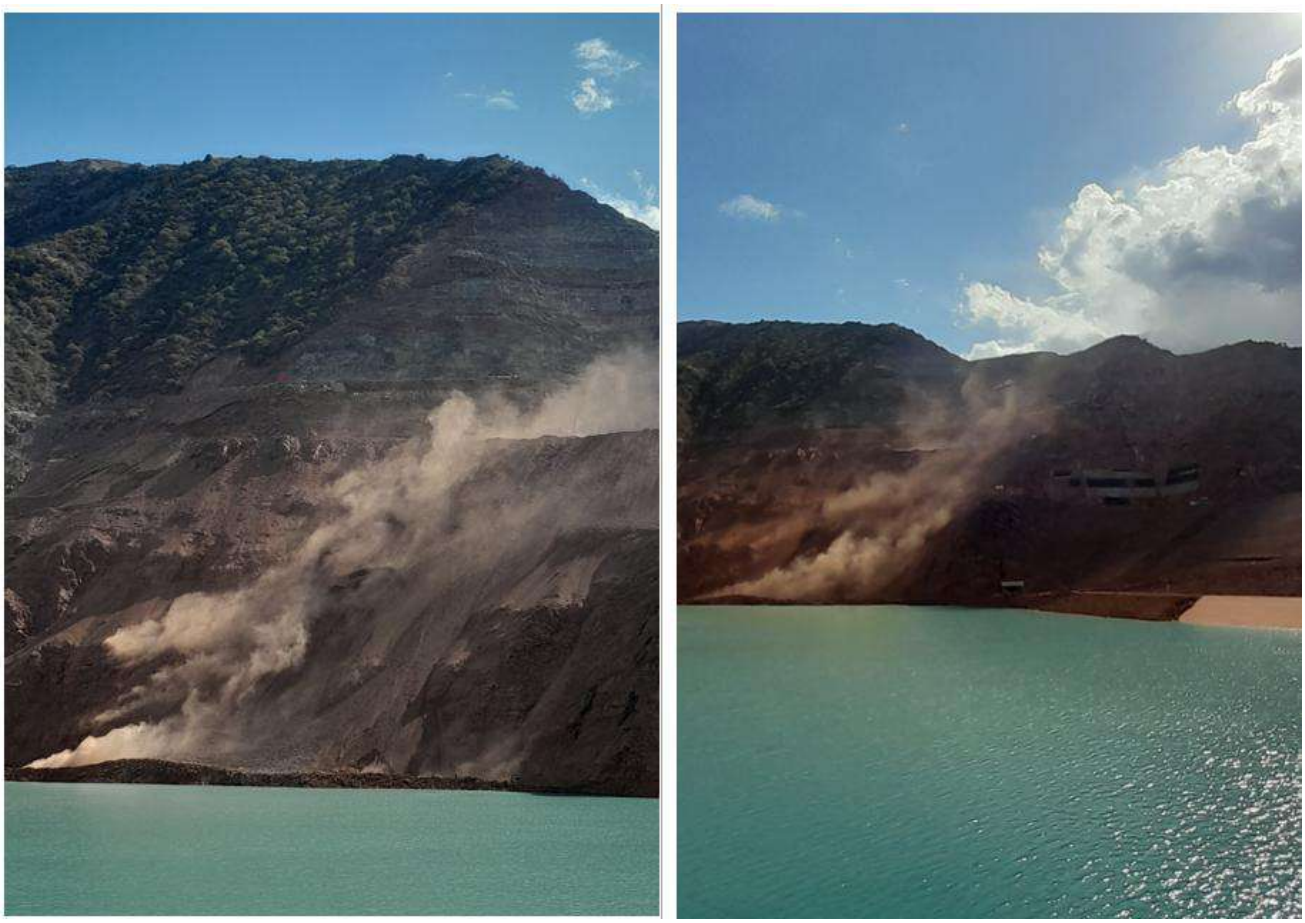


Visible dust plumes from internal haul roads (2023) Visible dust plumes from dumping materials and works on Lot 2 (dam) and Lot 3 (right bank structures) (2023)

Figure 2-77 - Dust cloud above the construction area on the left bank (2024)



Figure 2-78 - On Site Observations of Visible Dust from Construction Activities



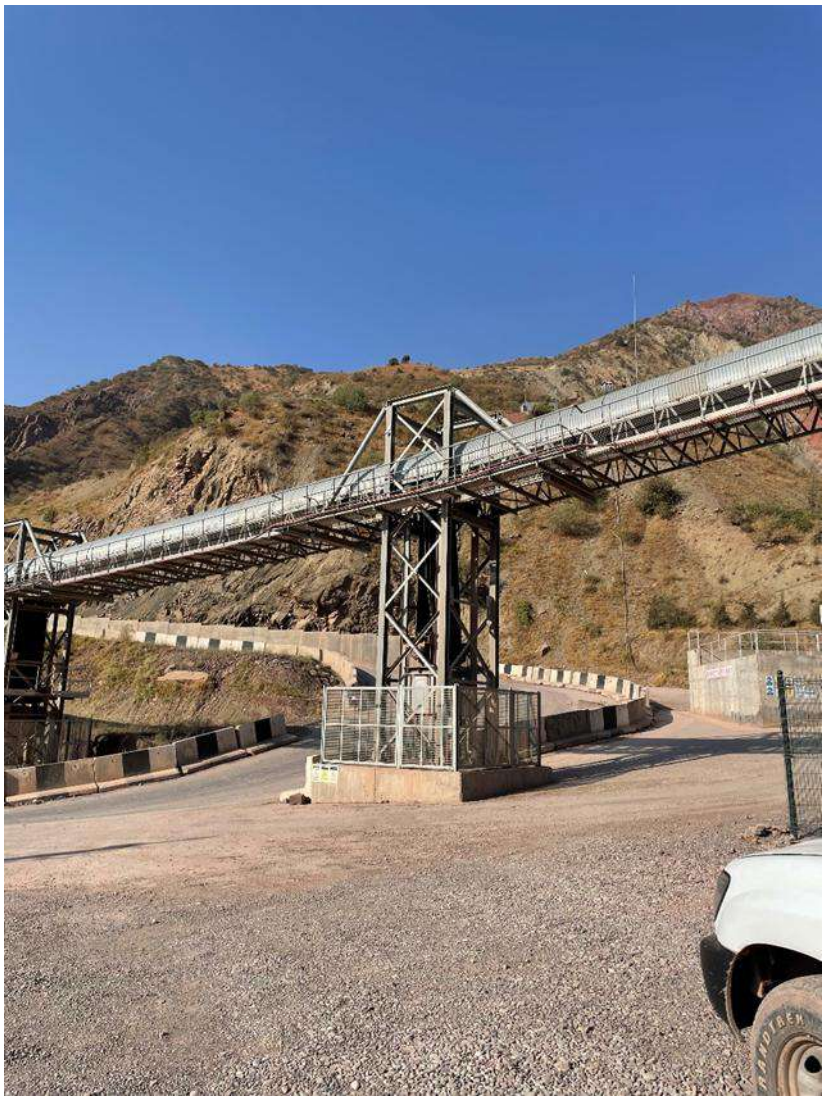
Visible dust plumes from material dumping down embankment (2023)

Figure 2-79 - Poor Air Quality in Underground Working Area (Lot 4 Early Works).



Evidence of extremely poor air quality inside tunnel working area (2023)

Figure 2-80 - The 'Flying Belt' Conveyor (2024)



Audit Summary

2.6.11 The results show that the measurements taken were generally within the adopted criteria for safe air quality within the working environment, however, given the short-term nature of sampling, the findings should be considered indictive only. The results cannot be used to assess regulatory compliance.

2.7 SUMMARY

2.7.1 To meet the requirements of the Law of the Republic of Tajikistan on the Protection of Atmospheric Air (Article 28), a comprehensive monitoring program has been established at the Project site. An independent audit of the program in 2023 determined that to indicate the presence of air pollutants and localized elevated concentrations, the program is for purpose. However, given the short-term nature of sampling, the findings should be considered indictive only and cannot be used to assess regulatory compliance.

2.7.2 The program has been designed to detect a suite of air pollutants including dust, combustion products, H_2S, CH_4 and SiO_2. All pollutants were detected at the site with plumes of visible dust dispersed at rates determined by prevailing meteorological conditions. Only the pollutant SiO_2 and CO triggered the mitigation criteria during the short sampling program.

2.7.3 For the purpose of assessing compliance with the air quality Project Standards described in **Volume 1, Chapter 8: Air quality**, the monitoring program in its current form does not provide adequate data for the following reasons:

- Spot samples do not represent air pollutant concentrations for the same exposure periods as the Project Standards for both ambient and occupational exposure;
- The sampling period is not a full year and therefore may not represent pollutant concentration fluctuations caused by all meteorological conditions; and
- The instrumentation used is not able to sample for the exposure periods required to assess against the Project Standards.

2.7.4 Further work will now be completed to refine the monitoring program to provide data to inform air pollutant management actions, embedded design mitigation and regulatory compliance.

3 CLIMATE AND GREENHOUSE GASES

3.1 CLIMATE BASELINE

CURRENT CLIMATE BASELINE

3.1.1 Tajikistan is the smallest country in Central Asia; approximately 93% of its territory is mountainous regions and 6% is occupied by glaciers. Tajikistan is in the temperate continental climate zone with moderate climate variables typical of Central Asia. Climate variability is linked to its geological sub-state, which includes 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 (World Bank, 2020).

3.1.2 The glaciers form an important role in regulating the climate whilst also retaining water and controlling flows (UNDP). Climate change impacts are already observed in Tajikistan, with 20 billion cubic meters of ice volume within glaciers already lost during the 20th century (about 2.5%), which is likely to be accelerated by increasing temperatures. Observations since 1930 suggest that the total area of glaciers has decreased by approximately 30%. It is estimated that the 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 (Global Support Programme).

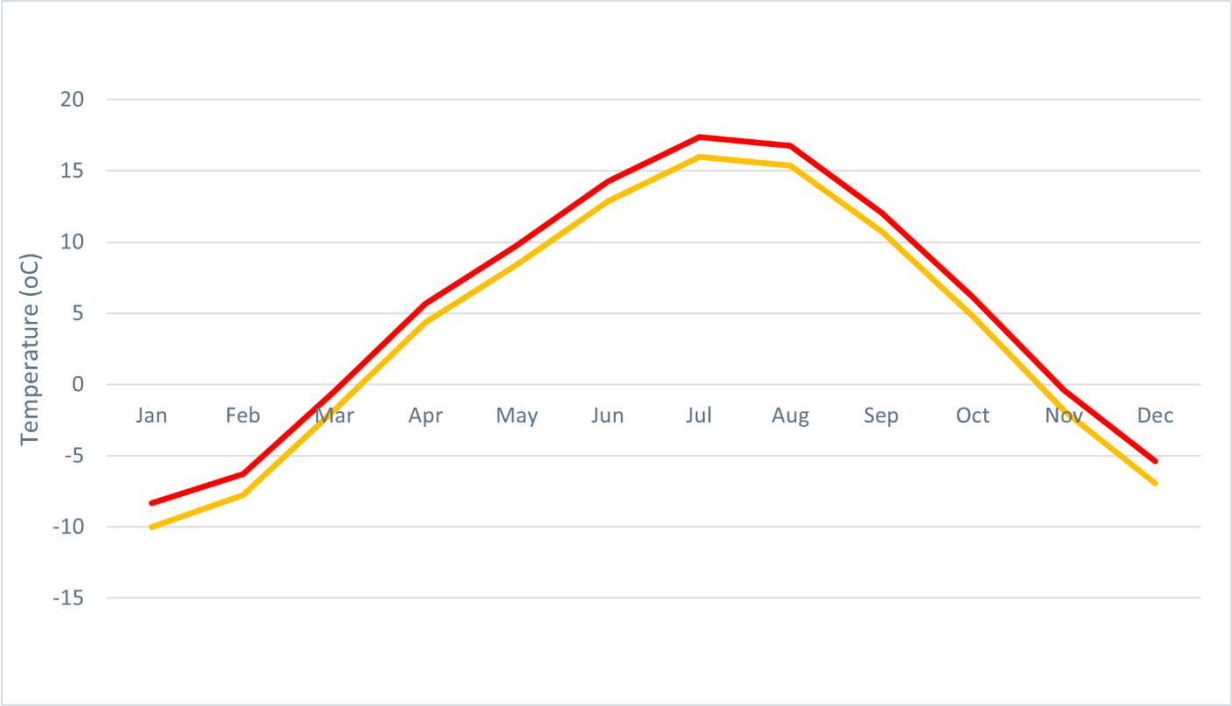
3.1.3 The climate change data describes trends in precipitation, temperature, wind and the impacts throughout the operational design life. Detailed hydrological data and trends affecting the operation of the Project can be found in **Volume 1: Chapter 13: Impacts on Water** of this ESIA.

3.1.4 Information on the current climate of Tajikistan has been obtained from the World Bank Climate Change Knowledge Portal (World Bank , 2020) and this serves as the baseline for the assessment. The Project is located in the Districts of Republican Subordination (DRS) located across central and west Tajikistan, which the World Bank Climate Change Knowledge Portal refers to as Tadzhikistan Territories and baseline climate information for the sub-region of the DRS is presented as representative of the regional climate.

Temperature

3.1.5 The temperatures experienced across Tajikistan are moderated by the mountainous terrain. Average monthly temperatures in the DRS are slightly warmer in comparison to the rest of Tajikistan as presented in **Figure 3-1**.

Figure 3-1 - Average Monthly Temperature for the DRS (red) and Tajikistan (orange) (1991-2021)



3.1.7 The coldest month in the DRS is January with an average temperature of -8.5°C and an average minimum temperature or -12.9°C. July is the warmest month with average temperatures in the region of 17.1°C, and maximum summer temperature reaching 24.1°C.

3.1.8 Seasonal temperatures range from an average of -6.9°C in winter (December, January, February) and 15.9°C in the summer (June, July, August). The average minimum temperature in winter is -11.0°C and average maximum summer temperature is 23.1°C.

3.1.9 **Table 3-1** shows historic temperature records from the 30 year time periods covering 1961 to 1990 and 1991 to 2021. The data shows that minimum average winter temperatures have increased by 1.07°C and maximum average summer temperatures have increased by 0.37°C.

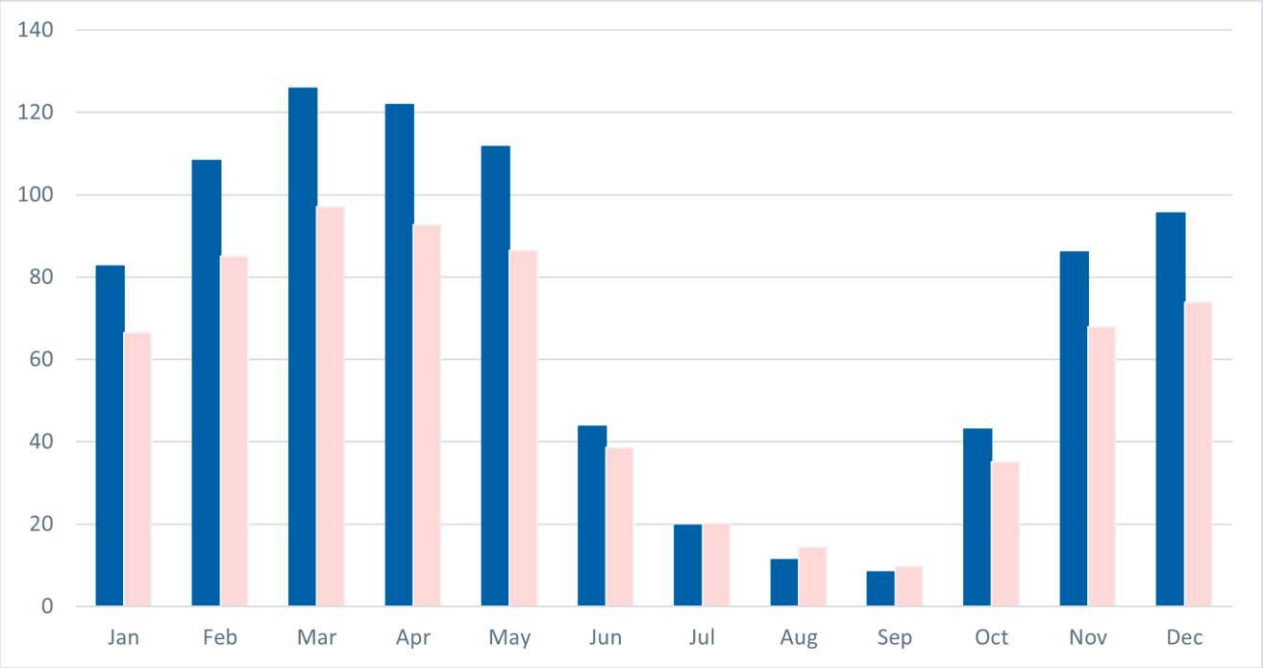
Table 3-1 – DRS Historic Average Temperature Comparison

Year	Minimum average winter temperature (°C)	Maximum average summer temperature (°C)	Average Annual Temperature (°C)
1961-1990	-12.10	22.71	4.17
1991-2021	-11.03	23.08	4.86

Precipitation

3.1.10 Average monthly precipitation in the DRS is generally higher in comparison to the rest of Tajikistan, as presented in **Figure 3-2**.

Figure 3-2 - Average Monthly Precipitation for the DRS (blue) and Tajikistan (pink) (1991-2021)



3.1.11 Within the DRS, the wettest month is March recording 126.9mm of precipitation. September is the driest month with 8.5mm of precipitation recorded.

3.1.12 Seasonally, average winter (December, January, February) precipitation is 289.5mm with the summer season (June, July, August) recording on average 76.4mm.

3.1.13 Precipitation records from the 30 year time periods covering 1961 to 1990 and 1991 to 2021 indicate increases in summer, winter and annual average precipitation rates of the DRS as detailed in **Table 3-2** which shows that from 1991 to 2021, average annual precipitation in the DRS was approximately 67mm higher than the average for 1961-1990. Increased precipitation, and changes to seasonal precipitation can result in flash flooding.

Table 3-2 – DRS Historic Average Precipitation

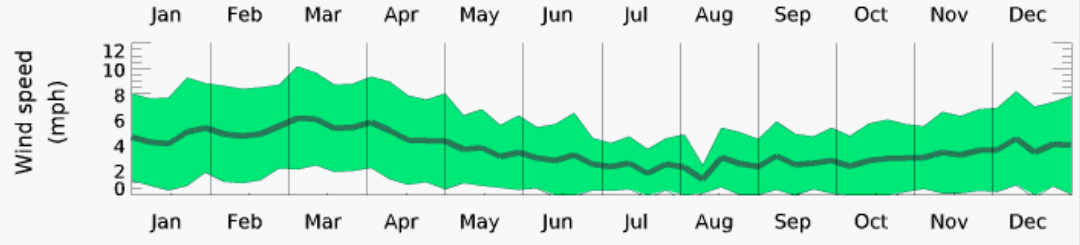
Year	Minimum average winter precipitation (mm)	Maximum average summer precipitation (mm)	Average Annual Precipitation (mm)
1961-1990	60.96	253.35	801.65
1991-2021	76.42	289.49	868.95

3.1.14 Water stress indicators for the region show that the Project is in an area of low (<10%) annual water stress. The Project is in an area at medium risk (0.4 – 0.6) of drought in the current baseline, where drought risk is categorized as low between 0.0 and 0.2 and high between 0.8 and 1.0) (World Resources Institute, 2021).

Wind

3.1.15 Wind speed data is not available from the World Bank Climate Change Knowledge Portal. However, Meteoblue presents observed climate data for the DRS (Meteoblue, 2024) with data obtained from a weather station approximately 72km away from Project site shown in Error! Reference source not f ound.**Figure 3-3**. This data is provided as an indication of the wind speeds at the Project site. Wind speeds are typically lowest in July and August and highest in March.

Figure 3-3 - Average Monthly Wind Speed (mph) for the DRS 2022



3.1.16 Dust storms are common in Tajikistan due to the aridity of the region situated in the 'global dust belt' which extends from the Sahara to the Gobi deserts. Dust storms are typical between April and November, however they are primarily associated with lowland areas. Between 2000 and 2014, the average annual number of days with a dust haze in Dushanbe (located approximately 100km west of the Project) was 12, and seven of those were noted as a strong haze were visibility is less than 2km (Abdullaev, S. F., and Sokolik, I. N., 2019).

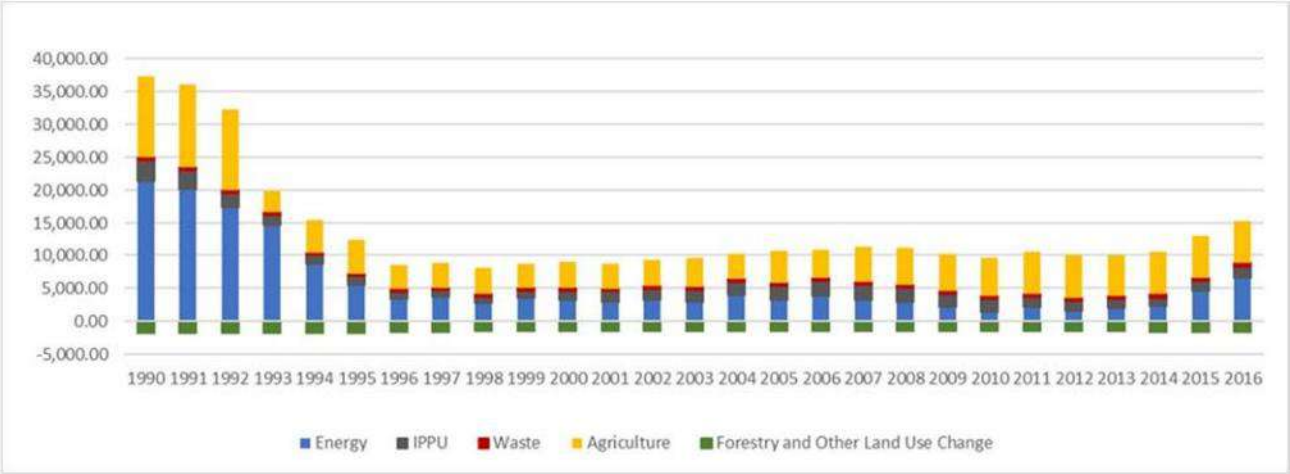
Solid Mass

Mudflow and landslides within mountainous and foothill regions are unpredictable and result from saturated ground, generated through precipitation and/or melting glaciers. Avalanches are where large amounts of uncompacted fresh snow are set into motion. The DRS is classified as having a high risk of landslides as rainfall patterns, terrain slope, geology, soil, land cover and (potentially) earthquakes that make localized landslides a frequent hazard phenomenon (GFDRR, 2020). Most mudflows occur in spring in lowland areas and in summer in highland regions when snowmelt occurs. Avalanches are typically observed in February and March (OSCE, n.d.)

3.2 GREENHOUSE GASES (GHG)

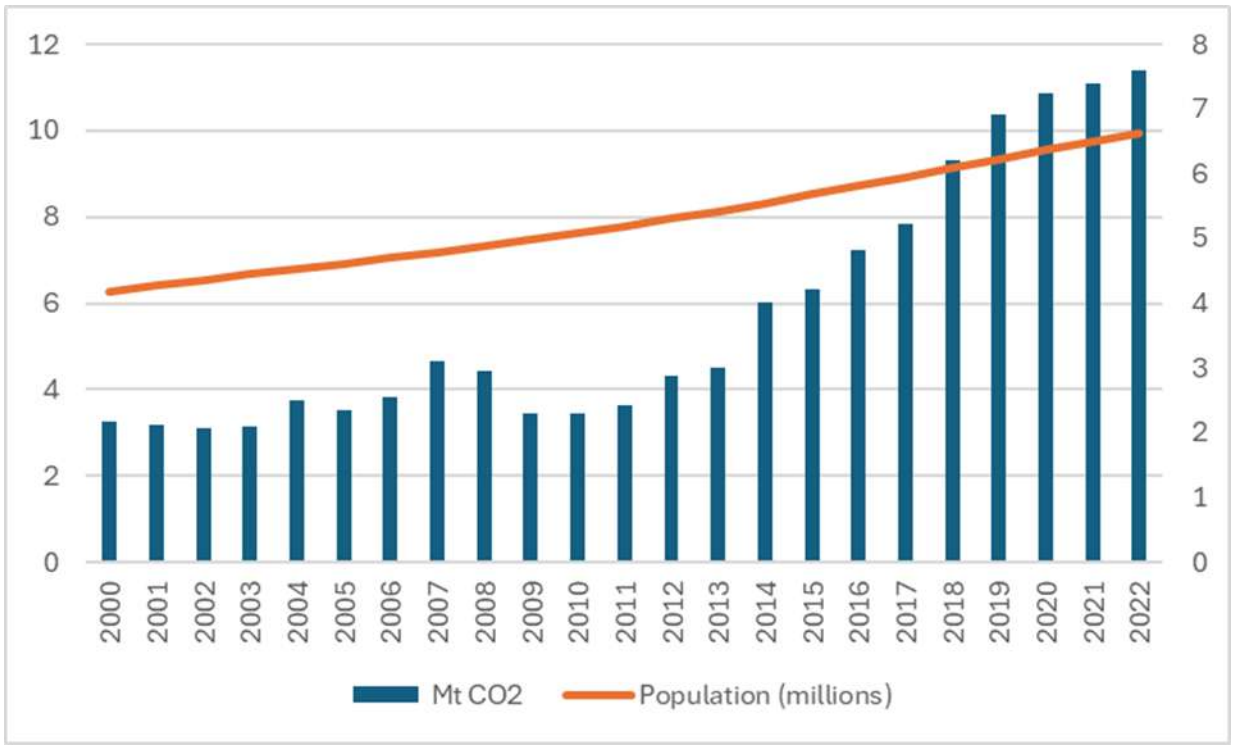
Tajikistan, as a signatory to the UN Framework Convention on Climate Change, submits reports on the country's GHG emissions. The most recent Nationally-Determined Contribution (NDC) report was submitted in 2021 and includes a GHG inventory covering the period 1990-2016. This data shows that Tajikistan's emissions fell precipitously after 1990, from a high point of over 35,000 MtCO2eq to a low of around 8,000 MtCO2eq in 1998. Total emissions remained around or below 10,000 MtCO2eq from the mid-1990s until the mid-2010s. Increases were noted after 2015, although it is noted that in 2016, total emissions remained just 39% of the 1990 total. These large falls in emissions came largely from the energy and agriculture sectors (Updated NDC of the Republic of Tajikistan, 2021).

Figure 3-4 - GHG Inventory of Tajikistan, 1990-2016 (MtCO2eq)



Data from the International Energy Agency is less complete than the NDC Report, with very limited data regarding agricultural and industrial emissions as only CO2 from fuel combustion is covered. However, the data covering the period 2000-2022 shows a similar direction of travel, with static, low emissions recorded from 2000 until the mid-2010s, with a sharp rise from 2014 until 2022. This rise was driven largely by increased burning of coal and oil (IEA, 2023). It should be noted that this has occurred in the context of significant population growth, with the Tajik population increasing from approximately 6.3 million in 2000 to 10.1 million in 2023 (World Bank Group Data, 2024), as well as poverty reduction efforts (see Section 12, Social baseline).

Figure 3-5 - Estimated fuel combustion emissions of the Republic of Tajikistan (IEA) (MtCO2) and population 2000-2022



3.2.1 Tajikistan's energy sector causes approximately 75% of the total GHG emissions of the country. While hydropower provides over 40% of the energy mix of Tajikistan and over 90% of domestic electricity generation (IEA, 2023), industrial and residential coal consumption has increased sharply in recent years. The Tajikistan Development strategy by 2030 states the policy goal of scaling up energy production to meet both domestic and export demand primarily through increased hydropower capacity, as well as the development of renewables such as solar (UNECE, 2024).

3.2.2 Hydropower is considered to be a clean and renewable source of energy, although emissions are incurred at various points throughout the lifecycle of a plant. During construction and maintenance, emissions and incurred by the production and transportation of materials, and the operation of on-site plant and facilities. Reservoirs can also be net emitters of GHGs, especially early in their lifecycle, due to the decomposition of organic matter which produced methane which then dissolves in the water, and is released either as bubbles or as water passes through the turbines, although the strength of this effect is determined by the specificities of the reservoir, and in some cases reservoirs may be carbon sinks (International Hydropower Association, 2022) (BBC, 2024) (Office of Energy Efficiency and Renewable Energy, n.d.). Indirect emissions due to land use change may also occur, if carbon sinks are lost (Alsaleh, Mansur Abdulwakil, & Samad Abdul-Rahim, 2021).

4 NOISE AND VIBRATION

4.1 INTRODUCTION

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

4.2 BASELINE SURVEY

4.2.1 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 of the entire duration of the construction program. Baseline measurements consisted of short-term attended measurements and are therefore only representative of conditions at the time the measurements were undertaken. However, the baseline data acquired serves as useful indicator of the existing noise climate.

4.2.2 **Table 4-1** presents a summary of the noise levels measured during the survey. As discussed subsequently, noise levels meet standards at most workplaces but there are some locations where workers are exposed to levels that exceed standards for at least short periods.

Table 4-1 - Summary of Measured Noise Levels

Measurement Location	Average Sound Pressure Level, dB $L_{Aeq,T}$	Maximum Sound Pressure Level, dB L_{Amax}	Rationale
1 – Area 1 Campsite	60	75	Significant numbers of sensitive receptors present
2 - Haul Road	76	95	Notable noise source
3 - DT4 Tunnel	86	99	Notable noise source
4 – Cofferdam	81	103	Area 1 Campsite
5 – Conveyor 2m	81	84	Notable noise source
5 – Conveyor 10m	77	80	
6 – Crushing 30m	89	98	Notable noise source
6 – Crushing 50m	85	94	

4.2.3 **Table 4-2** shows the approximate distance from the measurement locations to the main activities.

Table 4-2 - Noise Measurement Distance

Measurement Location	Distance (m)
1 – Area 1 Campsite	400
2 – Haul Road	15
3 – DT4 Tunnel	10
4 – Cofferdam	40
5 – Conveyor	2 and 10
6 – Crushing Plant	30 and 50

4.3 BASELINE DATA

4.3.1 Baseline data were collected at six locations on the Site, as shown in **Figure 4-1**.

4.3.2 The purpose of the survey was to provide some quantification of the existing sound climate from various sources and receptors across the construction site.

Figure 4-1 - Noise Survey Locations



AREA 1 CAMPSITE

4.3.3 Noise levels in the Area 1 Campsite were relatively loud with some obvious presence of noise from construction traffic using the Site's road network, private transport and general settlement noise.

4.3.4 A short-term noise measurement was undertaken within Area 1 Campsite overlooking the haul road in the main site, as shown in **Figure 4-3**. The noise measurement was undertaken at approximately 3m from the façade of one of the accommodation buildings. **Figure 4-4** shows the time history of the measured dB $L_{Aeq,T}$ sound levels.

Figure 4-2 - Time History Noise Levels - Area 1 Campsite

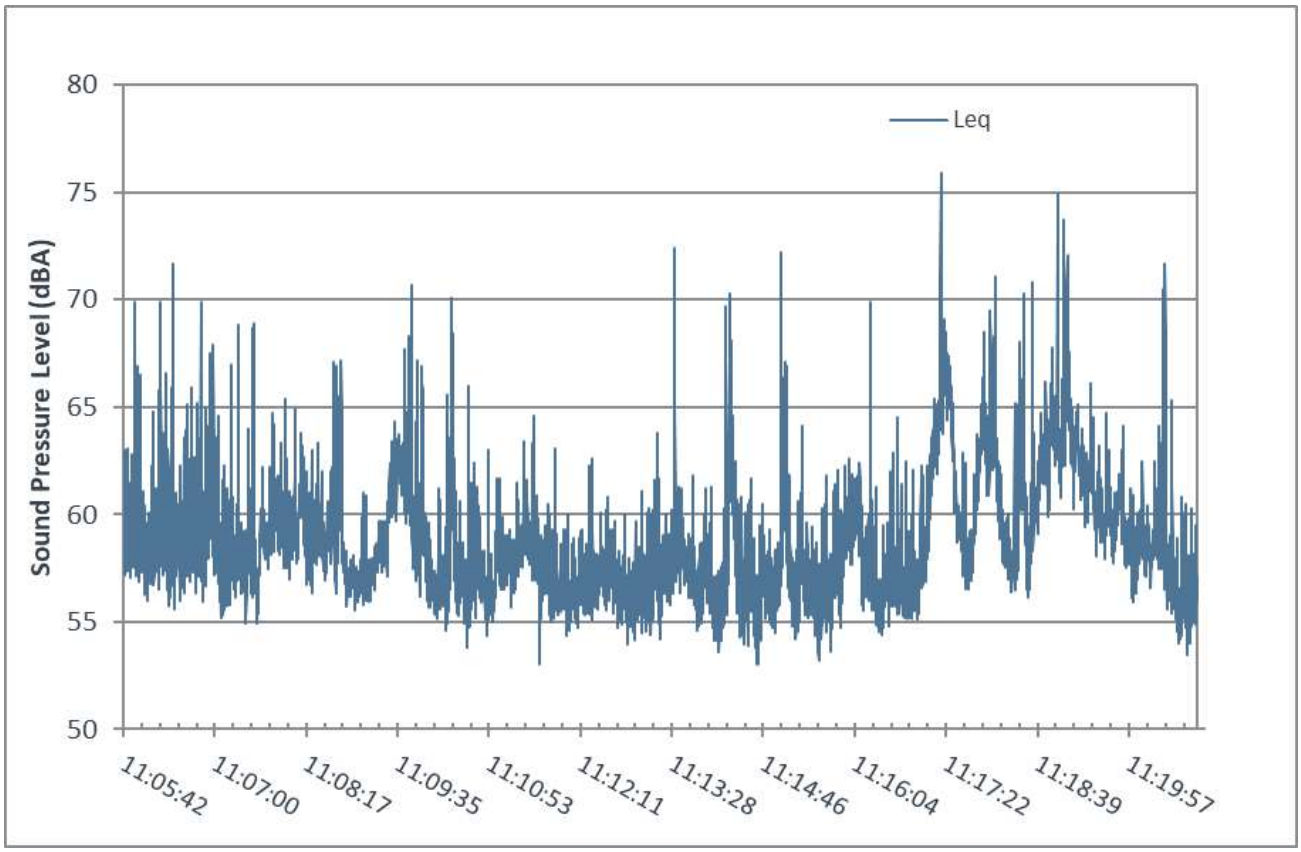
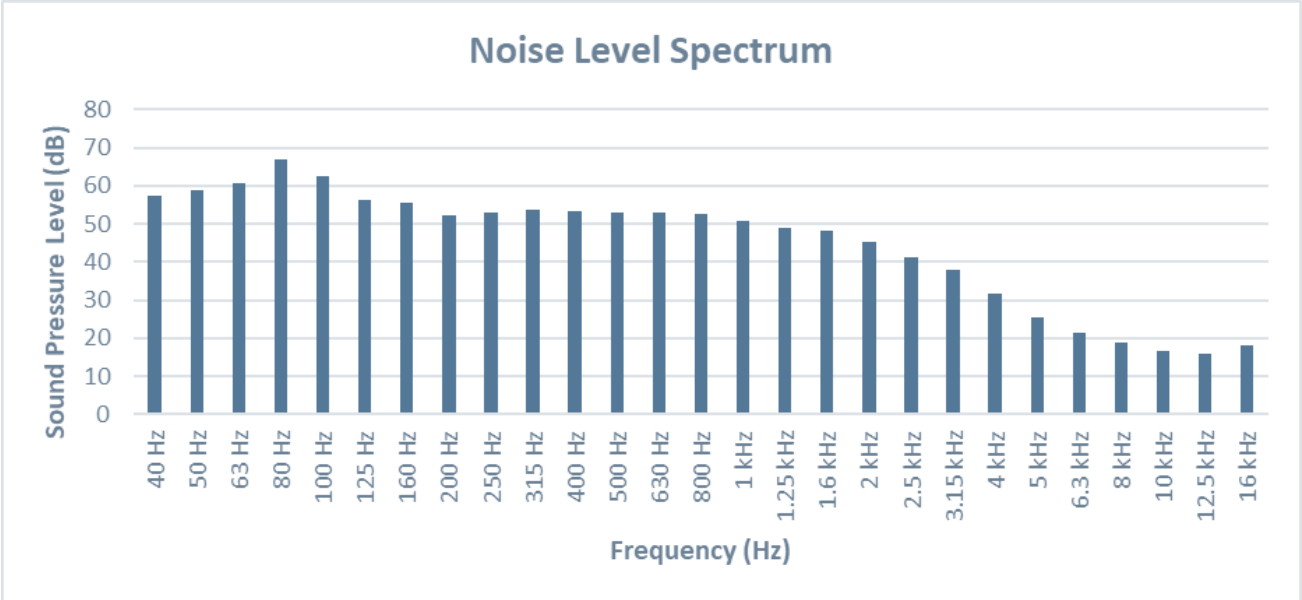


Figure 4-3 - Baseline Noise Survey Photos - Area 1 Campsite



4.3.5 **Figure 4-3** shows the noise levels in each 1/3 octave frequency band. The data indicates that noise levels are concentrated in low frequencies between 40 to 160 Hz.

Figure 4-4 - Noise Level Spectrum - Area 1 Campsite



HAUL ROAD

4.3.6 The noise character of the Haul Road is similar to many main roads in being dominated by a constant profile of peaks and troughs in sound as road traffic passes through. Traffic generally ranged between 4x4 vehicles, pickup trucks, HGVs and other heavy construction traffic.

4.3.7 A short-term noise measurement was undertaken within short distance of the haul road in the main site, as shown in **Figure 4-5**. The noise measurement was undertaken at approximately 15m from

the haul road during a normal period in the daytime. **Figure 4-6** shows the time history of the measured dB $L_{Aeq,T}$ sound levels.

Figure 4-5 - Time History Noise Levels - Haul Road

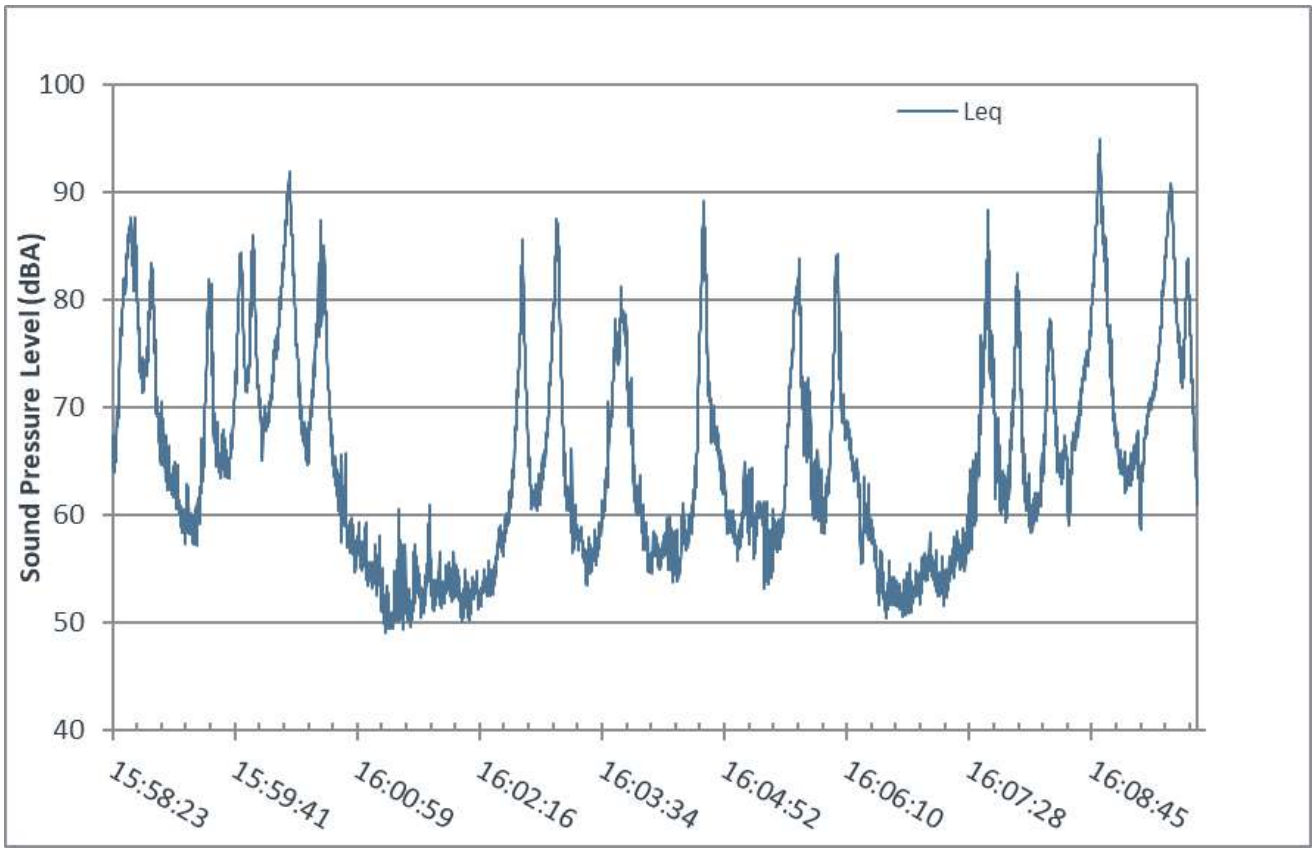
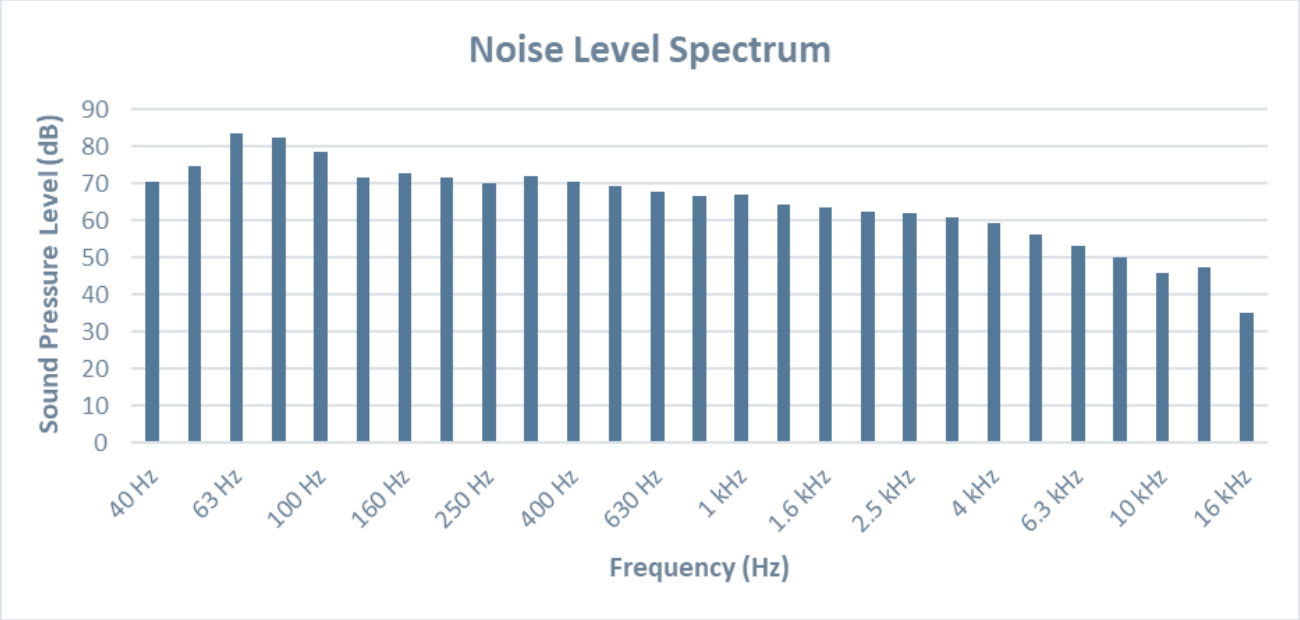


Figure 4-6 - Baseline Noise Survey Photos - Haul Road



4.3.8 **Figure 4-6** shows the measured noise levels in each 1/3 octave frequency band. The data indicates that noise levels are concentrated in low frequencies between 63 to 100 Hz.

Figure 4-7 - Noise Level Spectrum - Haul Road



DT4 TUNNEL

4.3.9 The noise profile of the D4 was dominated by a relatively constant level of noise from a range of construction activities happening at the time that the survey was undertaken.

4.3.10 A short-term noise measurement was undertaken within short distance of the activities inside DT4, as shown in **Figure 4-8**. The noise measurement was undertaken at approximately 10m from the activities during a normal period in the daytime. **Figure 4-9** shows the time history of the measured dB $L_{Aeq,T}$ sound levels.

Figure 4-8 - Time History Noise Levels - DT4 Activities

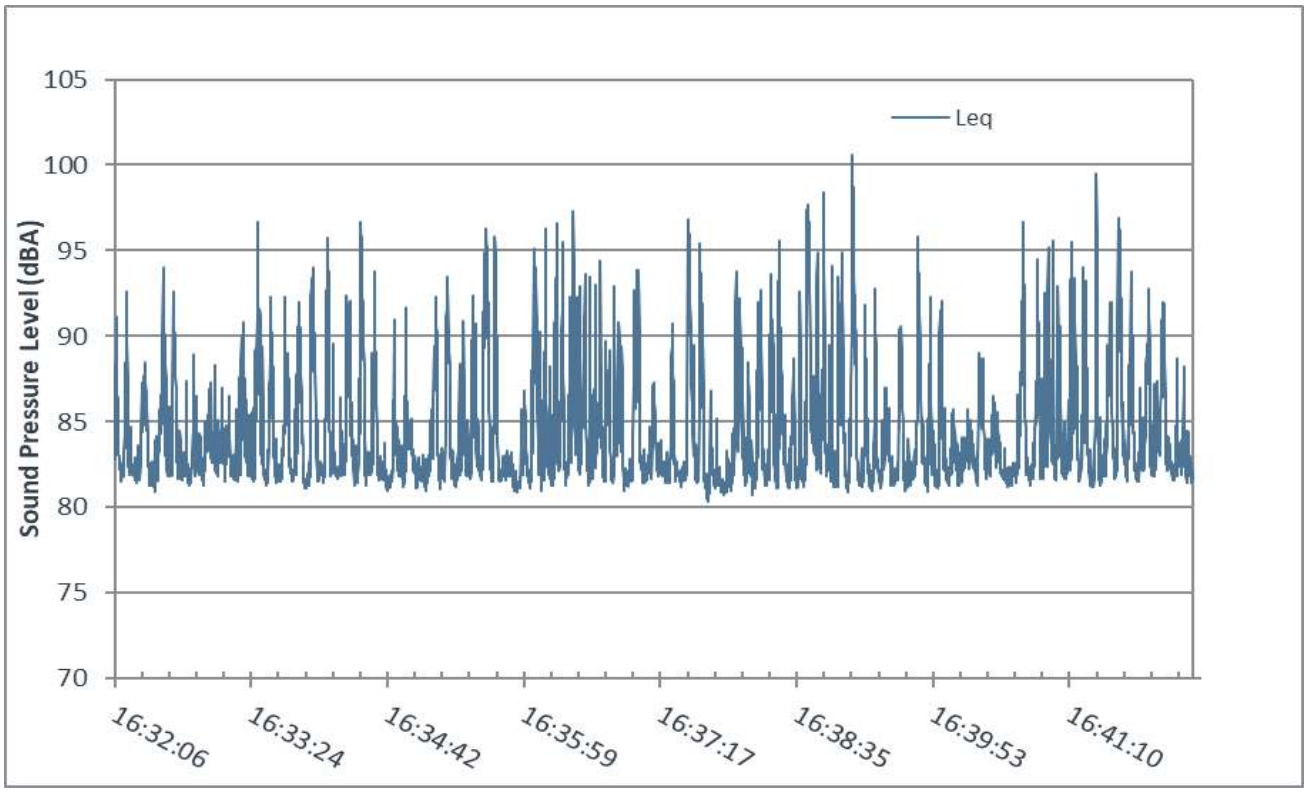


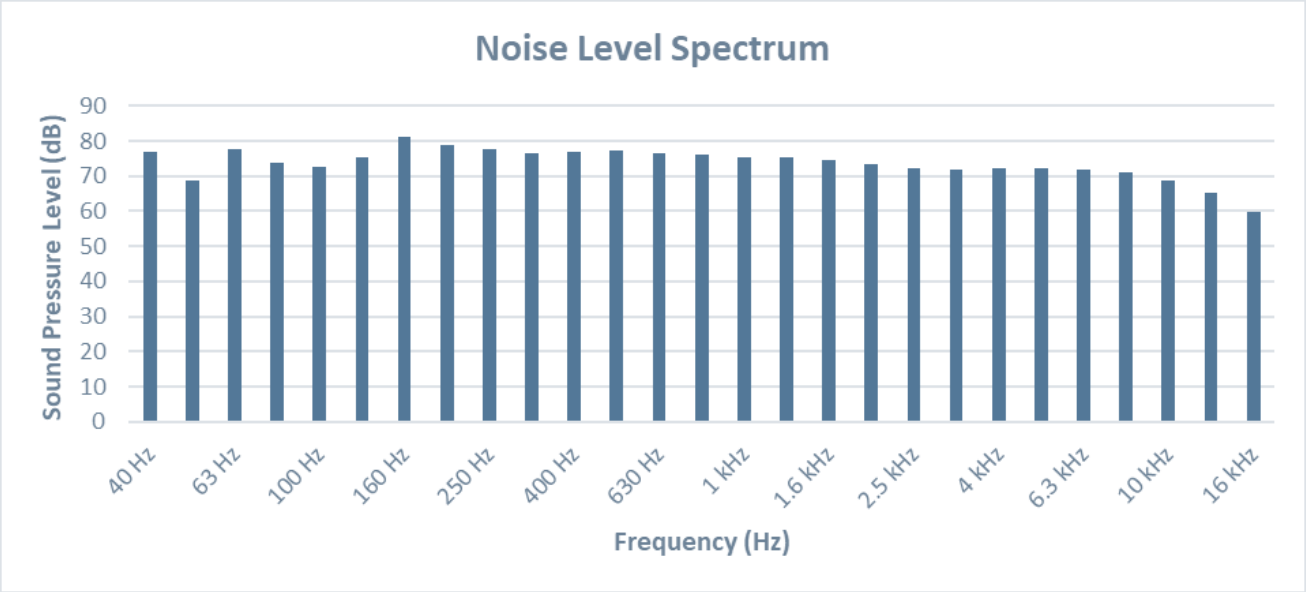
Figure 4-9 - Baseline Noise Survey Photos



DT4 Activities

4.3.11 **Figure 4-9** shows the noise levels in each 1/3 octave frequency bands. The data indicates that noise levels are equally distributed across the frequency bands.

Figure 4-10 - Noise Level Spectrum - DT4 Activities



COFFERDAM

4.3.12 A short-term noise measurement was undertaken within short distance of the activities at the Cofferdam, as shown in **Figure 4-10**. The noise measurement was undertaken at approximately 40m from the activities during a normal period in the daytime. **Figure 4-11** shows the time history of the measured dB $L_{Aeq,T}$ sound levels.

Figure 4-11 - Time History Noise Levels - Cofferdam Activities

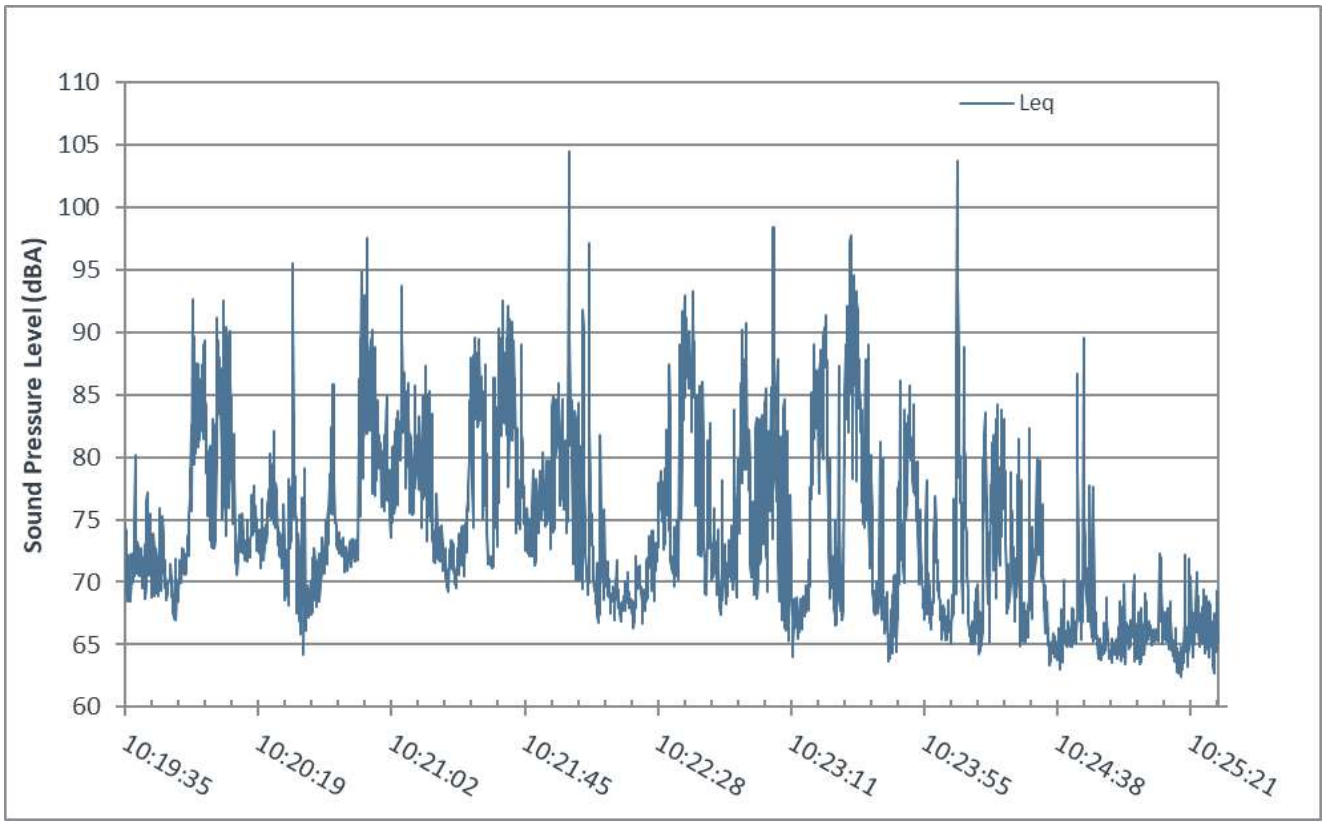
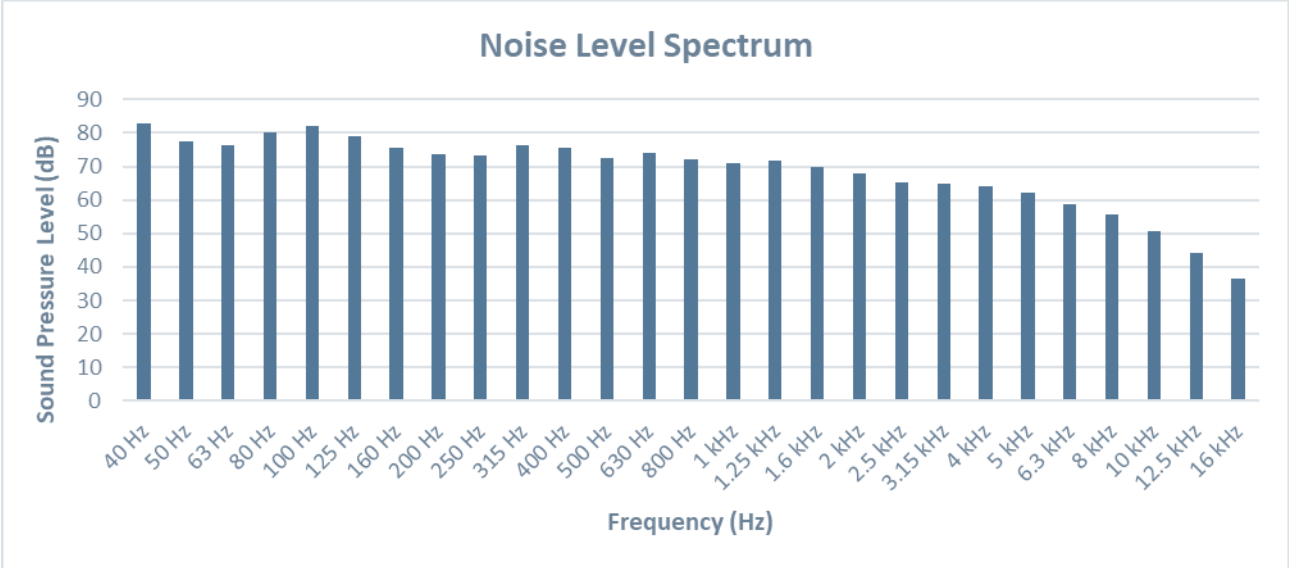


Figure 4-12 - Baseline Noise Survey Photos - Cofferdam Activities



4.3.13 **Figure 4-12** shows the noise levels in each 1/3 octave frequency band. The data indicates that noise levels are concentrated in low and mid frequency bands.

Figure 4-13 - Noise Level Spectrum - Cofferdam Activities



CONVEYOR

4.3.14 Noise levels around the conveyor are generally characterized by the obvious presence of noise from construction vehicle movements and construction activities.

4.3.15 A short-term noise measurement was undertaken within short distance of the conveyor, as shown in **Figure 4-13**. The noise measurements were undertaken at approximately 2m and 10m from the activities during a normal period in the daytime. **Figure 4-14** shows the time history of the measured dB $L_{Aeq,T}$ sound levels.

Figure 4-14 - Time History Noise Levels - Conveyor

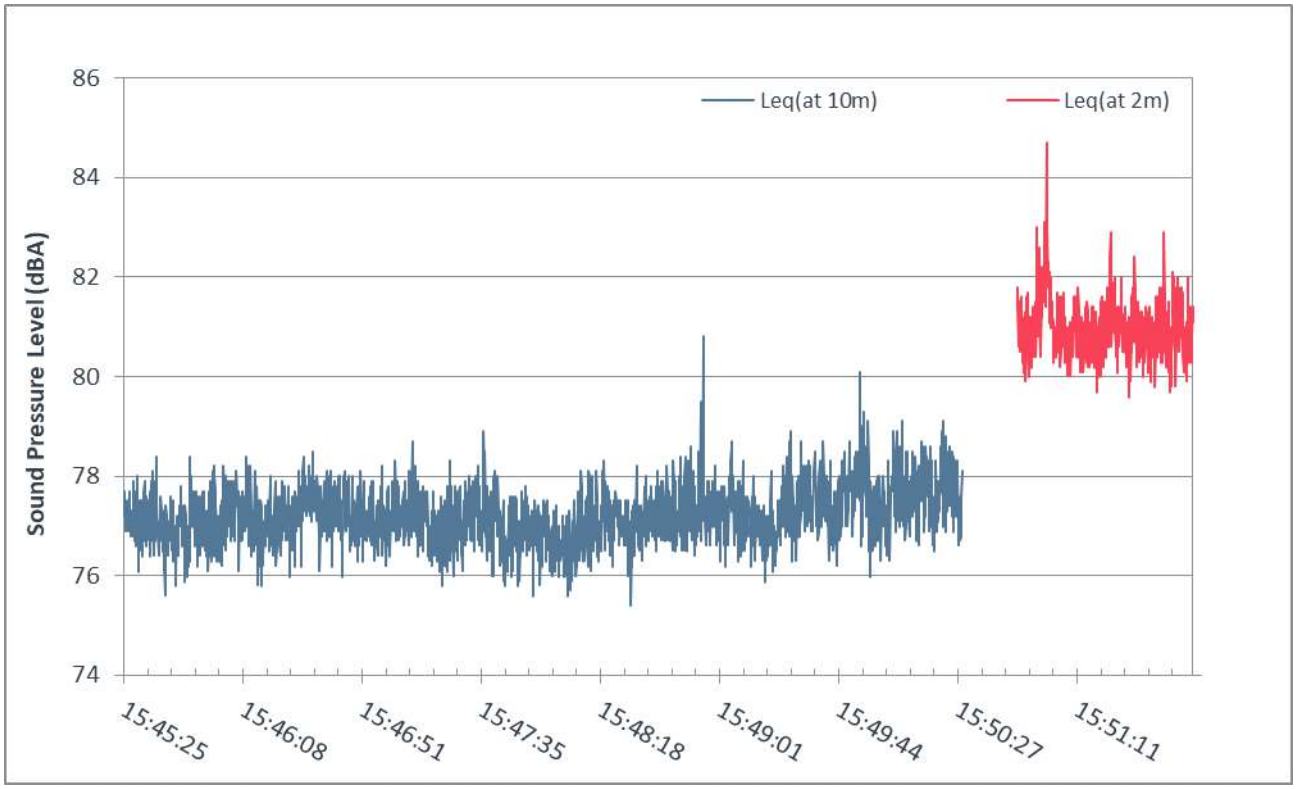
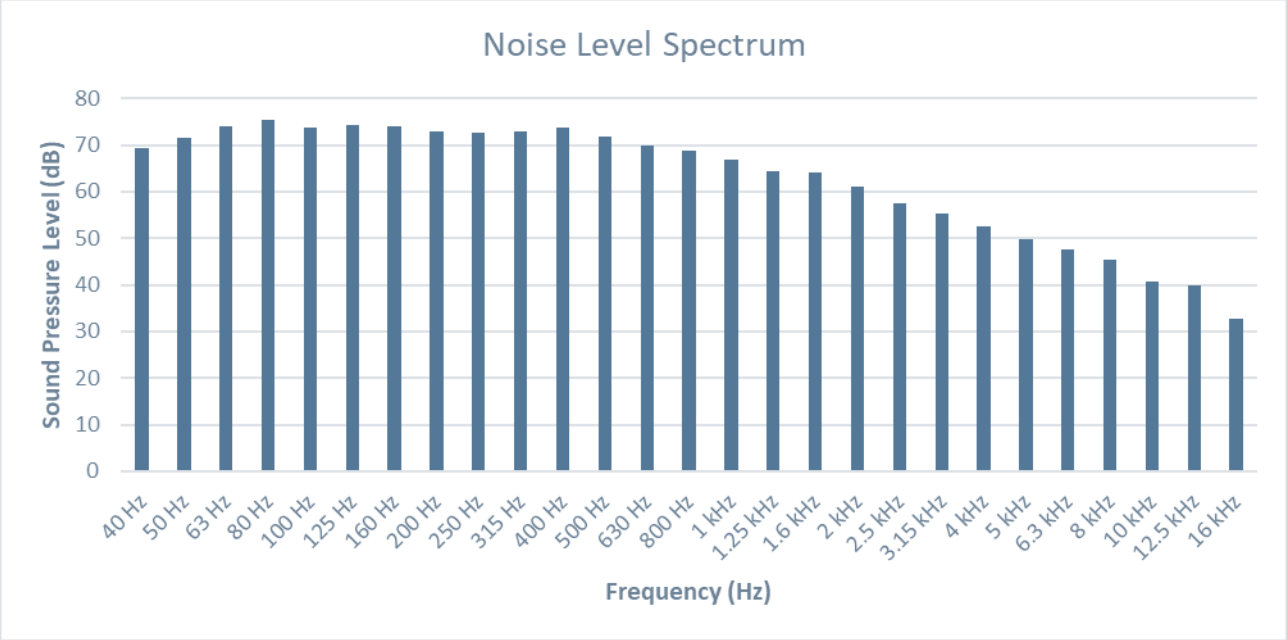


Figure 4-15 - Baseline Noise Survey Photos - Conveyor



4.3.16 **Figure 4-15** shows the noise levels in each 1/3 octave frequency bands. The data in the graph shows that noise levels are concentrated in low and mid frequency bands.

Figure 4-16 - Noise Level Spectrum - Conveyor



CRUSHING PLANT

4.3.17 Noise levels around the crushing plant are generally characterized by the obvious presence of noise from construction vehicle movements and construction activities.

4.3.18 A short-term noise measurement was undertaken within short distance of the crushing plant, as shown in **Figure 4-17**. The noise measurements were undertaken at approximately 30m and 50 from the activities during a normal period in the daytime. **Figure 4-17** shows the time history of the measured dB $L_{Aeq,T}$ sound levels. It is noted that this is one of two crushing plants of similar size.

4.3.19 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.

Figure 4-17 - Time History Noise Levels - Crushing Plant

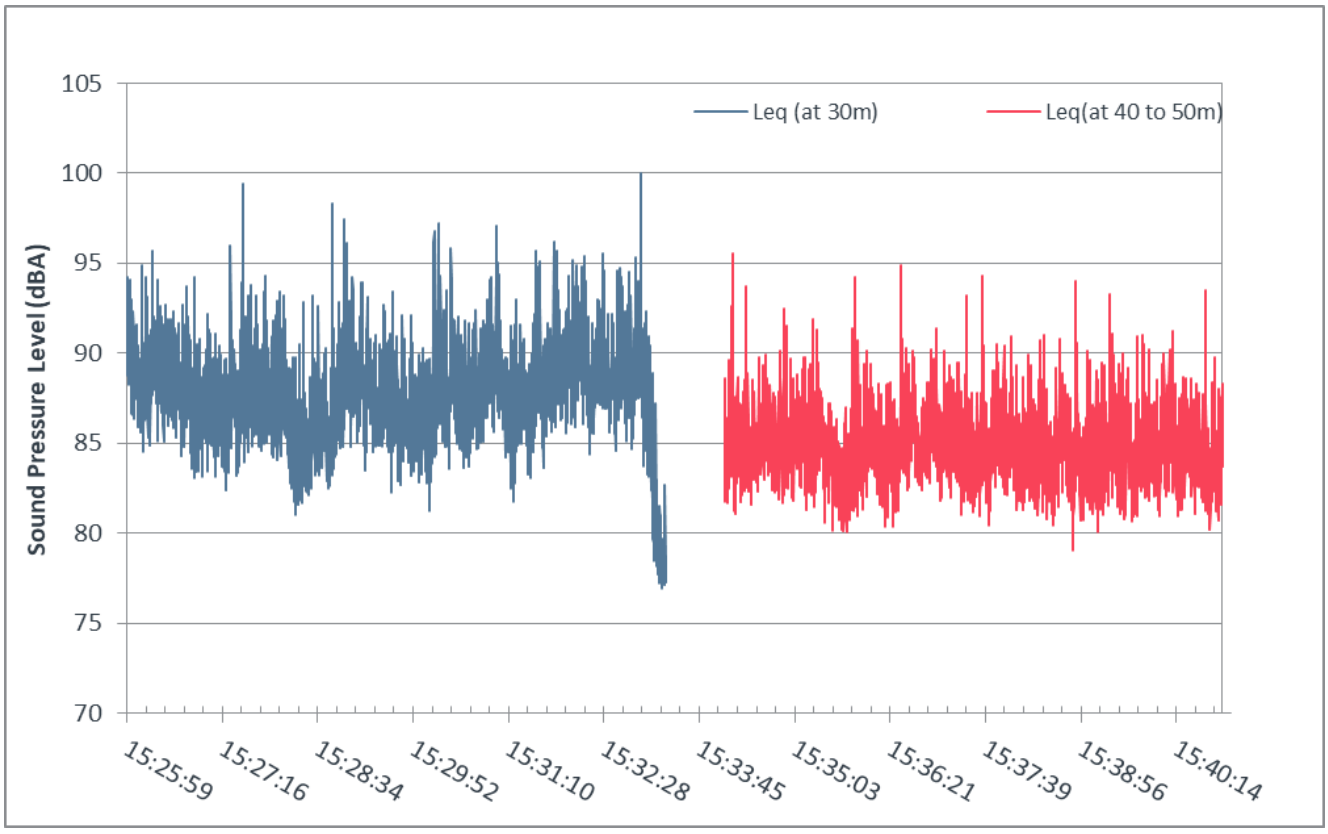
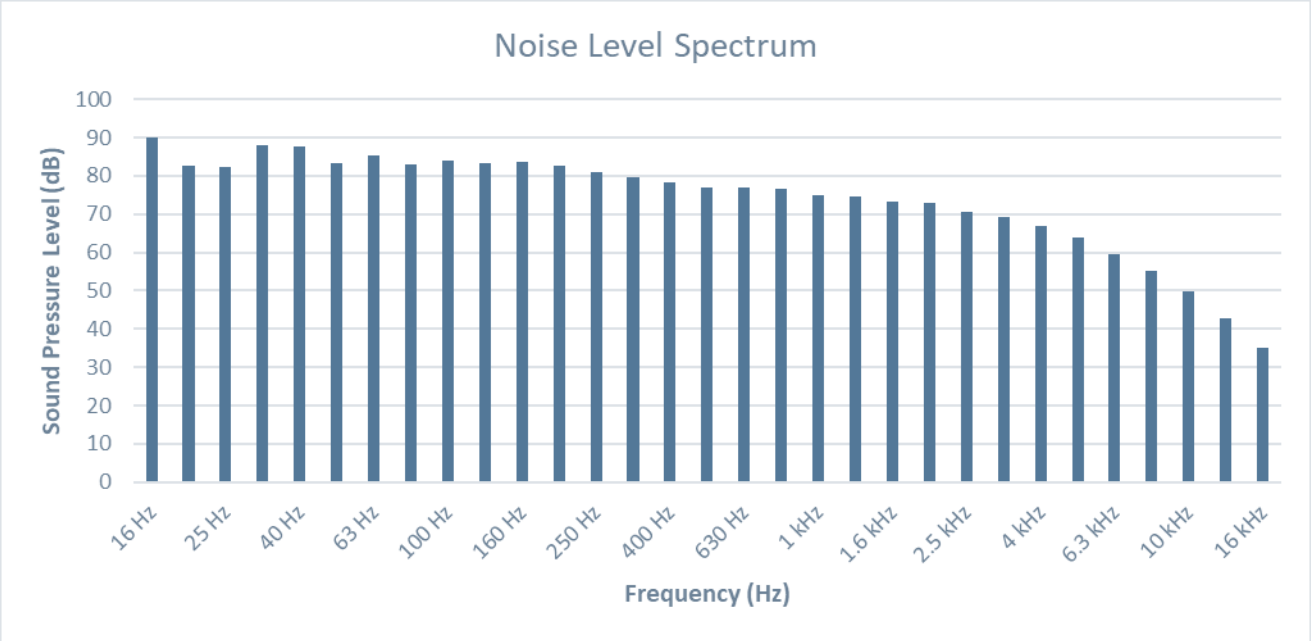


Figure 4-18 - Baseline Noise Survey Photos - Crushing Plant



4.3.20 **Figure 4-18** shows the noise levels in each 1/3 octave frequency bands. It can be seen from the graph that noise levels are concentrated in low and mid frequency bands.

Figure 4-19 - Noise Level Spectrum - Crushing Plant



4.4 RECEPTORS

4.4.1 The receptors considered in the noise assessment are described in **Figure 4-19** and are indicated in **Table 4-3**.

Table 4-3 - Receptors for Noise

Factors	Definition
Off-Site receptors	Noise sensitive receptors off-site in Rogun City. In this group, worker accommodation and other nearby dwellings have been considered, and the healthcare clinic.
On-Site receptors	Noise sensitive receptors within the site. In this group the worker accommodation has been considered.
On-Site workers	Workers active on the site, undertaking normal activities during their working hours.

Figure 4-20 - Diagram indicating locations of noise sources and receptors



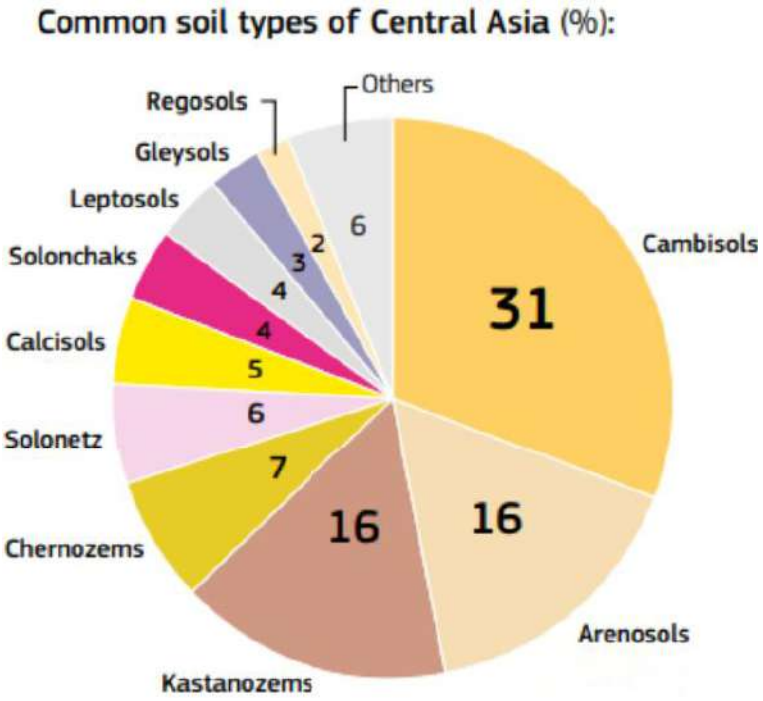
5 SOILS AND GEOLOGY

5.1 INTRODUCTION

5.1.1 While the western part of the Central Asia is generally low-lying and gently undulating, the high mountains of the Pamir and Tian Shan ranges in the south and east are the westernmost extension of the Himalayan Mountain belt. Glaciers, together with permanent snow and ice cover, are widespread. Several peaks rise to over 5000m.

5.1.2 **Figure 5-1** shows the proportion of soil types present nationally across Central Asia (European Comission & FAO, 2023).

Figure 5-1 - Soil types by proportion in Central Asia



5.1.3 The high elevations of Tajikistan mean that the upper slopes are permanently covered with ice and snow that support permafrost-affected soils. Lower slopes are covered by grass and shrubs that provide inputs of organic matter to the soil. However, limited rainfall and low temperatures for most of the year mean that soil-forming processes are slow. The mountain slopes eventually grade into broad plains, which are crossed by ephemeral rivers that often drain into land-locked saline basins. Lowland soils are poorly developed, generally gravelly or sandy, with sparse vegetation. More than 90% of Tajikistan is mountainous territory. Half of the country sits 3,000 meters or more above sea level (asl). The valleys are important for Tajikistan's human geography but make up around 7% of the country's area. The Vakhsh river valley lies within the Project's AoI and is the largest river in Tajikistan.

5.2 SOILS

5.2.1 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).

5.2.2 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.

Cambisols

5.2.3 Based on the soil forms of the Harmonized World Soil Database (HWSD), the site is underlain by Cambisols (FAO, 2015). Most Cambisols occur in regions with a precipitation surplus but in terrain positions that permit surficial discharge of excess water which is consistent with conditions around the site (FAO).

5.2.4 A Cambisol in the World Reference Base for Soil Resources (WRB, 2022) is a soil in the beginning of soil formation, so soil horizon differentiation is weak. This is evident from weak, often brown discoloration and structure formation in the soil profile and the presence of appreciable quantities of weatherable minerals. Cambisols are derived from a wide range of geologies, mostly in alluvial, colluvial and aeolian deposits. Most Cambisols are medium-textured and have a good structural stability, a high porosity, a good water holding capacity and good internal drainage, making them good agricultural soils, and are intensively used. Cambisols in temperate climates are among the most productive soils on earth, subject to climatic and slope conditions.

5.2.5 Cambisols are common in areas with active erosion where they may occur in association with mature tropical soils. Many of the photographs taken at the project site do show soils that qualify as Cambisols (refer to **Figure 5-2**. The other soil forms identified at the site included Ferralsols, Arenosols and Leptosols. The distribution of these soils is shown in **Figure 6-8**.

Figure 5-2 - Cambisols



Leptosols

5.2.6 Leptosols are also present on Site and are largely found in mountainous regions and in areas where soil has been eroded to the extent that hard rock comes near to the surface. These are very shallow soils over hard rock (refer to **Figure 5-3**). Leptosols are very typical of areas with slopes as steep as those of the study area. This means that they often have limited depth (soil surface within 25cm of continuous hard rock from the soil surface). This is because soils are constantly eroded off the

slopes, leaving only a thin layer of soil and bedrock. Their depth limitations make these soils are unattractive rainfed agriculture because of their inability to hold water. As such, and as is the case around the AoI, areas where leptosols are present are mainly used for grazing livestock. However, given it is relative stability, this can lead to sustained soil erosion. This is discussed further later in this section.

Figure 5-3 - Leptosols



Arenosols

5.2.7 Arenosols are also present within the Project's AoI. These are sandy soils with no soil profile development and are devoid of subsurface clay accumulation. They are dry, desert-like soils that have low organic content and are sparsely vegetated by drought- or salt-tolerant plants.

5.2.8 Their excessive permeability, low humus and nutrient content limits their agricultural capacity without irrigation. This also characterizes them with a surface horizon which is light in color, dry for most of the year and often by a significant accumulation of migrated layer silicate clay, soluble salts, or sodium ions (Britannica, Earth sciences, n.d.). These can be fluvial soils, as is the case across much of the Site (refer to **Figure 5-8**).

Figure 5-4 - Fluvial Arenosols





Ferralsols

5.2.9 Ferralsols are present at the Site and are red and yellow weathered soils which are technically defined by a fine-textured subsurface layer of low silt-to-clay ratio, being rich in kaolinite and metal oxides, particularly iron and aluminum. Because of the residual metal oxides and the leaching of mineral nutrients, they have low fertility (Britannica, Britannica, n.d.). They are typically deep soils that are very homogeneous in color, texture, structure and mineralogy (see **Figure 5-5**).

Figure 5-5 - Ferralsols



As mentioned, much of the study site was highly disturbed. A soil that has been heavily modified due to long-term human activity is classified as an Anthrosol. For the purposes of this study, where soils could fit into more than one soil form category, they have been given more descriptive names, such as Ferralsol Anthrosols, Cambisol Anthrosols and Arenosol Luvisols. Where red Ferralsols and brown Cambisols have been identified stockpiled in construction areas, these have been called Ferralsol Anthrosols (see **Figure 5-6**) and Cambisol Anthrosols (see **Figure 5-2**). Where sandy Arenosols have been identified on the riverbanks where they have clearly been deposited by fluvial activity, these have been called Arenosol Luvisols (see **Figure 5-4**).

Figure 5-6 - Ferralsol Anthrosols

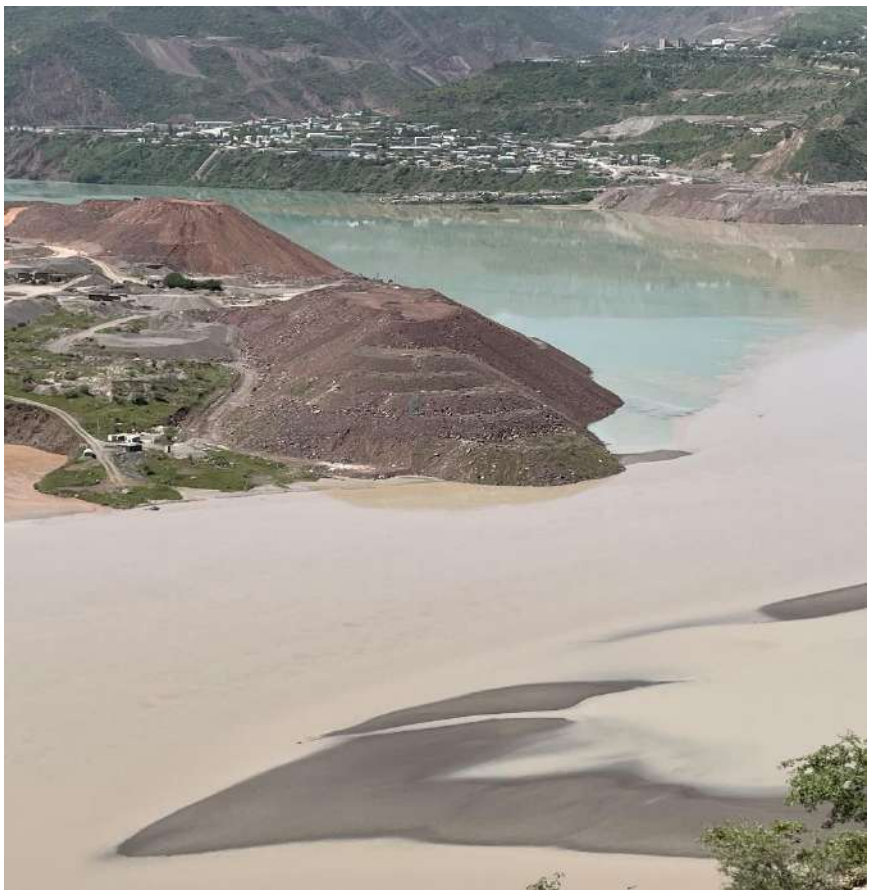


Figure 5-7 - Cambisol Anthrosols



Figure 5-8 - Site Soils

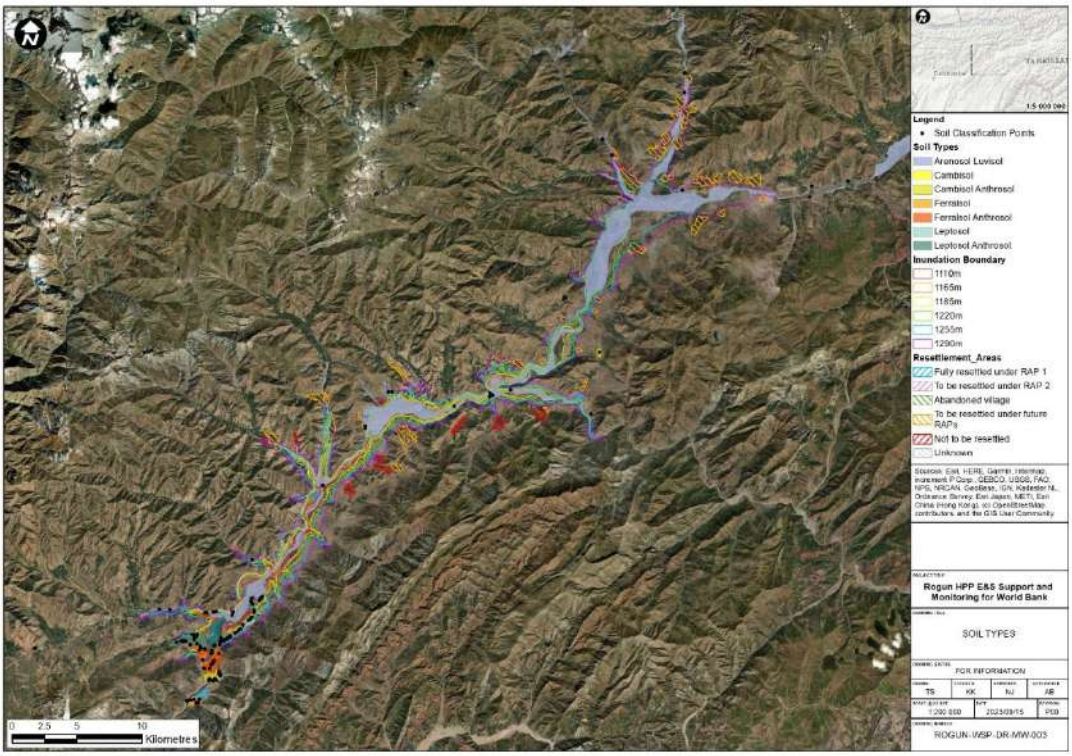
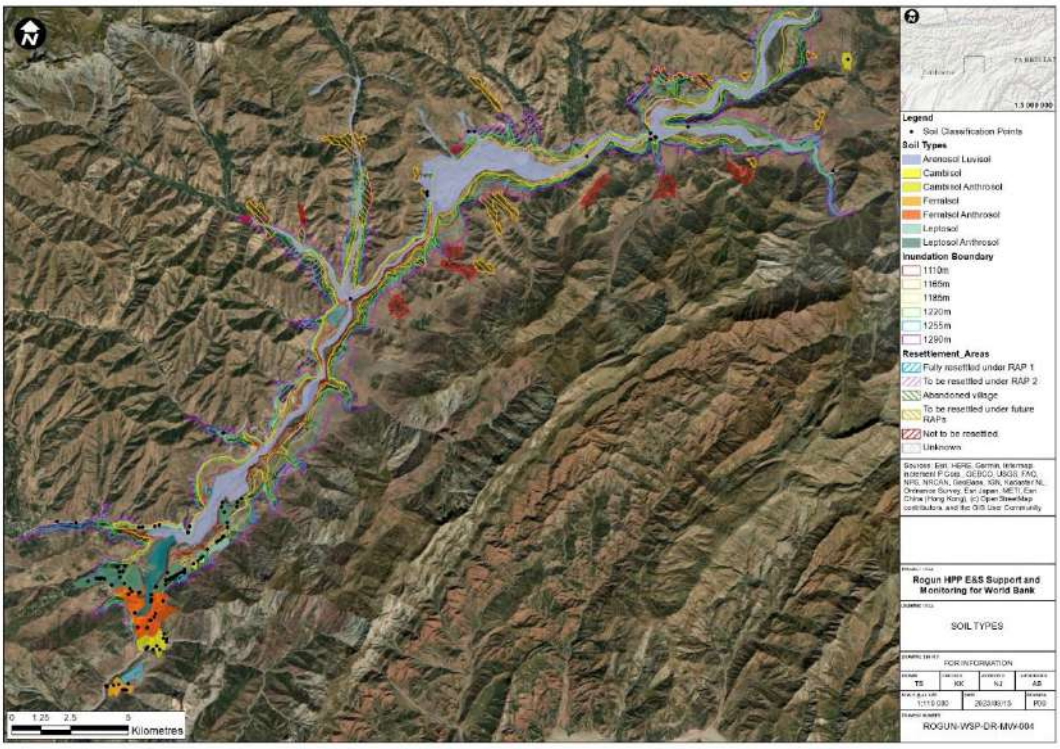


Figure 5-9 - Focussed Site Soils



SOIL DEGRADATION

5.2.10 Land degradation is a major obstacle for food security and broader sustainable development in Central Asia. This region, consisting of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, is a major hotspot of land degradation across the world[3]. Among the countries of the region, Tajikistan is considered the most vulnerable to desertification. Soil erosion is caused by natural processes of wind and rain and anthropogenic from activities such as overgrazing livestock and vehicle movements. Climate change is a significant driver of wind erosion in particular, as long hot, dry periods cause the soil to become looser and more friable.

5.2.11 In Tajikistan common causes have been referenced as rising temperatures, droughts, the irrational use of land and inaccessibility to irrigation. Moreover, unmanaged water flows led to surface run off gradually eroding the topsoil of irrigated land. The worst affected area in Tajikistan is the Khatlon province where 885 ha have been taken out of agricultural circulation (Central Asian Bureau for Analytical Reporting (CABAR), 2024).

5.2.12 Since 2015 the country began to implement the state program to return degraded lands to agricultural use. This has brought activities such as strip cropping, mulching, gabion construction, gully rehabilitation, plantation of shrubs and trees, wind break poplar plantation and pasture rotation. This has led to a decrease in the rate of soil erosion from 150 t/ha to 8-15 t/ha/ year in Tajikistan. By employing appropriate soil management practices, a considerable amount of nutrients such as nitrogen, phosphorus, sulfur and potassium was retained in farmland for crop production, instead of being lost in the wind or water runoff to streams and rivers.

5.3 GEOLOGY

5.3.1 The Republic of 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) at the junction between two of the major structural-facies zones in Central Asia, specifically the Tajik depression and the South-Western Tien Shan, this being expressed in the vicinity of the dam by the Vakhsh Fault, which is a steep thrust fault (Torgoey et al, 2017). According to Torgoey et al, 2017 most of the Project facilities are situated within a single tectonic block, bounded by two subparallel branches of the Vakhsh Fault: The Ionakhsh and Gulizindan faults respectively.

5.3.2 The Rogun TEAS (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.

[3]Mirzabaev, A., (2023) 'The impact of land degradation on agricultural profits and implications for poverty reduction in Central Asia', Available at: https://www.sciencedirect.com/science/article/abs/pii/S0264837722005579 (Accessed: 10.10.2024).

- 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.

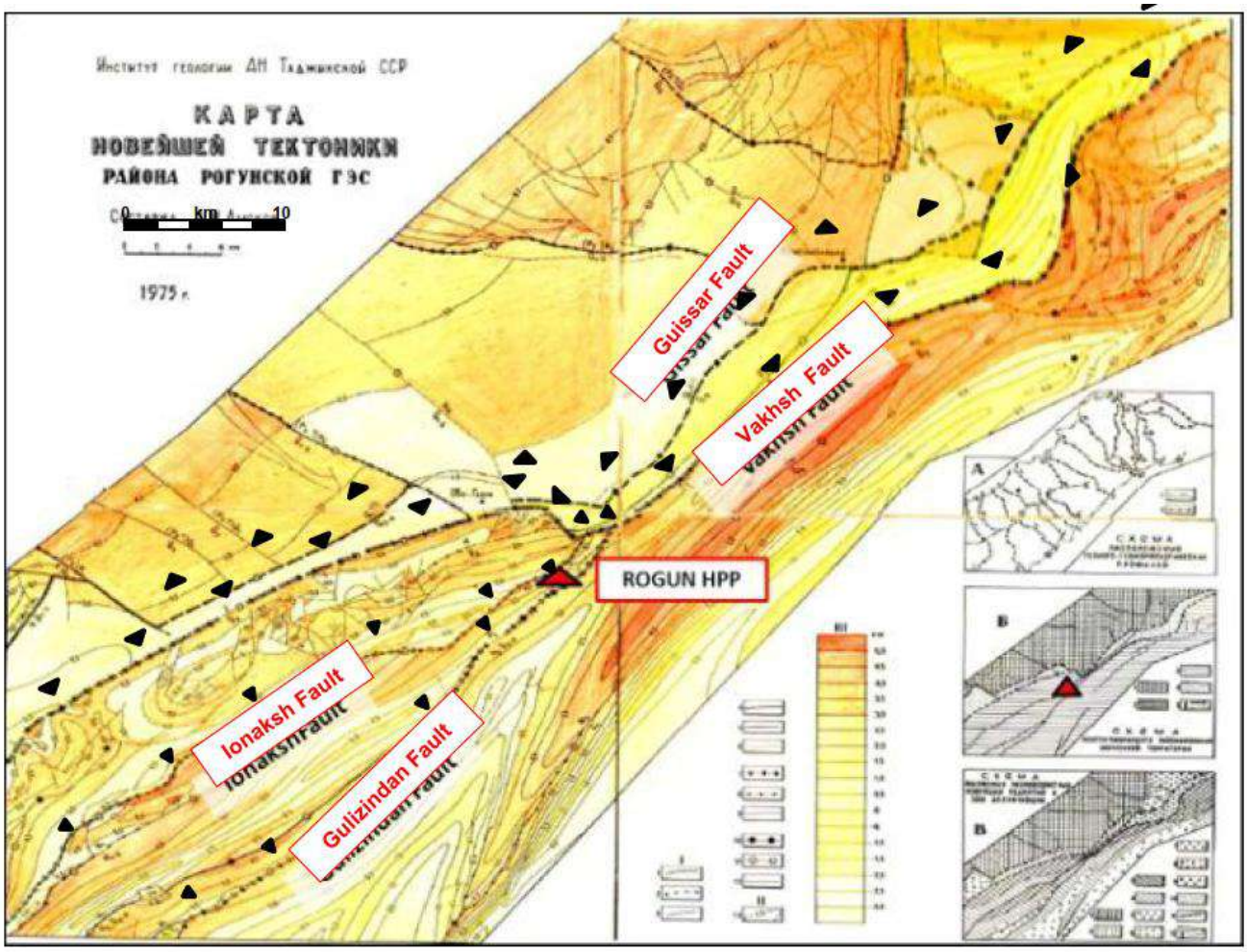
5.3.3 The primary tectonic feature at the site is the Ionakhsh fault which extends along the reservoir, broadly following the left of the Vakhsh valley, crossing the river within the upstream section of the dam. The fault then continues in the rock mass on the right side of the valley, forming a steeply dipping fault at an angle of between 65o (Torgoey et al, 2017) and 80o ((Kolichko and Fil', 1981) to the southwest under the dam (Kolichko and Fil', 1981).

5.3.4 Along the fault, Upper Jurassic and Cretaceous rocks come into contact (Torgoev et al, 2017), with the Jurassic sediments comprising predominantly halite overlain by mudstone. The Lower Cretaceous strata are reported by Torgoev et al (2017) to comprise irregularly interbedded sandstones and siltstones with some subordinate mudstones. In the reservoir area Kolichko and Fil' (1981) report the presence of Upper Cretaceous marine mudstones, limestones, sandstones, and gypsum.

Salt Wedge Treatment

5.3.5 The Rogun dam site and reservoir lie in close proximity to the Vakhsh Fault, Ionakhsh Fault and Gulizindan Fault. In particular, the Ionakhsh fault crosses the site on the upstream part of the dam axis (**Figure 5-10**).

Figure 5-10 - Location of the main geological faults in relation to Rogun HPP



5.3.6 These faults are comprised of Jurassic-Cretaceous sediments which, through successive earthquakes have pulled the Jurassic salt formations to the surface. A key consideration of the dam design is the management of the risk of freshwater intrusion through the dam to these sediments preventing the salt formations from dissolving. The potential impact on the Dam from the Salt Wedge has been studied since the initial design during Soviet times in the 1970s.

5.3.7 The Salt Wedge that fills the Ionakhsh Fault, is approximately10 m thick at the top (at around 950 m asl) and increases in thickness with depth.

5.3.8 The area is tectonically very active, and geodetic measurements carried out before 1978 demonstrate that both the Lonakhsh Fault and Vakhsh Fault 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 (Figure 5-11).

5.3.9 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:

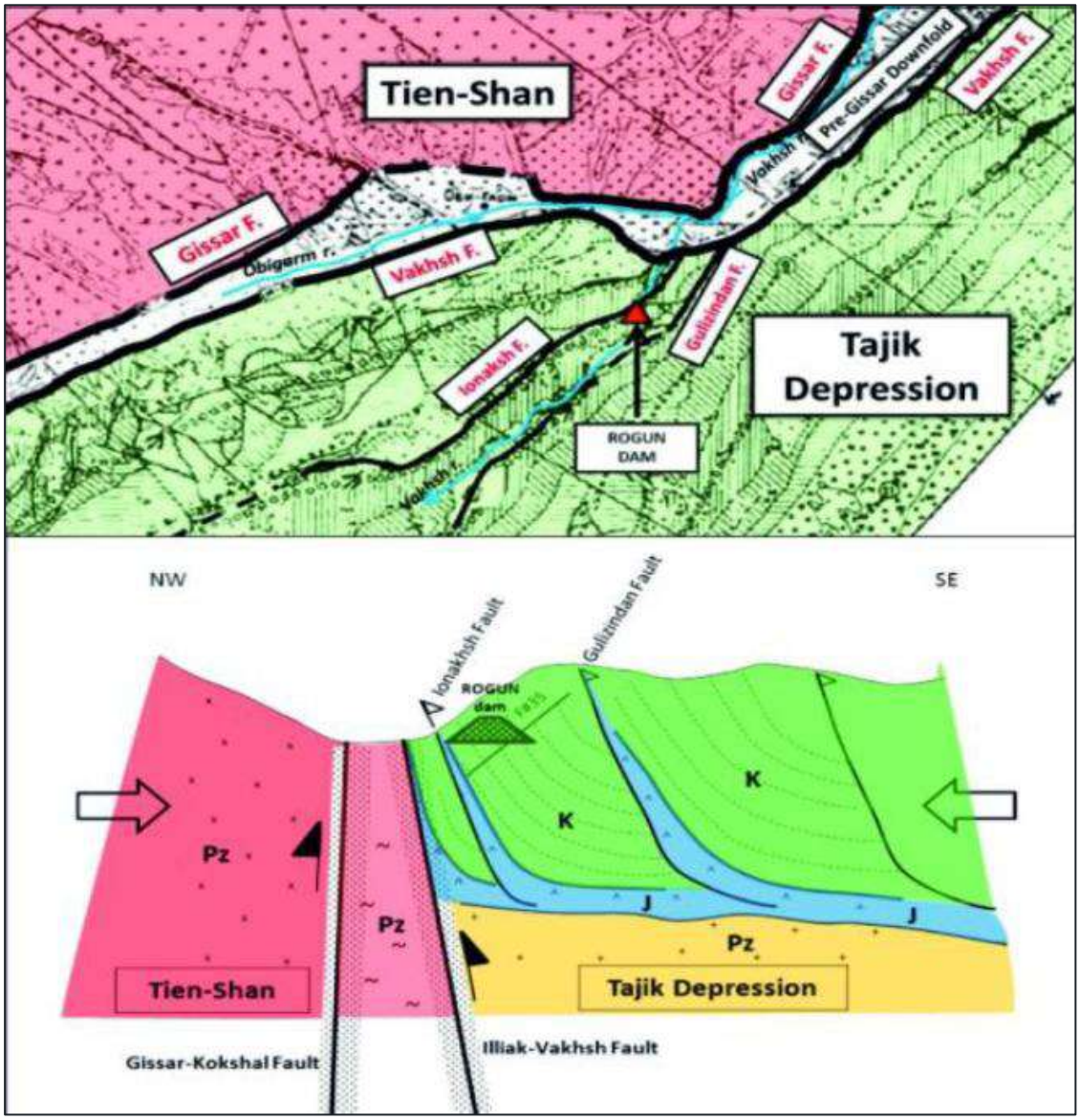
- Hydraulic and grouting barriers.
- Installation of a monitoring system to follow-up performance of the treatment works during reservoir filling and operation.
- The monitoring system triggers pre-defined indicators.
- Contingency plans which identify remedial measures to be implemented in the event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

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

5.3.11 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.

5.3.12 The Ionakhsh fault is the most important of the local faults that could provide a preferred path out of the reservoir. It is associated with a salt wedge at the river crossing and at the intake to the diversion tunnels and the right abutment and extends to Nurek Dam. It is reported by OSHC "Barki Tojik", 2013 that within the Ionakhsh fault zone there is a salt unit comprising halite and anhydrite caused by the tectonic stresses in the region migrating into the valley floor where it is eroded and dissolved by the overlying river. OSHC "Barki Tojik", 2013 report that the salt unit has a wedge shape with a thickness of approximately 1.5 m to 2 m in the left bank and up to 12 m in the right bank. OSHC "Barki Tojik", 2013 report that thickness of the salt unit increases with depth, increasing in thickness by approximately 15 m with every 100 m depth. In the Rogun dam and reservoir area the Quaternary sediments are reported by Torgoev et al (2017) as being fragmented in distribution and varying in thickness and origin. Talus deposits including a loam matrix are reported as being present on the upper sections of the right-bank slope, reaching a thickness of up to 60 meters. Within the dam area itself Kolichko and Fil' (1981) report talus cones of up to 20 meters in thickness with boulder-gravel deposits not exceeding 8 m to 12 m in thickness. In the upper part of the reservoir Kolichko and Fil' (1981) report alluvial terrace deposits up to 100 m thick.

Figure 5-11 - Geological and tectonic structure of Rogun area, with the upper figure being a plan of faults in the dam area and the lower diagram comprising a schematic cross section of the site showing the geological structure and geodynamic setting (from Torgoev et al, 2017)



5.3.13 The salt wedge has been considered a project risk from the early stages of project development and mitigation thereof has been an important part of the design phase. An early attempt to mitigate potential dissolution of the salt wedge included grouting the top of the salt wedge and maintaining a high hydraulic head downstream thereof to keep the groundwater above the wedge saturated by the injection of brine.

5.3.14 Downstream pressure balancing injection wells were supposed to be connected to the pressure tunnel, while the brine was injected upstream of this line of pressure balancing wells. Unexpectedly, the absorption of brine reduced to very low values, indicating clogging of the injection wells, and creating doubts about the viability of the brine injection system. Subsequent attempts at salt wedge mitigation focused on reduction of the rock mass conductivity to reduce salt leaching to very low values.

5.3.15 The operation of the salt wedge mitigation system is particularly important during main dam phase 1, but once the dam reaches elevation level 1110m the core of the main dam becomes the impervious element, and the importance of the salt wedge mitigation system decreases as the pressures will be balanced by the reservoir waters.

5.3.16 A staged approach to the technical studies is being undertaken, Seismic studies have been completed for the Stage 1 of the construction (i.e. up to 1,110 m asl). Seismic studies for the Project to full height are being commissioned and will commence in 2025. These studies are not expected to require substantive design changes, however, where concerns are identified, updates to the design will be undertaken in line with the Management of Change Process as required by the ESMP.

5.3.17 The following features have potential influence on the Rogun Dam design.

- The salt wedge as elaborated upon above.
- 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. The visible part of these masses is principally made up of gypsum, but there may also be salt present. 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 1250m elevation. Slope stability - Significant potential slides have been identified, corresponding to an evaluation of slope stability. 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 (Coyne et Bellier, 2014). According to the existing Project ESIA (Poyry Energy Ltd., 2014), the main geological formations of the general Rogun area are the Paleozoic granite on the right bank of the Vakhsh River valley and the Mezo-Cenozoic terrigen-carbonate formation on the left bank. A South-Hissar group of structural-formational zones are located on the right bank of the valley.

- The left bank consists of deposits of the ‘Afghan-Tajik depression’. The regional tectonic stresses involve sudden co-seismic rupture and permanent aseismic creeping (Poyry Energy Ltd., 2014).

5.3.18 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.

6 CONTAMINATED LAND

6.1 INTRODUCTION

6.1.1 Heavy metals, persistent organic pollutants (POPs) from industry and pesticides, and novel pollutants originating from pharmaceuticals and personal care products are most commonly found in contaminated land across the world. Hydrocarbons and volatile organic compounds (VOCs) are also common sources of pollution and most commonly affects land close to transport infrastructure and industrial facilities.

6.1.2 Industrial waste is a major driver of land contamination. The best available data for the volume of mining and industrial waste produced annually in Tajikistan is 1,267,646 tons in 2014. There is no available data on the volume of hazardous waste produced annually, but it is widely acknowledged that it is a prominent issue as there is no defined method for treatment and management of hazardous waste in Tajik law. Approximately there are 65 sites affected by land contamination from the industry practice and the disposal of industrial and municipal waste in Tajikistan (Ulugov, U., et al., 2018).

6.1.3 Soviet-era agrochemicals are a significant source of land contamination in Central Asia, as policy mandated the use of pesticides in agriculture which were used extensively in Tajikistan, many of which are now known to be hazardous. Contaminated sites are particularly present in the west of the country as that is where arable land is primarily located.

6.1.4 Historically, Tajikistan had several regions of large-scale agriculture and extensive pesticide use, with an estimated 63,000 tons of agricultural pesticides delivered for agricultural use between 1965 and 1990. Tajik use of dichloro-diphenyl-trichloroethane (DDT) between 1960 and 1970 for growing cotton was estimated to be 8,700 tons per year, primarily in the western regions of the country (Barron, Mace G. et al., 2007).

6.1.5 Tajikistan is known to contain multiple large uncontrolled pesticide burial sites. These include the Soviet-era pesticide disposal site in the southwest of the country near the city of Vakhsh around 100km from the site, which has been estimated to contain 3,000–9,500 tons of uncontrolled and obsolete organochlorine pesticides.

6.1.6 During the 1990s, many former pesticides stored in Tajikistan were privatized, resulting in the discovery of obsolete pesticides by the new owners. These pesticides have since been disturbed and spread by construction works and erosion, leading to soil contamination in villages (FAO, 2022).

6.1.7 The average waste generation per year in Tajikistan is approximately 2.6 million tons. There are approximately 70 official municipal solid waste landfills in Tajikistan.

6.1.8 Landfill sites are known to be a significant potential source of contamination risks as they produce a substance known as leachate, which is formed when water soaks through layers of waste and accumulates a high concentrations of water-soluble chemicals and suspended particles, some of which are highly toxic. Leachate can then seep into the surrounding environment and spread contamination to soil and groundwater. Older sites may also contain hazardous chemicals which have since been banned.

6.1.9 Plastic waste can also be a source of land contamination wherever human activities are present. Plastics are generally non-hazardous in the short term. However, improperly discarded plastic waste

can have a number of negative environmental impacts, including on the soil. Plastics do not biodegrade but break into smaller and smaller microplastics over time which are absorbed into the soil, water environment, and food chain. Many plastics also contain hazardous additives which leach into the soil as the plastic begins to degrade. Some plastics may degrade into novel pollutants over time or under UV radiation, which has a demonstrable negative impact on soil organisms as well as polluting the surrounding environment (Ford, F., et al., 2022). This is a risk for the Project where plastic waste is disposed of at landfill sites created for the Project or resettlement sites, or in cases of improper disposal (e.g., littering by Project workers).

6.1.10 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. These included, but were not limited to:

- WeBuild on-Site diesel fueling station;
- WeBuild workshop;
- WeBuild waste oil and waste filters storage location;
- Batching Plant A;
- WeBuild rock crusher; and
- Upstream reservoir banks (left side).

6.1.11 It is noted that site conditions are not considered to be materially different than described in the ESIA. Some improvements have been observed, such as recent improvements in occupational health and safety and traffic management, and there has definitely been an improvement in supervision of environmental and social performance by Contractors. These improvements are in response to actions taken in advance of the effectiveness of the Environmental and Social Commitment Plan.WSP staff's judgement of the general situation around the site were restricted because they were mainly shown WeBuild locations, which was not a representative sample of the whole site. There were marked differences in the management and operation of the sites and facilities between the different contractors and organizations, this report does not look to identify individual companies or organizations for good or bad practice but instead seeks to identify general trends and or areas requiring improvement and action. The key findings and observations from the visit are summarised in this section. No stakeholder engagement was undertaken by WSP staff during their site visit.

6.2 FUEL STORAGE

6.2.1 WSP visited 6no. tank farms (4no. were active, 2no. 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 organizations 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).

6.2.2 Most commonly the operators referred to either new or current 'Russian Standards', the compliance of the installations against the 'Russian Standards' is beyond the scope of this report. However, it

should be noted that a number of operators stating their installations were compliant with the current 'Russian Standard' had significantly variable installations, including but not limited to; the construction of the tanks (single skinned / doubled skinned), tanks sited within a bund, tanks being buried / covered, pipework running above or underground, installations installed on concrete hard standing and spill response equipment.

6.2.3 The contractor management plans related to fuel storage and contaminated land will provide details on fire safety and spill prevention measures in the fuel storage areas; plans for presence of appropriate signage; the level of staff awareness and experience regarding spill or fire incident procedures; and the availability of trained staff on site.

6.2.4 In general, conditions remain approximately the same as noted in the ESIA: fuel storage is variable, with some leaking tanks and some GIIP. Resolution will be ensured and actions will be taken pending World Bank Project effectiveness, and overall increased attention to environmental and social matters.

MAIN ROGUN TANK FARM (CONSTRUCTION AREA 1).

6.2.5 The 'Main' Rogun Tank Farm, located in Construction Area 1, has been identified in previous reports as a potential area of concern, with anecdotal evidence of surficial soils being saturated with diesel and 'dripping' out of the southern retaining wall. During the site visit conducted in September 2023, WSP did not find the soils to be saturated with diesel, however, there was evidence of localised spills around refilling points and seepage from below the level of tanks (Note: It had not rained for several days before and did not rain during the September 2023 visit). It should be noted that 'lower' buried tanks on the southwestern corner of the installation were being filled at the time of the visit.

Figure 6-1 - Visible Seepage from 'Main' Rogun Tank Farm



6.2.6 The buried tanks at the highest point of the tank farm (southeastern corner) are situate on the top of a slope above the main site access road. It was noted that the previously buried tanks have started to become exposed with recent rains washing the surficial soils down the slope towards to the main access road.

ABANDONED & DISUSED TANK FARMS

6.2.7 WSP visited 1no. abandoned and 1no. disused tank farms.

6.2.8 WSP could not establish the operator of the 'abandoned' tank farm, which anecdotally was installed during the soviet era, and has not been active for a least 4 years. 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.

6.2.9 A metal works contractor with workshops adjacent to the ‘abandoned’ tank farm has a standalone diesel tank located adjacent to the top tier of the tanks, the standalone tank was not currently in use and was sparingly used (dependent upon the companies works). No visual or olfactory evidence of contamination was noted on or around the standalone tank. The disused tank farm had been operated by one of the main contractors and is scheduled to be relocated by the same contractor, although the new location for removing wastes from storage areas are not universally understood. Visual evidence of spills/leaks was noted around above ground infrastructure which serviced the nearby filling points. It should also be noted that the bunded area overflowed into a sump, which according to the contractor drained to ground.

CONTRACTORS TANKS AND TANK FARMS

6.2.10 In addition to the ‘main’ diesel tank farm operated by Rogun HPP, a number of contractors operate their own diesel storage installations, ranging from tank farms consisting of multiple fixed tanks or parked fuel tanker trailers to individual tanks of varying builds and sizes.

Figure 6-2 - Contractor Tank Farms



6.2.11 Speaking to a number of contractors their tanks (including tank farms) had been relocated either within the Rogun HPP project or from other projects, with a number of tanks seemingly decades old. The standards to which the majoirty of tanks and or tank farms had been installed to is not univerally known, however the majority of contractors citied previous or current ‘Russian Standards’.

Figure 6-3 - Contractor (Single) Diesel Tanks



6.2.12 During the September 2023 visit, visual and olfactory evidence of spills were noted around the majority of tanks and or tank farms.

Figure 6-4 - Visual Evidence of Spills / Leaks



6.3 WORKSHOPS & CONSTRUCTION AREAS

6.3.1 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.

Figure 6-5 - Workshops



6.4 SEWAGE

6.4.1 The sewage arrangements onsite are not universally known, with contradictory information seemingly provided by Rogun HPP and the contractors onsite.

CONSTRUCTION SITE 1

6.4.2 A sewage treatment works is located in Construction Site 1, the works currently consists of 3no. settlement ponds with chloride manually dosed into one of the ponds (Note: WSP were not able to witness or confirm the dosing during the site visit of September 2023). 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. WSP did not enter the building, but the building appeared derelict from the outside.

6.4.3 Unknown effluent appeared to be bypassing the settlement tanks, the origin of the effluent could not be established during the site visit however, appeared to be entering the area from multiple upgradient directions. There were no solid wastes observed either within the settlement tanks or in

the surrounding effluent. It was noted that effluent from the upper most settlement tank, was overflowing and combining with the known effluent, this effluent was followed down gradient where it discharged into the reservoir.

6.4.4 Anecdotally WSP were told the solid wastes were ‘collected’ at the contractor’s compounds / facilities and only the liquid effluent was piped to the sewage treatment works. Speaking to a number of contractors located within Construction Site 1, the location of where the solid wastes were collected is not universally known. Contractors were stating the sewage was piped or pumped out of their compounds to a central location / facility.

Figure 6-6 - Construction Site 1 Sewage Treatment



CONTRACTORS COMPOUNDS AND WORKSHOPS

6.4.5 Across the wider site away from Construction Area 1 different contractors anecdotally utilized septic tanks to collect sewage. 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 our September 2023 site visit). This arrangement would be consistent with arrangements witnessed for water runoff at a number of compounds (see Section 6.5).

6.5 CURRENT CONDITIONS REMAIN APPROXIMATELY THE SAME AS NOTED IN THE ESIA. AGAIN, REQUIREMENTS WILL BE IMPLEMENTED UPON WORLD BANK PROJECT EFFECTIVENESS. THE STATED CONDITIONS REFLECT THOSE AS OF EARLY 2025.WATER TREATMENT & RUNOFF

6.5.1 OJSC Rogun HPP, and the Rogun HPP Contractors and operators have applied different approaches and standards to the control, treatment and disposal of water. The majority of the discharges noted during the September 2023 site visits were to ground or river or reservoir with very limited or no treatment prior to discharge.

6.5.2 Current conditions remain approximately the same as noted in the ESIA. Again, requirements will be implemented upon World Bank Project effectiveness. The stated conditions reflect those as of early 2025.

WORKSHOPS

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. It was

noted however, that once collected only one contractor had sufficient infrastructure to collect and treat the runoff. A number of contractors had excavated what they defined as ‘Septic Tanks’ adjacent to the workshop areas, it should be noted that these ‘Septic Tanks’ were not consistent with a conventional understanding (or GIIP) of a septic tank, were contained and drained straight to ground with no collection or treatment witnessed. 1 no. ‘Septic Tank’ had visible Light Non-Aqueous Phase Liquid (LNAPL) (most likely engine oil) on the surface of the ponded water.

Figure 6-7 - ‘Septic Tanks’ Used for the collection of water runoff.



WASHOUT AREAS

6.5.3 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).

6.5.4 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.

6.5.5 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.

Figure 6-8 - Washout Areas



6.6 LANDFILLS & WASTE MANAGEMENT

6.6.1 Speaking with a the OJSC Rogun HPP Environmental Manager and number of operators and contractors WSP were told contradictory arrangements with regards to waste disposal arrangements. This confusion was evident in the different approaches to waste segregation and mixtures of waste deposits and or storage witnessed across the site, during the September 2023 site visit.

Dump sites were observed on site and are described from paragraph 13.3.52 of this annex.

CONTRACTOR FACILITES AND WORKSHOPS

6.6.2 WSP observed significant differences between the contractors onsite, ranging from considered bunded segregation to general waste areas with no discernible segregation. Anecdotal information suggested some areas belonged to contractors who have not operated onsite for at least 5 years.

6.6.3 Additional areas of waste storage included a large stockpile of tires with no clear management or ownership. Waste oil storage in some cases was not noted to be bunded and was draining to ground. Multiple drums of bitumen stored on open ground; however, it was noted that this waste was awaiting collection from an appropriate waste carrier. WSP were told a number of the sites 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, this contradicted discussions with the Rogun HPP team.

Figure 6-9 - Waste Storage - Contractors Compounds



6.7 SUB-STATIONS & TRANSFORMERS

6.7.1 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 PCB (Polychlorinated Biphenyls) transformer oil was utilized historically onsite and may still be present within the some of the legacy equipment.

6.7.2 Speaking 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 offsite.

6.8 ASBESTOS

6.8.1 Possible Asbestos Containing Materials (ACMs) in the form of corrugated asbestos sheeting were noted on a handful of buildings within Construction Area 1.

6.8.2 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.

Figure 6-10 - Possible ACM



6.9 SUMMARY

6.9.1 In summary, there are some small areas on the construction site where fuel and other petroleum-based compounds have contaminated the surface and shallow subsurface soil, and some locations where asbestos fibers are present and exposed. As indicated above, detailed surveys have not been completed. Nonetheless, going forward, waste management plans will be prepared by the contractors (based on the waste management frameworks included in the ESMP) to ensure proper management of each type of waste.

7 WATER ENVIRONMENT

7.1 INTRODUCTION

7.1.1 This chapter describes the baseline conditions of the water environment with respect to the Rogun HPP Project under seven categories namely, hydrological influences, hydrology (surface water quantity), minimum environmental flows, flood risk, surface water quality, geomorphology and sediment.

7.1.2 Baseline information has been derived from existing studies or obtained from a limited amount of in-situ water quality data collected during a site visit. Baseline data sources are summarized in Section 7.3 and the water quality data is presented in Section 7.4.

7.2 HYDROGEOLOGY

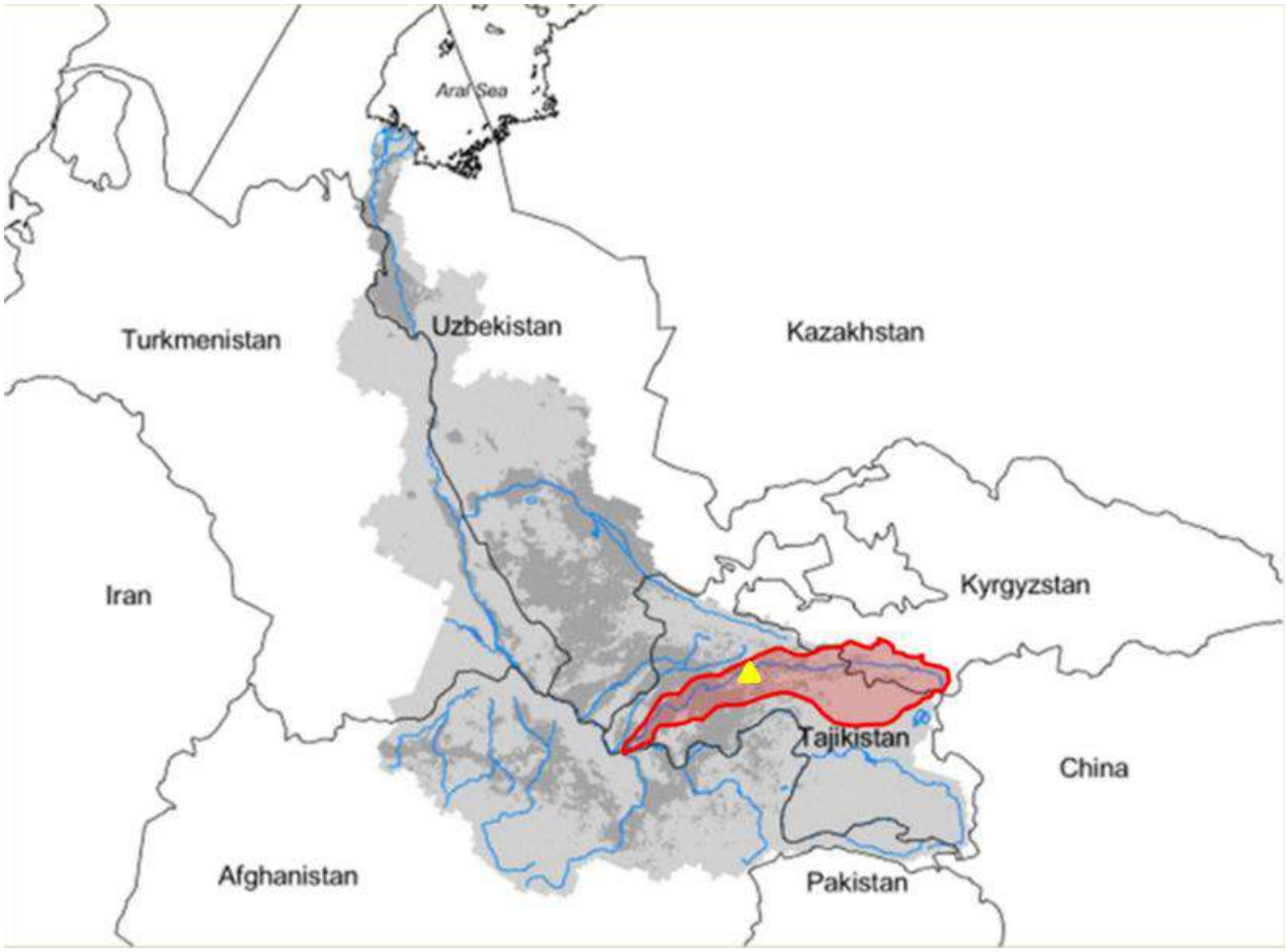
7.2.1 The Upper Cretaceous and Jurassic sediments are metamorphosed and assumed to be dominated by secondary fracture porosity. Kolichko and Fil' (1981) report that the hydraulic conductivity of the bedrock varies depending on fracture intensity from close to zero to 30 L/s (it is assumed they are stating 30 L/s/m2 thus 3 x 10-2 m/s). Tornoe et al (2017) report that the Upper Cretaceous sediments in the area contain groundwater and are directly recharged by precipitation infiltration.

7.2.2 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). It has been assumed that groundwater quality reflects natural conditions except in the vicinity of settlements and the construction area where there is likely to be anthropogenic impacts from leaking tanks, septic systems, sewage pipes, spills and agricultural sources. Given the topography and steep terrain in the area, it is however likely that areas of groundwater will lie in localized fractures rather than in large subsurface aquifers and only those limited areas of the valley where there are alluvial deposits that groundwater levels are in continuity with river levels.

HYDROLOGICAL SETTING AND LAND USE

7.2.3 The Amu Darya headwaters are located within the high snow-capped Parmir and Tian Shan Mountain ranges and the Amu Darya River basin extends across several countries from its headwaters 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. Pöyry, (2014). **Figure 7-1** is reproduced from Pöyry (2014) and shows the Amu Darya catchment area with the Vakhsh subbasin indicated by red shading. The Rogun dam location is indicated by the yellow triangle.

Figure 7-1 - The Amu Darya Basin and Vakhsh Subbasin (Pöyry 2014)



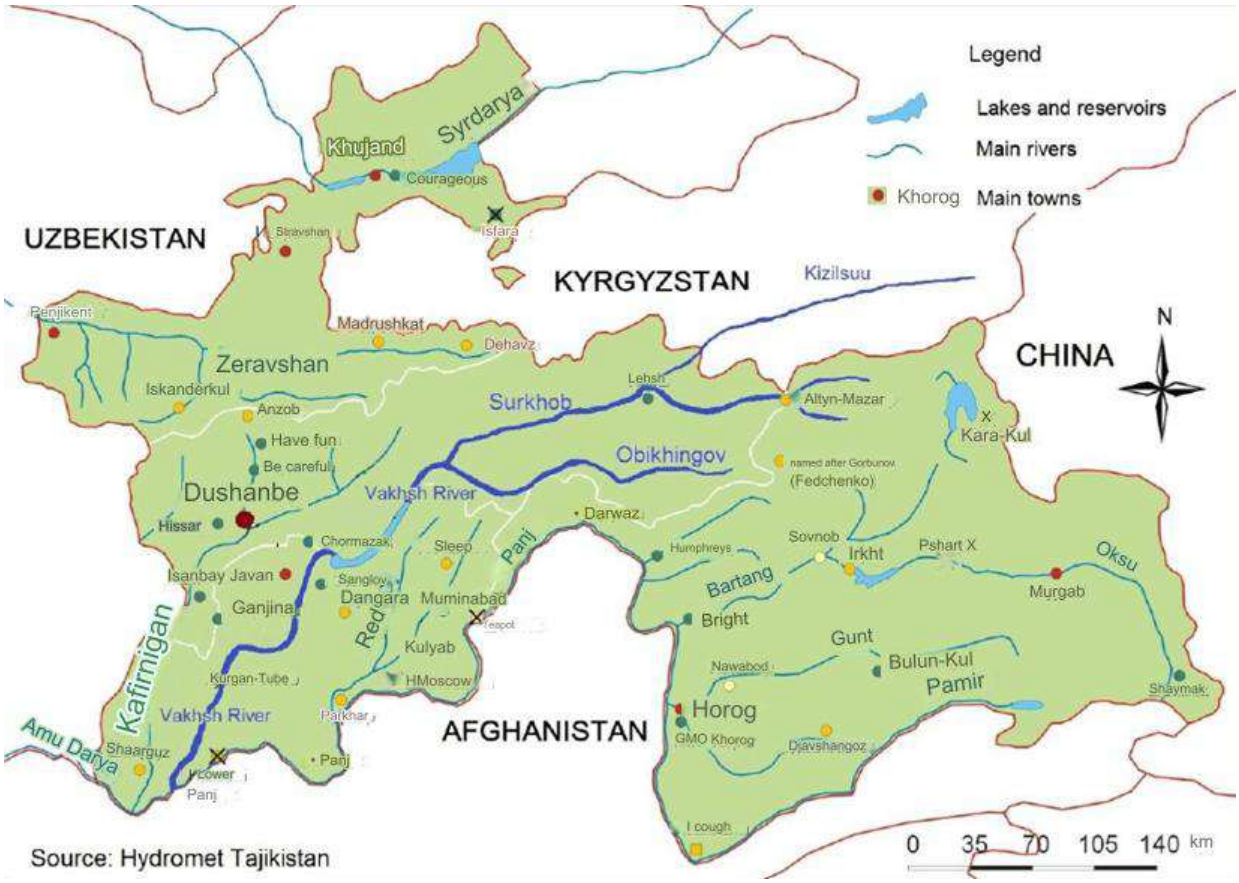
7.2.4 The Amu Darya River itself starts where the Vakhsh and Panj rivers combine and flows across an arid plain to the delta that empties into the Aral Sea.

7.2.5 The Surkhob River flows from the north-eastern part of the catchment, bordered to the north by the Pamir mountains. The Khingob flows from the south-eastern part of the catchment and drains the mountains of the central Pamir, particularly the Somoni Peak Range at 7,495 masl. **Figure 7-2**, as reproduced from Pöyry (2014), shows the Vakhsh river and the Surkhob and Khingob tributaries.

7.2.6 Approximately 30% of the Vakhsh river catchment lies above 4,000 masl, within the snow and glacier cover zone. Among the many glaciers which feed the Vakhsh tributaries, the Fedchenko Glacier is reported to extend 77 km and is the world longest glacier outside the Polar Regions, with a maximum thickness of 1,000 m. Within the catchment the total glacier area is estimated to be between 3,882 km² and 5,000 km², which represent between 13 and 16% of the Vakhsh catchment at Rogun (Coyne et Bellier, 2014).

7.2.7 The two main tributaries of the catchment are the Surkhob and Khingob (also known as Obikhingov or Obikhingou) Rivers which join to form the Vakhsh river and the Rogun dam site is located 34 km downstream of the rivers' confluence. The Vakhsh drains a catchment of approximately 30,390 km² and at the Rogun dam site the river flows through a narrow, V-shaped gorge approximately 400 to 500 m deep, with valley gradients up to 50° (Pöyry, 2014).

Figure 7-2 - Vakhsh River and Main Tributaries (Pöyry 2014)



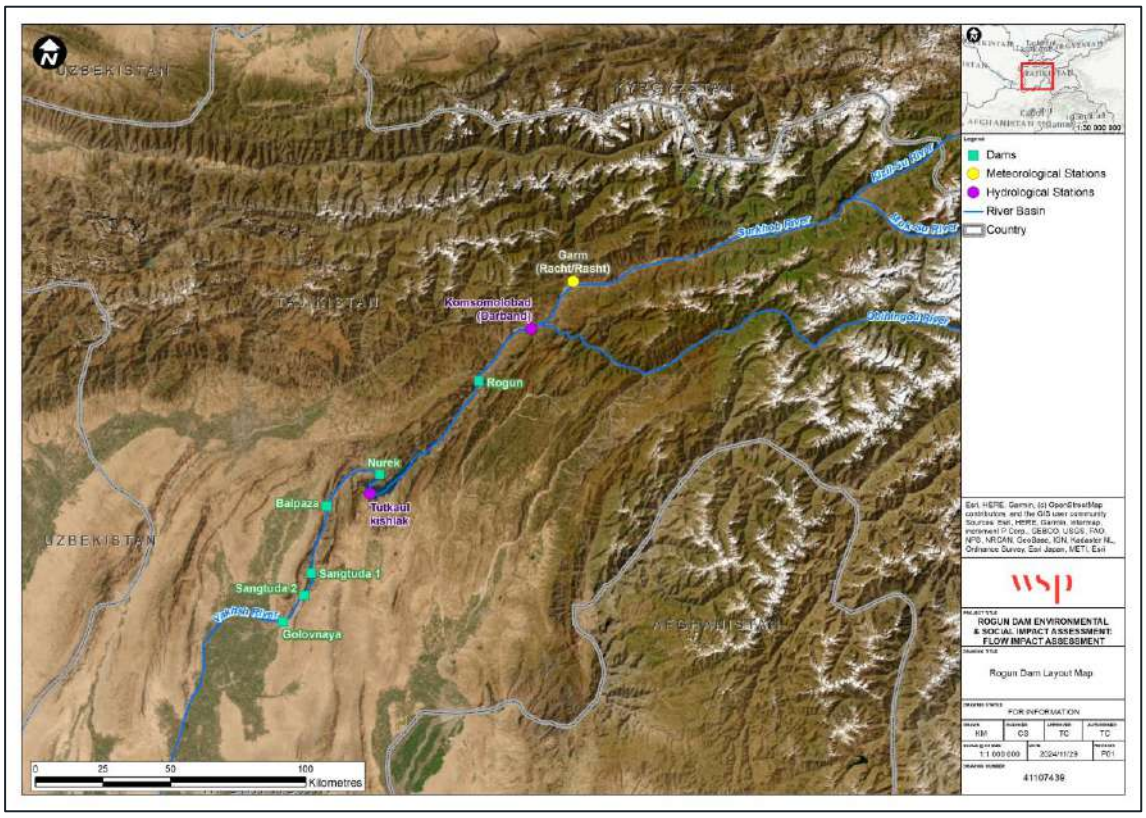
7.2.8 Along its length, much of the Amu Darya flood plain has been developed for agriculture and settlements, made possible by a consistent supply of water for irrigation purposes. In the lower reaches of the river basin important nature reserves have been established, including the Amudarya State Nature Reserve established in 1982 in Turkmenistan that covers an area of 48 500 ha.

7.2.9 In the Vakhsh river catchment, agriculture and housing are concentrated in the valley bottoms where the terrain is less steep. Most land has been cleared for grazing and no longer supports forest and scrub (Pöyry, 2014).

TRANSBOUNDARY CONTEXT

7.2.10 The Amu Darya River Basin has been subject to numerous water-sharing agreements dating back to the 1980s. The latest agreements relevant to the operation of the Rogun HPP are presented in Chapter 2 of this ESIA. The Rogun HPP will be operated within the constraints of these agreements, and they inform the operational baseline for the project.

Figure 7-3: Rogun Reservoir layout map, Vakhsh River and tributaries.



VAKHSH CASCADE OF HPPS

7.2.11 A schematic of the Vakhsh HPP cascade and the locations of the irrigation abstractions points is shown in Error! Reference source not found.. The Rogun and Nurek Reservoirs are the largest r eservoirs in the cascade and have sufficient capacity to provide flow regulation. The Shurob Reservoir is planned to be constructed between Rogun and Nurek Reservoirs. The Shurob Reservoir is being planned and is not considered in the simulations. The capacity of the remaining reservoirs in the cascade are small and are treated as run of river HPPs. There are abstractions for irrigation and some domestic use from the reservoirs and river reaches between the reservoirs. Water is abstracted from the river into the Main Vakhsh canal to supply water for irrigation and two HPP before returning water to the river. The return flows include irrigation flushing water and the return from the Main Vakhsh canal. The full cascade was simulated in the TEAS (OSHPC Barki Tojik, 2013). In the assessment in **Volume 1: Chapter 13: Impacts on Water** of this ESIA, the full cascade is not modelled. The Rogun and Nurek Reservoirs are modelled to assess the change in flows between Rogun and Nurek Reservoirs and the discharges from Nurek Reservoir.

7.2.12 In the Amu Darya river basin most of the large hydropower plants are located in the Vakhsh river, while on the other tributaries like the Panj and the Kafirnigan there are small run-of-river hydropower which do not affect the flow pattern of the basin (Pöyry 2014).

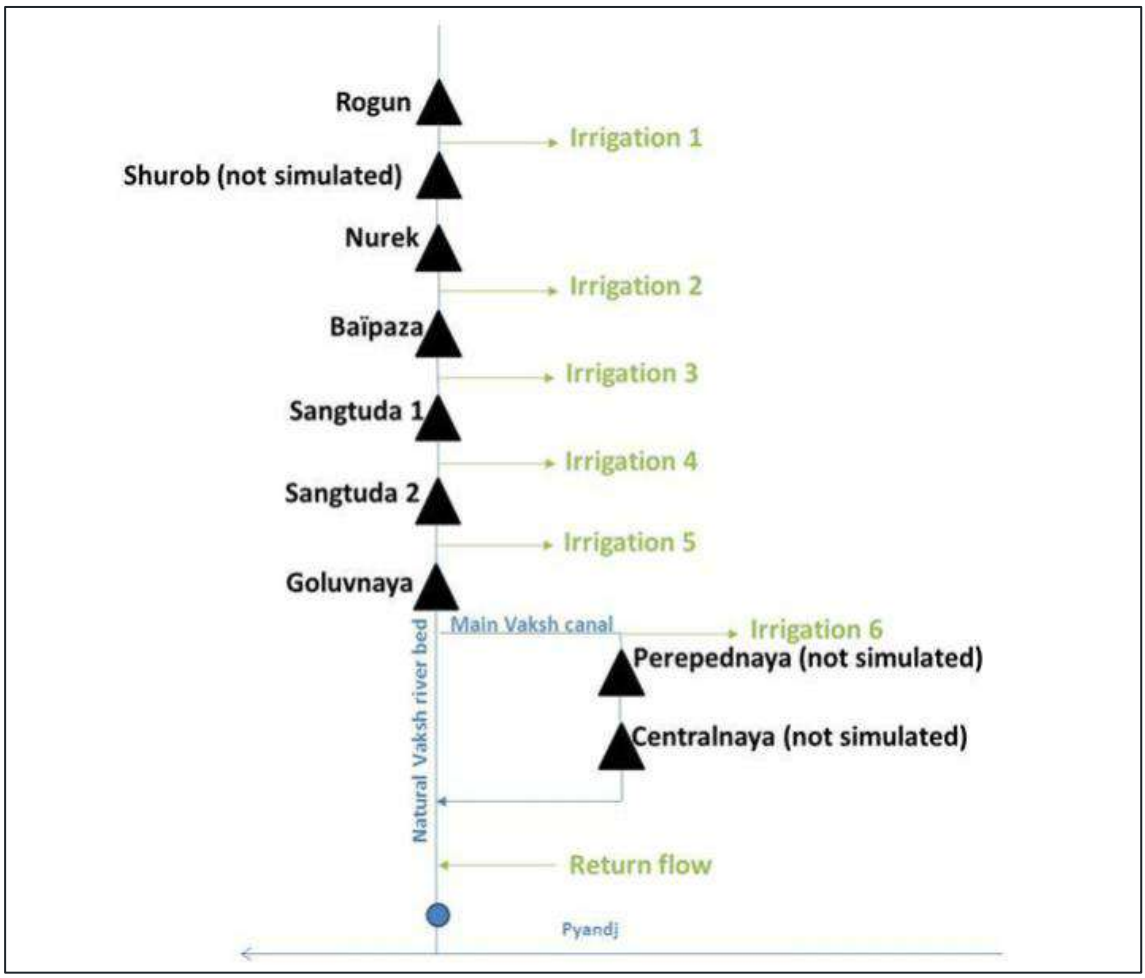
7.2.13 **Table 7-1** present a summary of the main hydropower plants (HPP) installed on the Vakhsh river (Pöyry 2014).

Table 7-1 - Vakhsh River Hydropower Plants

HPP	Regulation capacity	Reservoir			Installed capacity (MW)	Head (m)
		Total volume (km^3)	Active storage (km^3)	Surface (km^2)		
Nurek	annual	10,500,000	4,537,000	98	3,000	265
Baipaza	weekly/daily	97,000	80,000	8	600	60
Sangtuda-1	daily	258,000	12,000	10	670	64
Sangtuda-2	daily	66,500	4,000	-	220	22
Golovnaya	daily	94,500	18,000	7	210	23
Perepadnaya	daily	-	-	-	30	-
Centralnaya	daily	-	-	-	15	-

7.2.14 Nurek is the only reservoir located in Tajikistan with regulation capacity and is regulated for hydropower production, while most of the other reservoirs are regulated for irrigation purposes. The chronology of the HPP cascades is shown in **Figure 7-4**.

Figure 7-4: Schematic of the Vakhsh HPP cascade



REGIONAL CONTEXT

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

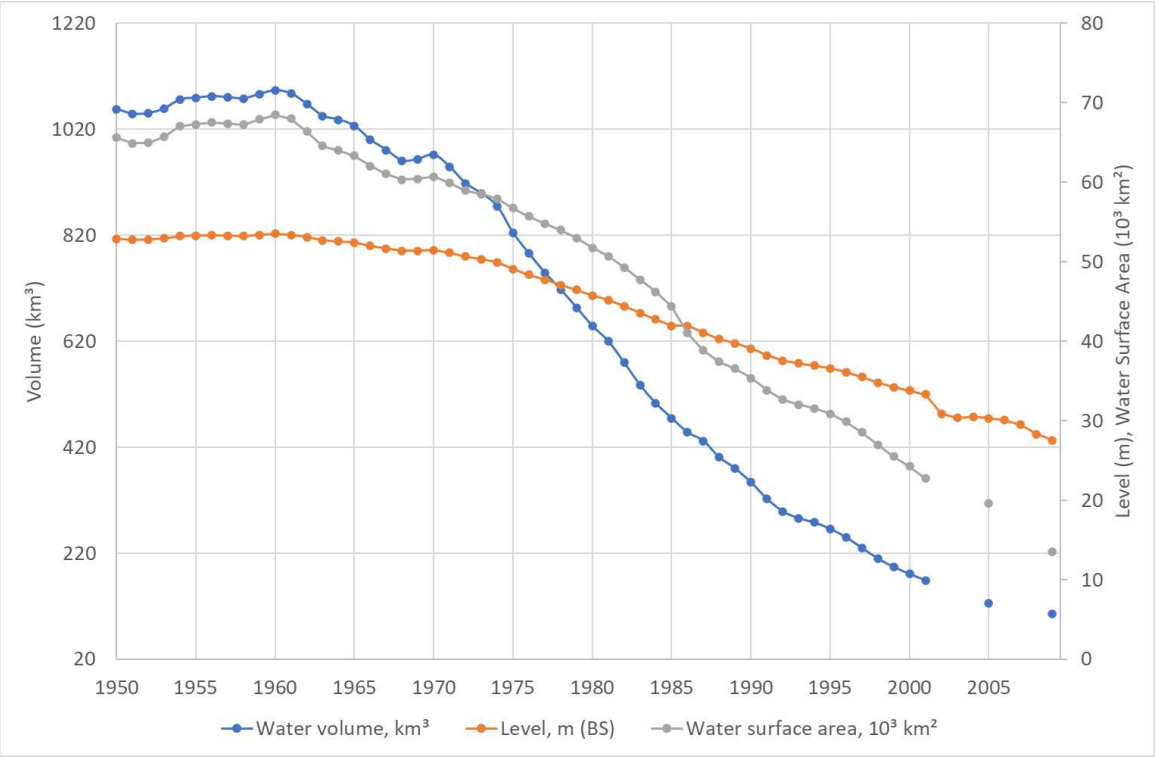
7.2.16 Pöyry (2014) report that after World War II and especially during the 1960s, inflow to the Aral Sea basin has been impacted by large irrigation projects. The increased abstractions from the two tributaries have affected the water balance within the Aral Sea, where the losses due to evaporation and abstraction have not been compensated by the inflows of the Amu Darya and Syr Darya. Figure 7-5 illustrates the reduction in water surface area of the Aral Sea from 1973 to 2022 (CaWater-info, 2023).

Figure 7-5 - Dynamics of Aral Sea transformation



7.2.17 CaWater-info (2023) estimate that the lake area of the Aral Sea reduced from approximately 68,000 km² in 1960 to 13,000 km² in 2009. **Figure 7-6** illustrates the estimated volume, water level and water surface area of the Aral Sea from 1950 to 2009 (CaWater-info, 2011).

Figure 7-6 - Aral Sea Volume, Level and Surface Timeseries.

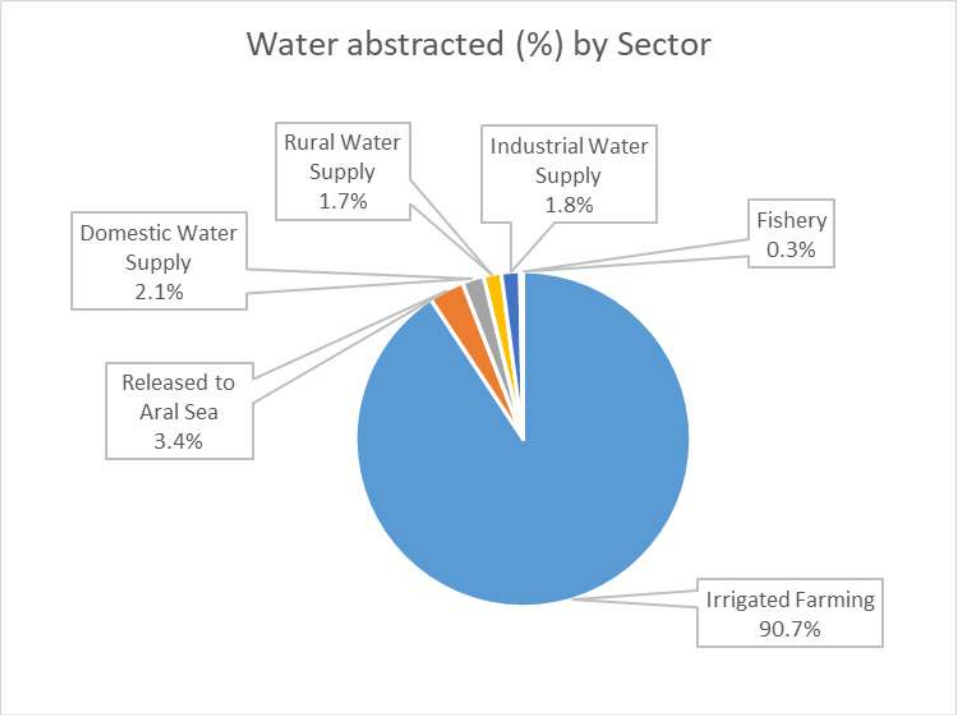


WATER USE WITHIN THE CATCHMENT

7.2.18 The development of the Amu Darya and Aral Sea basins began in the 1960s with the construction of reservoirs, canals, pumping stations, and drainage channels to support the irrigation of large-scale cotton, wheat, fodder, fruit, vegetables and rice cultivation in the semi-arid steppe areas (Pöyry, 2014).

7.2.19 Pöyry (2014) reports that Uzbekistan abstracts the largest amount of water for irrigation purposes with 46.4% of the total Amu Darya abstraction, followed by Turkmenistan with 36.4% and Tajikistan with 13.6%. Kyrgyzstan water abstraction is negligible at 0.1%, while the remaining 3.4% is released into the Aral Sea (statistics reported for the year 1997). Error! Reference source not found. i llustrates the subdivision of abstractions from the Amu Darya between water users for 1997 (Pöyry 2014).

Figure 7-7 - Water abstractions in the Amu Darya river by sector for 1997.



7.2.20 The Vakhsh river provides water for several irrigation schemes all of which are located downstream of Nurek dam. The main irrigation infrastructures are the Danghara tunnel with a capacity of 100 m^3/s, the Yavan tunnel with a capacity of 75 m^3/s and the Vakhsh main canal with a capacity of 210 m^3/s, in addition to several smaller irrigation systems (Pöyry 2014).

7.2.21 In the upper Vakhsh river, upstream of Nurek, the demand for irrigation is limited due to the lack of suitable land (Pöyry 2014).

7.2.22 The abstraction demand for irrigation follows the vegetation period and is subject to the crop type and elevation. A first peak in water consumption is observed in March, to artificially inundate the fields while a second and higher peak is observed between June and August (Pöyry 2014).

AMU DARYA BASIN

7.2.23 According to the Amu Darya Basin Network the upstream Amu Darya catchment area[4] is 309,000 km^2 of which 72.8% is within the borders of Tajikistan. Pöyry (2014) report that the Amu Darya catchment area extends over an area of 534,700 km^2 but the total catchment area varies from 465,000 km^2 to 612,000 km^2, depending on the data source (ENVSEC. 2011, as reported in UNECE, 2011).

7.2.24 Within the basin, sources of the Amu Darya are disputed as some of the tributaries do not permanently contribute to the flows of the Amu Darya and either have been permanently diverted or discharge to desert areas (Pöyry 2014). Over 35 reservoirs with a storage capacity exceeding $10x10^6$ m^3 have been constructed in the basin, representing some 80% of the catchment volume and annual flows are estimated at 73.6 km^3/year (Kamil, 2021).

[4] The area that is upstream of the Kerki gauging station, where the river flows into the desert lowlands.

7.2.25 The Amu Darya catchment is shared by 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 while approximately 8% is estimated to be generated in Afghanistan; 6% in Uzbekistan; 4% in Turkmenistan; and 2% in Kyrgyzstan (Pöyry, 2014). As cited by Pöyry (2014), the Panj River forms the headwaters of the Amu Darya River. Following the confluence of the Vakhsh and the Panj the river is known as the Amu Darya. Other major tributaries of the Amu Darya downstream of the Vakhsh confluence are the Kunduz (originating from Afghanistan), the Kafirnigan (originating from Tajikistan), the Sherobod and the Surkhandarya (both originating from Uzbekistan). The main characteristics of the Amu Darya River basin and its two main subbasins, the Vakhsh and the Panj, are summarized in **Table 7-2** which has been reproduced from Pöyry (2014) and indicates that the Vakhsh river accounts for approximately 25% of the Amu Darya discharge volume, despite occupying only 7% of the catchment area.

Table 7-2 - Amu Darya, Vakhsh and Panj River Basin Characteristics

River	Basin area (km^2)	Length (km)	Altitude (m)		Average flow (km^3/yr)	Catchment yield factor ($l/s/km^2$)
			Min	Max		
Amu Darya	534,700	2,415	28	7,495	78.46	4.6
Vakhsh	39,100	786	326	7,495	20.1	16.3
Panj	114,000	921	326	6,974	31.6	8.8

REGIONAL RIVER MONITORING STATIONS – AMU DARYA

7.2.26 Pöyry (2014) provides details of several additional regional hydrometric stations located along the Amu Darya River basin, which are reported to record (daily) hydrological and water quality parameters. A summary of these monitoring locations is provided in **Table 7-3**, which has been reproduced from Pöyry (2014).

Table 7-3 - Hydrometric Stations on Amu Darya River Basin (Pöyry, 2014)

Station	Hydrological Parameters	Observation Period
Gharm (Rasht)	flow, level, temperature, ice	1933-1992
Vakhsh (Darband)	flow, level, temperature, ice	1949-1957; 1976-1997; 2000-2010
Vakhsh (Tutkaul &/Sariguzar)	flow, level, temperature	1967-1992
Vakhsh (Golovnaya HPP)	flow, level	1966-2010
Vakhsh (Tigrovaya Balka)	flow, level	1960-1962; 1983-1990; 2011
Panj (Nyijni Panj)	flow, level	1965-1967; 1969-1972,1976-1990
Amu Darya (Termez)	flow, level, temperature	1933-1992
Amu Darya (Samanbay)	flow, level	Not stated

7.2.27 At the time of writing, flow data from two of the stations summarized in **Table 7-4** were made available by the National Agency for Hydrometeorology of the Republic of Tajikistan, namely Gharm and Darband stations. Flow data has also been provided for a number of other unknown stations, for which the station names do not align with those listed in **Table 7-4** or **Table 7-5** and for which little information is available.

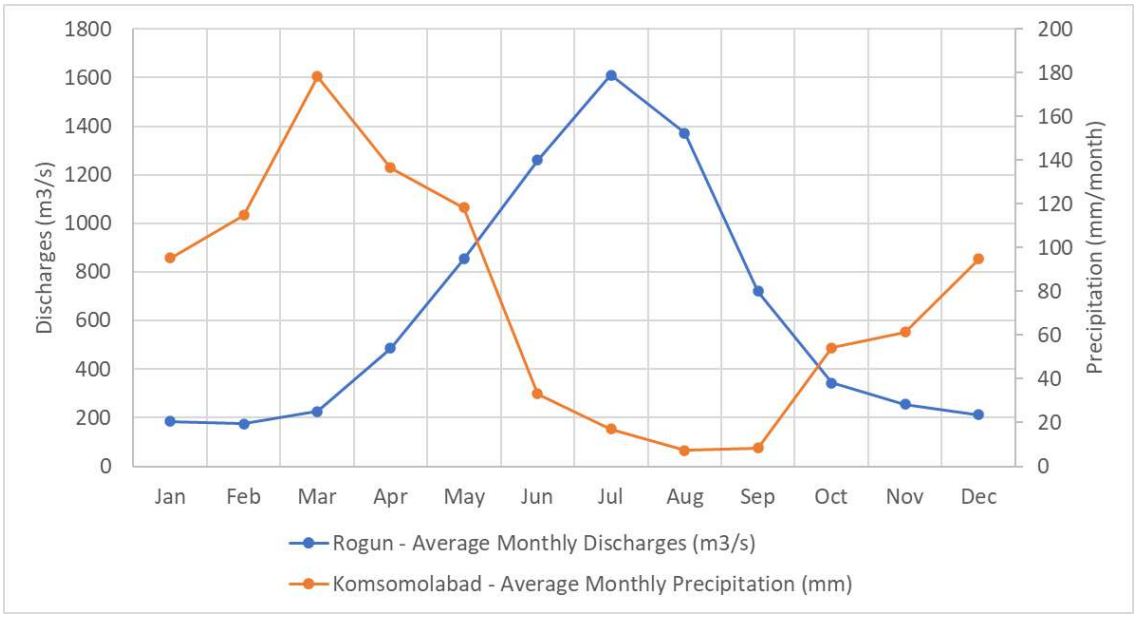
THE VAKHSH RIVER

7.2.28 The Vakhsh River exhibits a typically snowmelt and glacier driven hydrological regime (Coyne et Bellier et al., 2014f).

7.2.29 **Figure 7-8** presents the average monthly flow pattern at Rogun dam (from a combined flow dataset from Pöyry (2014) and the World Bank (2023)) and the average monthly precipitation measured at Mehrobod (then known as Komsomolobod or Komsomolabad) (data obtained from Pöyry (2014)). The graph illustrates that the flows are not correlated with precipitation but are correlated with seasonal temperature change.

7.2.30 **Figure 7-8** shows that most of the annual precipitation (approximately 70%), occurs in the winter and spring months. The highest average precipitation is recorded in March with approximately 180 mm/month. Most of the river discharge occurs in the summer months between June and August, with the highest average discharge rates recorded in July at approximately 1,600 m^3/s.

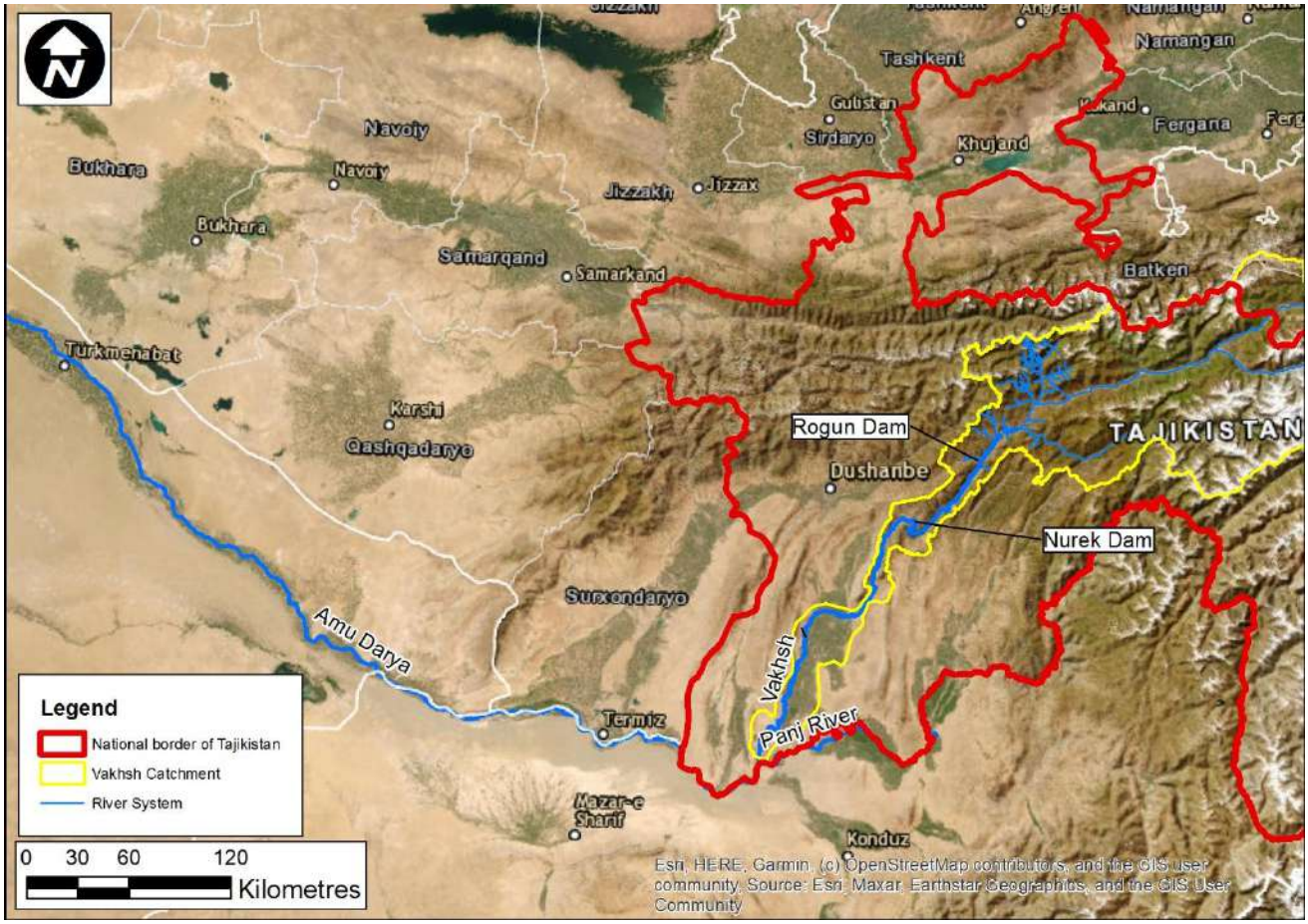
Figure 7-8 - Average Monthly Discharges at Rogun and Average Monthly Precipitation at Mehrobod (Komsomolabad)



7.2.31 Rogun HPP is located approximately 70 km upstream of the Nurek dam on the Vakhsh river. The Qizilsu, one of the Vakhsh headwaters, originates in the Pamir-Alai Mountain and joins the Muk-Su, to form the Surkhob river. The Surkhob then joins the Khingob to form the Vakhsh river approximately 34 km upstream of Rogun dam.

7.2.32 **Figure 7-9**, as reproduced from Coyne et Bellier et al., (2014) shows the Vakhsh watershed and the locations of the Rogun and Nurek dams.

Figure 7-9 - Vakhsh River watershed with locations of the Rogun and Nurek dams (Coyne et Bellier et al., 2014)



VAKHSH RIVER MONITORING STATIONS

7.2.33 Coyne et Bellier et al. (2014) identify seven hydrometric stations in the project area, gathering flow measurements using standardized instruments and methods of the Tajik Metereological Service.

7.2.34 Details of the gauging stations including river name, catchment area and observation period are reproduced from Coyne et Bellier et al. (2014f) in **Table 7-4**.

Table 7-4 - Hydrometric Stations on Vakhsh River Basin (Coyne et Bellier et al., 2014f)

River	Hydrometric Station	Catchment Area (km^2)	Observation Period
Surkhob	Garm	20,000	1932-1994
Surkhob	Ustye	22,840	1973-present
Vakhsh	Mehrobod (Komsomolabad)	29,500	1942-1957; 1975-present
Vakhsh	Rogun Dam Site	30,390	1973-1977
Vakhsh	Tutkaul kishlak	31,200	1930-1967

River	Hydrometric Station	Catchment Area (km^2)	Observation Period
Khingob	Tavildara kishlak	5,390	1953-present
Khingob	Ustye	6,660	1941-1975

7.2.35 Due to the limited inflows time series available at the Rogun Dam Site location, Coyne et Bellier et al. (2014f) estimated the inflows to the Rogun dam by combining data from different hydrometric stations:

- From 1932 to 1972: flow rates recorded at Tutkaul gauging station;
- From 1973 to 1988: flow rates at Tutkaul are reconstituted based on observations made at Mehrobod. Correlations between the two stations are based on two periods of common record (1949-1957 and 1963-1972); and
- From 1988 to 2008: flow rates are calculated based on Nurek HPP inflows.

7.2.36 Flow data available to inform this ESIA include the final combined flow data for 1932 to 2007 generated by Coyne et Bellier et al. (2014f) and Vakhsh River flow data provided by the World Bank for the period 2009 to 2022.

7.2.37 Coyne et Bellier et al. (2014f) consider discharge measurements at the Nurek Dam to be valid for the Rogun dam site given the drained catchment area between both dams is small (less than 3% of the catchment) and therefore this data is considered representative of the flow conditions at Rogun dam for the purposes of this assessment. In summary, the Rogun dam flow data used for this assessment has been sourced from:

- Coyne et Bellier et al. (2014f): Appendix 2, Table 1, for the period 1932-2007; and
- World Bank provided data, for the period 2008-2022.

VAKHSH RIVER HYDROLOGICAL CHARACTERISATION

7.2.38 The previously described Vakhsh flow data used by Coyne et Bellier et al. (2014f), in addition to the flow data provided by the World Bank (2023), was used to provide estimates of the flow rates downstream of Rogun dam, prior to construction of the dam.

7.2.39 The available flow data was compared to identify any significant change in the flow data characteristics between the two datasets. Subsequently, a description of the three scenarios was prepared, with flow data supporting the characterization of the “Previous Baseline” and, in the absence of flood data, a qualitative description of the flow regime for the “Current Conditions” and “Future Baseline” scenarios was drafted.

7.2.40 The three scenarios for the flow rate assessment of the Vakhsh river flows downstream of Rogun dam are based on different phases of Rogun dam construction:

- “Previous Baseline”: before the restart of the dam construction, pre-2019;
- “Current Conditions”: during the construction, operation and filling of Rogun dam, from 2019 to 2038; and
- “Future Baseline”: during the fully operational phase of the hydropower project, post 2036.

7.2.41 Boxplots of the flow data at the Rogun HPP dam were created using three datasets, namely:

- Old dataset: Rogun dam inflows for the period from 1932 to 2007 (Coyne et Bellier et al., 2014f);
- New dataset: Nurek HPP inflows for the period from 2008 to 2019 (World Bank, 2023); and
- Full dataset: The combined dataset of the Rogun and Nurek datasets for the period 1932 to 2019.

7.2.42 The boxplots in **Figure 7-10**, **Figure 7-11** and **Figure 7-12** respectively present:

- Annual average flows;
- April-September average flows; and
- October-March average flows.

7.2.43 The minimum and maximum values of the flow datasets are indicated by the whiskers, while the box indicates the first, second and third quartiles of the datasets.

Figure 7-10 - Annual average flows box plot comparison (Coyne et Bellier et al., 2014f, World Bank, 2023).

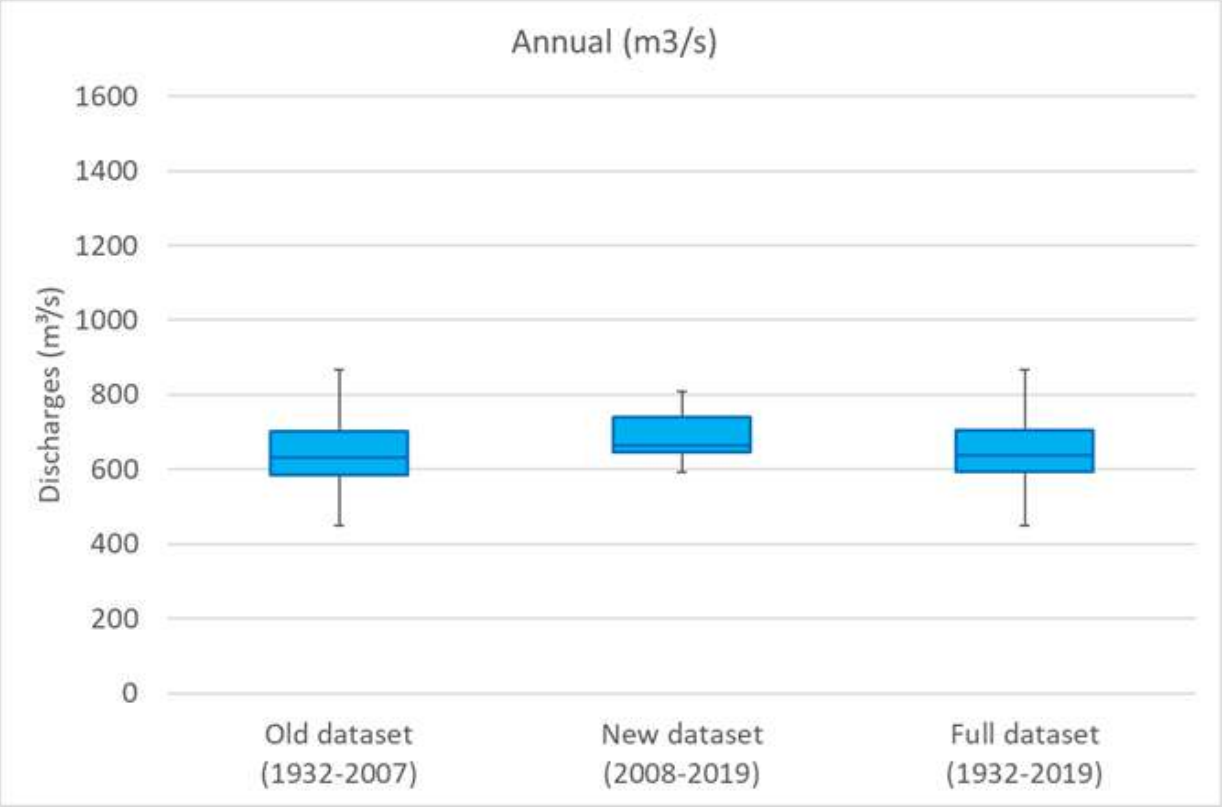


Figure 7-11 - April-September average flows box plot comparison (Coyne et Bellier et al., 2014f, World Bank, 2023).

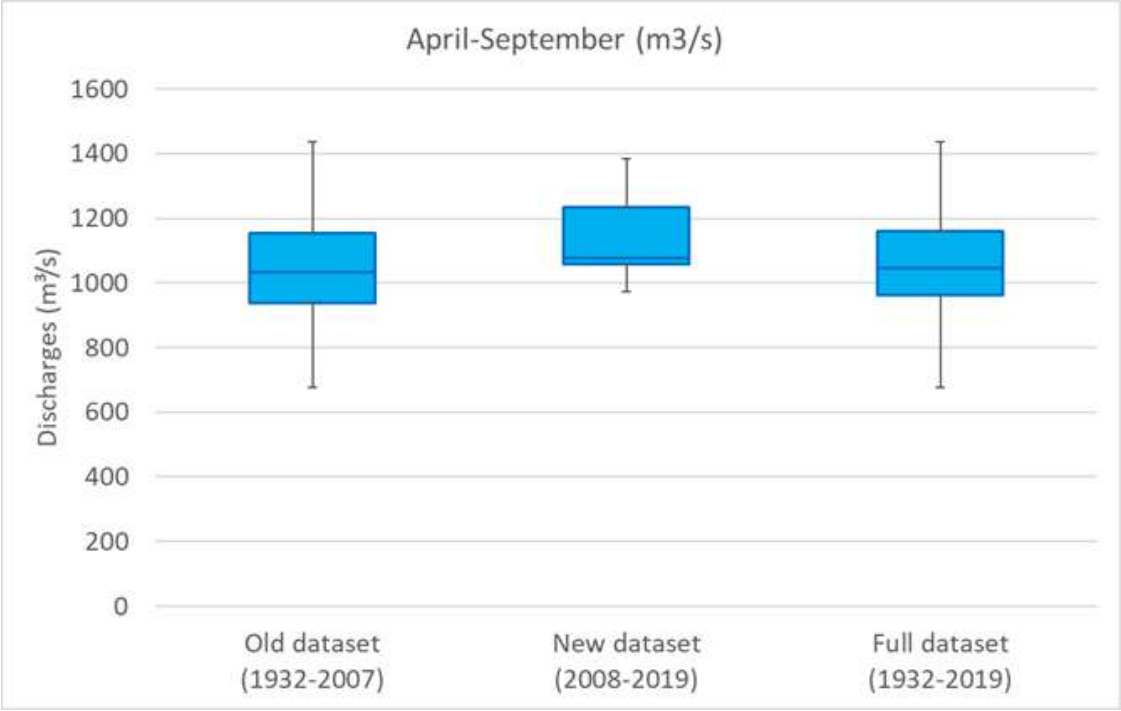
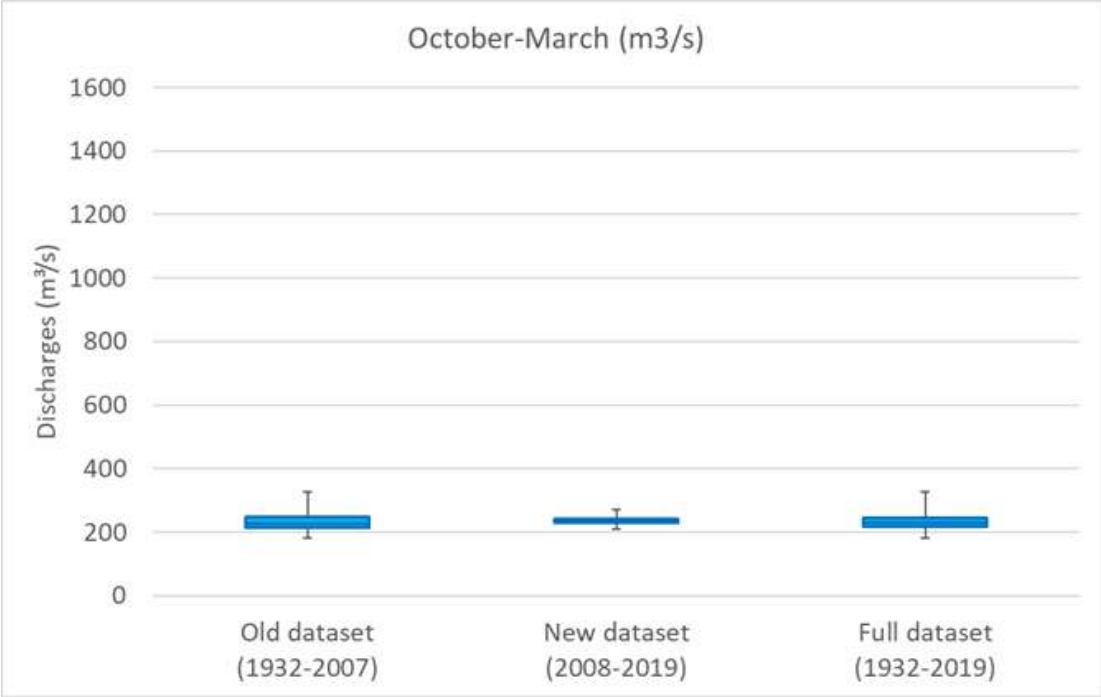


Figure 7-12 - October-March average flows box plot comparison (Coyne et Bellier et al., 2014f, World Bank, 2023).



7.2.44 The analysis shows that the new dataset (from 2008 to 2019) present similar box plots compared to the dataset from 1932 to 2007, albeit with notably higher flow values during the April to September period potentially due to the significantly smaller sample size of the dataset. The boxplot for the combined ('full') dataset demonstrates minimal changes to the flow statistics with similar statistic values shown compared to the dataset that was used for the previous studies in 2014.

7.2.45 This flow rate assessment supports the conclusion that the inclusion of the new dataset (2008 to 2019) to the old dataset (1932 to 2007) does not significantly alter the characterization of baseline Vakhsh river flows when compared to the characterization in the previous ESIA (Pöyry, 2014) and TEAS studies (Coyne et Bellier et al., 2014).

PREVIOUS BASELINE

7.2.46 Over the period 1932-2019, prior to the restart of Rogun HPP construction activities, the average annual flow in the Vakhsh is estimated to range from 450 m^3/s to 867 m^3/s, with an average value of 645 m^3/s. The average flows during the spring-summer period (i.e. high flow season) are more than four times those in the autumn-spring period (i.e. low flow season) at flow rates of 1,054 m^3/s and 234 m^3/s, respectively. The maximum average flow registered in the April to September period is 1,438 m^3/s, and the minimum is 678 m^3/s. During the October-March period the maximum average flow is 326 m^3/s and the minimum 182 m^3/s.

7.2.47 A summary of flow statistics over the full dataset is provided for annual average flows, April-September average flows and October-March average flows in **Table 7-5**.

Table 7-5 - Vakhsh Average Flow Statistics at Rogun Dam over the 'Full' Dataset (Annual, April-September and October-March Periods).

Average Flow Statistic / Percentile	Annual Period (m^3/s)	April-September Period (m^3/s)	October-March Period (m^3/s)
Minimum	450	678	182
5%	515	819	200
25%	593	961	218
50%	638	1047	230
75%	703	1160	245
95%	777	1288	286
Maximum	867	1438	326

7.2.48 Additional hydrometric data was provided by the National Agency for Hydrometeorology of the Republic of Tajikistan.

7.2.49 **Table** 7-6 and **Table 7-7** present average flow statistics from two stations closest to Rogun dam:

- Darband hydrometric station: located on the Vakhsh river just downstream of the confluence between the Surkhob and Khingob rivers; and
- Garm hydrometric station: located on the Surkhob river before the confluence with the Khingob.

Table 7-6 - Darband Average Flow Statistics for Annual, April-September and October-March Periods.

Average Flow Statistic / Percentile	Annual Period (m^3/s)	April-September Period (m^3/s)	October-March Period (m^3/s)
min	239	696	192
5%	435	804	198
25%	568	939	208
50%	598	987	226
75%	649	1078	243
95%	733	1193	273
max	817	1235	290

Table 7-7 - Gharm Average Flow Statistics for Annual, April-September and October-March Periods.

Average Flow Statistic / Percentile	Annual Period (m3/s)	April-September Period (m^3/s)	October-March Period (m^3/s)
min	233	355	103
5%	253	380	107
25%	292	464	122
50%	323	520	128
75%	354	576	135
95%	426	714	151
max	457	760	180

CONSTRUCTION, INITIAL OPERATION AND RESERVOIR FILLING PHASE (2019 - 2036)

7.2.50 Tajikistan intends to make use of its full water share of 9.5 km^3 per year, as assigned under the Nukus declaration and Protocol 566, to fill both the Rogun dam reservoir and provide for its other water demands. According to Pöyry, between 2005 and 2011 Tajikistan did not use 1.2 km^3 of its water share, which could be made available to fill the Rogun dam reservoir. Modelling of the reservoir filling period by Coyne et Bellier 2014d estimated it would take 16 years to reach a full surface level of 1,290 msl under the intended filling regime.

7.2.51 Considering the total storage volume of 13.3 km^3 the average annual rate of water retention was shown to be 0.83 km^3. In the initial filling phase, the annual water volume retained would be limited by the rate of dam construction, while in the later stages it would be possible to store more water than the average annual 1.2 km^3 of Tajikistan's unused water share. **Table 7-5** illustrates this water retention in the context of the minimum recorded annual discharge on the Vakhsh at Rogun of 14.2 km^3, and 20.1 km^3 50% of the time.

7.2.52 Should Tajikistan abstract its full Protocol 566 water share, water shortages could result for downstream users in dry years (Pöyry 2014). To avoid adverse impacts on the downstream irrigation users in dry years during Rogun filling phase, Pöyry (2014) recommended that, in this eventuality, Tajikistan should commit to reduce or not retain additional water depending on the severity of the drought and, as a compensation measure, more water should be retained within Rogun reservoir during wet years.

7.2.53 These recommendations will be implemented under the agreed water retention regime so that the filling of the Rogun reservoir will not adversely affect downstream water users during dry years. The system is actively managed through the Interstate Commission for Water Coordination. Annual allocations will be adjusted according to state of storage in reservoirs and meteorological conditions. The protocols of the ICWC would never permit (assuming it is managed responsibly) an abstraction level per country that would result in dry flows later in cascade.

FULLY OPERATIONAL PHASE (POST 2036)

7.2.54 The Rogun HPP will be operated in a manner that redistributes discharges on the Vakhsh from summer to winter. Three potential operation patterns have been identified (Pöyry 2014):

- Operation pattern 1: applying the same water allocation and water use patterns as currently applied by Tajikistan. This would be achieved by operating Rogun dam with the same principles that are currently applied to Nurek (i.e. not redistributing more water from summer to winter than is currently implemented by the Nurek dam) and by operating Nurek as a run-of-river dam for hydropower purposes only.
- Operation pattern 2: 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 substantially reduce water availability in summer for irrigation and would be to the detriment of downstream water users.
- Operation pattern 3: maximizing water allocation benefits to all users in terms of operating Rogun HPP not only for electricity generation but also improving water regulation and water allocation in the entire river basin, especially in dry years.

7.2.55 It is planned to operate the Rogun HPP under Operation Pattern 1. Pöyry (2014) reports that deviations from the envisaged operation pattern could also result from adverse climatic conditions. Despite the operating pattern that will be adopted for Rogun HPP, significant alteration to the flow regime will be experienced in the river reach between Rogun dam and the Nurek reservoir, due to the shift of river flows from summer to winter. Consequently, it will be necessary that a minimum environmental flow is maintained along this reach of the Vakhsh to mitigate effects to the fluvial ecosystem.

7.2.56 Minimum environmental flows are covered under Technical Annex A06, however a summary of the assessed minimum environmental flow requirements for the Vakhsh River, are presented in **Table 7-8** which have been assessed based on the Desktop method of assessment. A monthly flow distribution was selected that corresponds to the flow characteristics of the Vakhsh and reflects the seasonal nature of flows in the Vakhsh.

7.2.57 The ‘Drought / Minimum Flows’ represent the recommended minimum flows that shall be observed in the Vakhsh (downstream of Rogun Dam) during the construction and operation of the dam and if a drought occurs in the Vaksh River upstream of the dam during construction and operational

phases; while the ‘Maintenance / Baseflows’ represent the flow that shall be provided to assist in the maintenance of the river and to prevent further degradation during non-drought conditions.

7.2.58 In the event of drought conditions in the upper catchment of the Vakhsh River with lower inflows to Rogun Dam, the drought flows (as per **Table 7-8**), should be provided, instead of the higher maintenance flows. Defining drought conditions is complex; the IPCC Sixth Assessment Report defines a drought simply as "drier than normal conditions". This means that a drought is "a moisture deficit relative to the average water availability at a given location and season". According to National Integrated Drought Information System, a multi-agency partnership, drought is generally defined as “a deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage”. In glacierised catchments, such as the Vakhsh River, “glacier melt droughts” can occur which can restrict downstream flows. Glacial melt droughts are defined as a deficiency in the glacier melt peak and caused by below normal temperatures in the summer season. (Marit Van Tiel, 2018).

7.2.59 There are two main types of drought conditions which may affect the Vakhsh River and downstream users. Meteorological drought occurs when there is a prolonged time with less than average precipitation. This type of drought typically the other kinds of drought. Hydrological drought is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs fall below a locally significant threshold. Hydrological drought tends to show up more slowly because it involves stored water that is used but not replenished.

For the purposes of this assessment, a drought is defined as a period where precipitation falls below the monthly averages for one season. It is recommended that as part of further work required on the evaluation of minimum environmental flows, the specific conditions that would trigger drought conditions are identified and defined.

7.2.60 Flow rates of a magnitude greater than those indicated in **Table 7-8** can be implemented as required to meet the operational requirements of the dam. The Tennant method has also been used as an alternative method of assessing minimum environmental flows as described in **Technical Annex A06** and, although the Tennant Method flows are not recommended for implementation, they are provided in **Table 7-8** for comparative purposes.

Table 7-8 - Flow requirements for the Vakhsh River downstream of the Rogun Dam (m3/s)

Flow	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Drought / Minimum Flows (Desktop Method)	102	76	64	55	53	51	68	90	122	152	156	136
Maintenance / Baseflows (Desktop Method)	141	107	89	78	75	73	95	125	168	207	213	187
Tennant Method Flows (comparative only)	34	26	21	18	18	23	48	85	126	160	137	72

7.2.61 Short term flow variability is a potential issue during the filling stage but will be resolved once the reservoir reaches FSL. The area upstream from Rogun will remain at current the baseline conditions and will be unchanged. Downstream of the dam, between Rogun and Nurek, during periods of weak flow, the turbines draw water from the reservoir and push water through downstream. While during

periods of high flows both turbine operation and overflows will contribute to flow beyond Rogun towards Nurek.

7.3 FLOOD RISK

APPROACH TO APPRAISAL OF FLOOD RISK

7.3.1 Several studies relating to floods are discussed by Pöyry (2014) and Coyne et Bellier et al. (2014f); these studies describe flood frequency analysis, estimation of the Probable Maximum Flood (PMF) and characterization of flood hydrographs for the Rogun HPP project. The frequency analysis conducted by Coyne et Bellier et al. (2014f) estimated peak discharge flow rates for the Rogun Dam site, utilizing pooled regional flood data to extend the dataset available for frequency analysis.

7.3.2 The pooling of data was implemented in a stepwise approach where peak discharge information from different regional datasets were added at each stage to extend the dataset used for analysis. These steps, as employed by Coyne et Bellier et al. (2014f), are summarized as:

- Step 1: data from the Vakhsh river basin, including data from the Garm, Ustye, Tavildara Kishlak, and Tutkaul Kishlak gauging stations (**Table 7-4**) was used;
- Step 2: regional data from the Indus and Chenab River basins was transposed to the Rogun catchment to provide additional sample data; using data from the Attock and Benzwar gauging stations, respectively; and
- Step 3: additional regional data from the Syr-Darya River basin (at the Tyumen Aryk gauging station) was transposed to the Rogun catchment.

7.3.3 This report undertook a comparison of the peak flow data used by Coyne et Bellier et al. (2014f), with the additional recent (2009 to 2022) peak flow data for the Vakhsh catchment that was provided by the World Bank. This comparison was used to qualitatively assess the potential for changes to the previously appraised (Coyne et Bellier et al., 2014f) peak flow regime and frequency analysis at the Rogun HPP dam, associated with the inclusion of these additional data. An update of the previous flood studies has not been considered under the scope of this ESIA update and this ESIA update relies on the previous studies by Coyne et Bellier et al. (2014f) and Pöyry (2014).

7.3.4 The additional (2009 to 2022) data have been compared against the peak discharges transposed to the Rogun Dam location from the ‘First Step’ of the previously undertaken flood analysis (Coyne et Bellier et al., 2014f; Table 6). The additional flow data provided by the World Bank corresponds to the Nurek HPP and therefore does not directly reflect flow rates measured at the Rogun HPP location, or the datasets transposed to the Rogun dam for the previous analysis. However, Coyne et Bellier et al. (2014f) consider discharge measurements at the Nurek Dam to be valid for the Rogun dam site given the drained catchment area between both dams is small (less than 3% of the catchment). Additionally, the Vakhsh is a snow and glacier melt influenced river with high flows correlating with the thaw season and peaking in summer months.

PEAK FLOW DATA AVAILABILITY

7.3.5 For the qualitative peak flow assessment undertaken, the data have been sourced from:

- Table 6 of the Techno-Economic Assessment Study for Rogun Hydroelectric Construction Project (Coyne et Bellier et al., 2014f): Peak flow discharges transposed to Rogun dam for the period 1932-2008; and

- World Bank (2023): Peak flow discharges at Nurek HPP operations for the period 2009-2022.

7.3.6 An update of the Coyne et Bellier et al. (2014f) Probable Maximum Floods (PMF) estimate is to be undertaken as an outcome of the Dam Safety Panel of Experts recommendations.

FLOOD FREQUENCY ANALYSIS

7.3.7 Due to the limited data at Tutkaul gauging station to estimate large return period (e.g. 1 in 10,000 year) flood events, Coyne et Bellier et al. (2014f) performed a three-step frequency analysis using the 'station-year approach'. This approach was used as a pooling methodology to extend the flood discharge sample size using data from hydrologically and climatically similar river basins (the Indus, Chenab and Syr Darya Rivers).

7.3.8 The resulting estimate of flood frequency data applicable to the Rogun HPP catchment, as reported by Coyne et Bellier et al. (2014f) is reproduced in **Table 7-9**.

Table 7-9 - Flood frequency data for the Rogun HPP dam catchment (from Coyne et Bellier et al., 2014f).

Return period (years)	Peak Discharge (m^3/s)
2	2,360
5	2,780
10	3,070
20	3,360
50	3,750
100	4,030
200	4,310
500	4,660
1,000	4,950
2,000	5,260
5,000	5,640
10,000	5,970

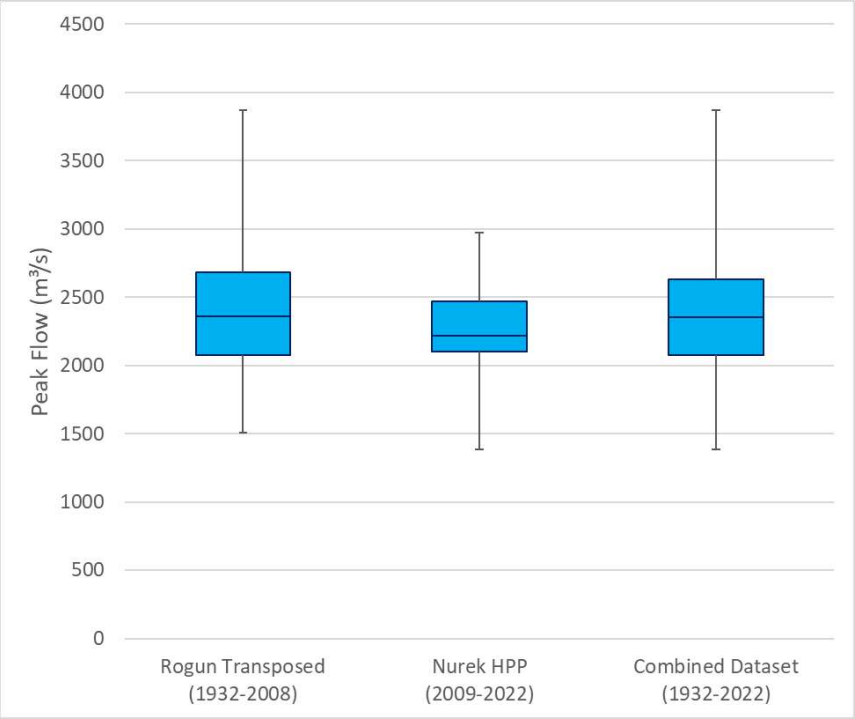
7.3.9 A comparison was undertaken between the peak flow data used by Coyne et Bellier et al. (2014f) and the recent (2009 to 2022) peak flow data for the Vakhsh catchment provided by the World Bank. The purpose of this comparison is to qualitatively assess the potential for changes to the previously appraised (Coyne et Bellier et al., 2014f) peak flow regime and frequency analysis at the Rogun HPP dam, associated with the inclusion of these additional data. The additional data has been compared against the transposed Rogun Dam peak discharges data obtained from the 'First Step' (i.e. utilizing Vakhsh river basin data) of the analysis undertaken by Coyne et Bellier et al. (2014f).

7.3.10 **Figure 7-13** presents boxplots providing a comparison of the following data:

- Peak flows transposed to Rogun dam for the period from 1932 to 2008 (Coyne et Bellier et al., 2014f);
- Nurek HPP peak flow data for the period from 2009 to 2022 (World Bank, 2023); and
- Dataset combining the Rogun and Nurek datasets, for the period 1932 to 2022.

7.3.11 The plot whiskers extend to the minimum and maximum values of the datasets, while the boxes present the lower quartile, median and upper quartile of the datasets.

Figure 7-13 - Peak flow discharge box plot comparison (Coyne et Bellier et al., 2014f; World Bank, 2023).



7.3.12 **Table 7-11** shows that the Nurek HPP (2009-2022) data present a similar box plot compared to the Rogun transposed dataset, albeit with a significantly lower maximum value which is not surprising given the significantly smaller sample size of the dataset. The boxplot for the combined dataset demonstrates minimal changes to the peak flow statistics, with similar statistic values shown compared to the original Rogun transposed dataset that has been used for the previous studies.

7.3.13 From this qualitative comparison the inclusion of the new (2009 to 2022) data would not significantly change the results of the flood frequency analysis performed by Coyne et Bellier et al. (2014f), as reported in **Table 7-9**. As an outcome of the Dam Safety Panel of Experts recommendations an update of hydrological calculations and flood studies is being procured which will provide a review and update of the flood studies results.

PROBABLE MAXIMUM FLOOD (PMF)

7.3.14 Due to the hydrological characteristics of the Vakhsh river basin, peak flows are primarily influenced by the snowmelt during the summer months rather than by precipitation. Consequently, conventional methods of estimating the PMF from the Probable Maximum Precipitation (PMP) were not applied by Coyne et Bellier et al. (2014f) in their analysis of PMF for the Rogun HPP dam. Coyne et Bellier et al. (2014f) developed an approach to estimate the PMF based on the degree-day method to consider:

- The availability of snow and ice cover (determined by the quantity of the winter precipitation); and
- The melting process in spring and summer (controlled by solar radiation).

7.3.15 The analysis provided an estimated a daily PMF of 7,770 m³/s and an instantaneous peak PMF flow of 8,160 m³/s (Coyne et Bellier et al., 2014f). An update of hydrological calculations, including the PMF, will be undertaken as an outcome of the Dam Safety PoE recommendations.

HYDROGRAPHS

7.3.16 Coyne et Bellier et al. (2014f) estimated a characteristic dimensionless flood hydrograph based on the observations of three major flood events observed on the Vakhsh river, measured at the Tutkaul gauging station:

- July 1953: the largest flood recorded on the Vakhsh with daily discharge of 3,500 m³/s and peak discharge of 3,730 m³/s;
- July 1958: major flood event with a daily discharge of 3,250 m³/s; and
- July 1969: major flood event in terms of flood volume with a daily discharge of 2,800 m³/s).

7.3.17 These three observed flood events are presented in **Figure 7-14**, reproduced from (Coyne et Bellier et al., 2014). The dimensionless flood hydrograph obtained by Coyne et Bellier et al. (2014), together with the three observed events, is presented in **Figure 7-15**. The flood hydrographs for the 10,000-year flood and PMF, as estimated by Coyne et Bellier et al. (2014) are presented in **Figure 7-16**.

7.3.18 An update of hydrological calculations will be undertaken as an outcome of the Dam Safety PoE recommendations.

Figure 7-14 - Observed Flood Events at Tutkaul gauging station during 1953, 1958, 1969 (Coyne et Bellier et al., 2014f).

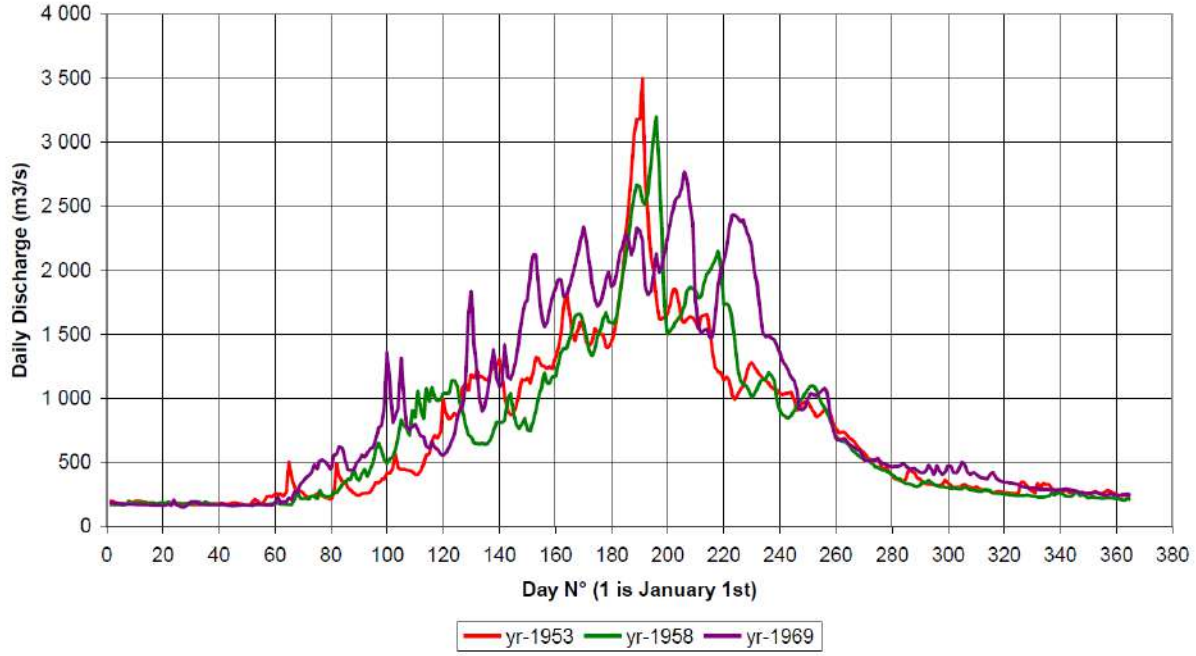


Figure 7-15 - Dimensionless annual flood hydrographs and observed flood events during 1953, 1958, and 1969 (Coyne et Bellier et al., 2014f).

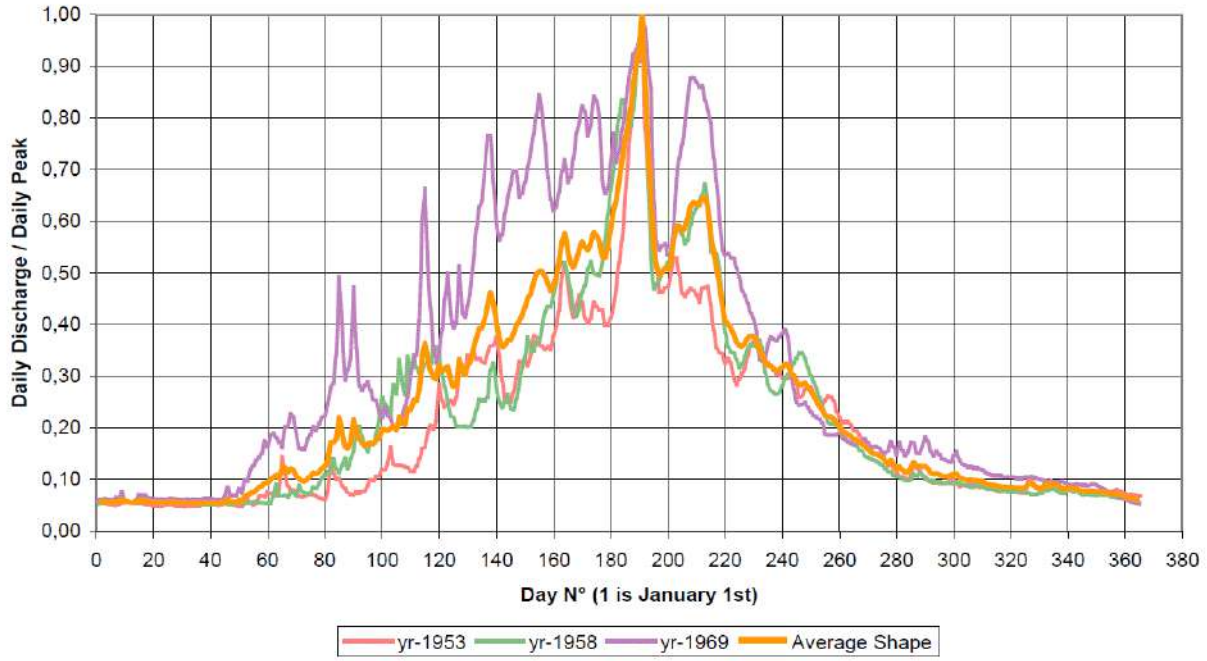
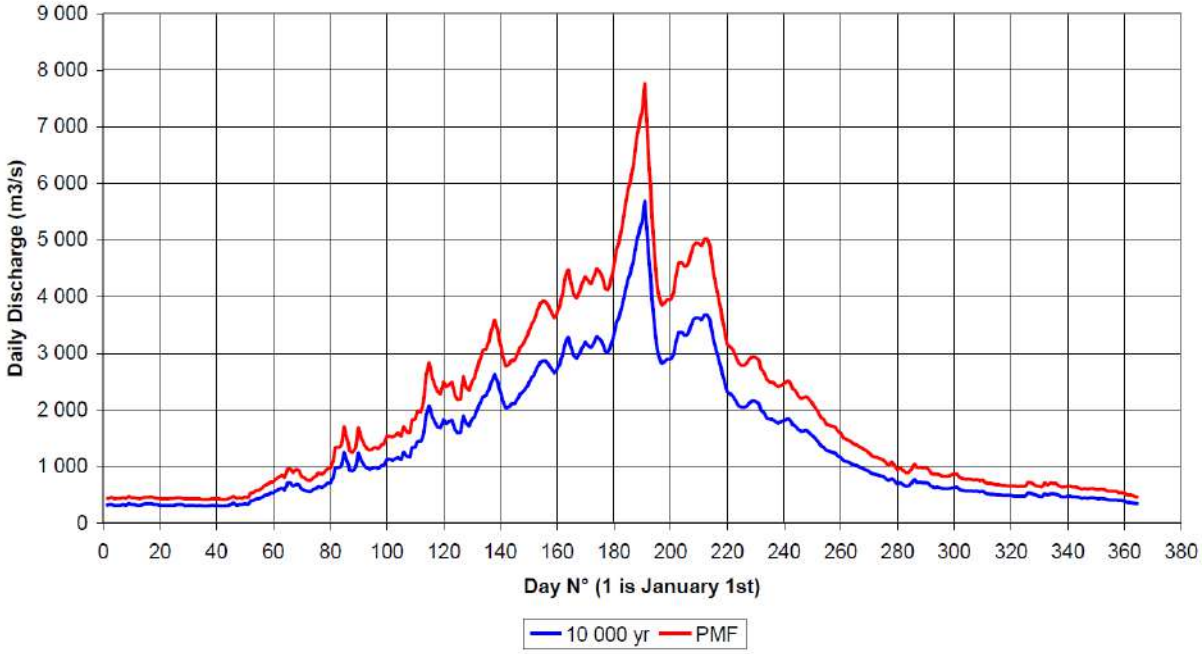


Figure 7-16 - Estimated annual flood hydrographs - 10,000-Year flood and PMF (Coyne et Bellier et al., 2014f).



7.4 SURFACE WATER QUALITY

7.4.1 The following sections discuss water quality data relevant to the construction of the Rogun HPP. Available water quality data is primarily sourced from the previous ESIA report conducted by Pöyry (2014) in which water quality of the catchments of the Vakhsh and Amu Darya Rivers are reported from 1998 and 1996. Details of more recent routine monitoring (2013–2022) in addition to samples collected by WSP staff in May 2023 are discussed (WSP, 2023).

HISTORICAL DATA: NUROBOD HYDROLOGICAL STATION, VAKHSH RIVER (1980 – 2010)

7.4.2 Monitoring has been undertaken since 1980 at the Nurobod hydrological station on the Vakhsh river, located within the future footprint of the Rogun reservoir (Pöyry, 2014). It is noted by Pöyry (2014) that the water quality at the station is primarily influenced by the natural hydrochemical processes occurring in the surrounding landscape and catchment.

7.4.3 Historical water quality analysis for the Nurobod station was performed locally in Nurobod 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 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.

7.4.4 Available data are reported in **Table 7-10** with comparison against World Health Organization (WHO) drinking water recommendations (WHO, 2017), European Union drinking water standards (EU, 2020) and Tajikistan water standards as set out by Tyuryaev et al. (2009).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. Between 1998 and 2010, the average pH is circum-neutral at 7.6 which is within local and international water quality standards. The average recorded temperature of the Vakhsh as reported by Pöyry (2014) is 7.6°C during the monitored period.

7.4.5 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. 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. When these results are compared to international water quality standards the sulphate is compliant with WHO and EU guidelines (**Table 7-10**). With regards to metal compounds, only chromium (Cr VI) and lead (Pb) are reported by Pöyry (2014) in the Vakhsh river, between 1980 and 2010 for chromium, and 2007 to 2010 for lead. Measured concentrations of these two metals are shown in **Table 7-10** for their respective monitoring periods. The concentrations of chromium are below EU drinking water limits, and the WHO drinking water limits. Concentrations narrowly exceed the Tajikistan limits as set out by Tyuryaev (2009) for chromium.

7.4.6 It is noted by Pöyry (2014) that the Lead (Pb) concentrations reported in **Table 7-10** are for the period of 2007-2010. Concentrations measured in previous years (from 2003 to 2005) were more than ten times higher with an average of 0.37 mg/L for Pb which was explained by Pöyry (2014) as a reporting error by Gidromet so have not been included. Pöyry (2014) highlight the importance of considering how water quality data may be used, and the need for improved water quality monitoring in relation to this error. Lead concentrations at average and maximum concentrations exceed both the EU and WHO drinking water limits but not the Tajikistan requirements.

Table 7-10 - Summary of annual average historical water quality data (after Poyry, 2014), annual average national hydrometeorology agency water quality data (2013-2022), and WSP spot water quality monitoring (2023).

Parameter	Unit	Water Quality Limits			Historical Data[a/b]			National Hydrometeorology Agency Data (2013 - 2022)[c]					WSP Monitoring 2023[d]									
		WHO [1]	EU[2]	TAJIKISTAN [3]	Vakhsh Nurobod 1998-2010	Amu Darya Termez 1996-2001	Amu Darya Samanbay 1996-2001	Vakhsh Nurobod 2013-2022	Vakhsh Obigarm 2014-2019	Khingob River 2013-2022	Surkhob River 2013-2022	Gharm 2019-2020	P1	P2	P3	P4	P5A	P5B	P6	P7	P8	P9
Northing[e]	-	-	-	-	*38°51'26"*	*unknown*	*unknown*	*38°51'26"*	*38°43'5.82*	*38°52.033'*	*38°52.304'*	*39°00'27"*	38°40'17.89	38°39'22.24	38°41'28.15	38°43'35.40	38°51'57.08	38°51'55.68	38°51'25.53	38°51'33.96	38°48'11.17	38°43'5.82
Easting[e]	-	-	-	-	*69°59'40"*	*unknown*	*unknown*	*69°59'40"*	*69°43'49.93*	*70°2.244'*	*70°1.900'*	*70°10'46"*	69°46'27.70	69°45'16.55	69°46'36.55	69°48'32.97	70° 1'30.05	70° 1'31.42	69°59'39.95	69°57'54.38	69°52'32.68	69°43'49.93
pH	-	-	**6.5 - 9.5**	-	7.6	7.6	7.6	7.63	7.75	7.55	7.76	7.08	7	7.5	7.6	7.6	7.7	7.6	7.6	8.1	7.8	8.4
Temperature (Sample)	°C	-	**-**	-	7.6	-	-	17.73	18.43	19.56	22.2	20.2	13.8	14.2	12.8	13.4	11.6	10.6	11.7	15.9	13.3	17.1
Temperature (Air)	°C												22.9	28.8	26.2	25.3	25	26.6	26.1	32.8	29	27
Dissolved Oxygen (O_2)	mg/L	-	**-**	Winter >4.0 Summer >8.0	-	10.5	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	%sat	-	**-**	-	-	99.7	98.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rugged Dissolved Oxygen (O_2)	mg/L	-	-	-	-	-	-	-	-	-	-	-	8.9	9	9.4	9.8	9.5	9.9	9.5	8.3	8.9	8.1
Biological Oxygen Demand (BOD)	mg/L	-	**3**	-	-	0.8	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical Oxygen Demand (COD)	mg/L	-	**-**	-	0.6	4.5	15.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxidation-Reduction Potential (ORP)	mV	-	**-**	-	-	-	-	-	-	-	-	-	74.1	60.7	64.8	71.6	73.8	73.8	78.5	69.4	97.5	94.1
Salinity	mg/L	-	**-**	-	-	551.4	1170	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	**-**	-	-	-	-	-	-	-	-	-	734.8	632.1	630.5	714.8	556.7	651.4	621.4	168.4	419.7	248.9
Total Dissolved Solids (TDS)	mg/L	-	**-**	-	-	-	-	-	-	-	-	-	606.4	517.1	533.5	596.5	485.8	584.5	541	132.4	350.2	190.2
Phosphate (PO_4)	mg/L	-	**-**	0.1	0.06	0.75	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite (NO_2)	mg/L	-	**0.5**	0.02	-	-	-	0.01	0.05	0.01	0.02	0.002	-	-	-	-	-	-	-	-	-	-
Nitrate (NO_3)	mg/L	*50*	**50**	9.1	1.6	0.6	0.5	0.91	1.15	2.12	0.05	-	-	-	-	-	-	-	-	-	-	-
Ammonium (NH_4)	mg/L	-	**0.5**	-	-	-	-	0.02	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-
Bicarbonate (HCO_3)	mg/L	-	**-**	-	105.4	131.1	142.9	64.77	122	84.75	77.9	108.3	-	-	-	-	-	-	-	-	-	-
Chloride (Cl)	mg/L	-	**250**	300	85.4	73.3	213.9	91.51	37.23	42.76	39.85	28.35	-	-	-	-	-	-	-	-	-	-
Sulphate (SO_4)	mg/L	-	**250**	100	169.6	176.6	**433.6**	120.59	43.2	104.33	124	33	-	-	-	-	-	-	-	-	-	-
Calcium (Ca)	mg/L	-	-	180	-	16.7	13.6	58.38	35.6	60.83	62.93	78.15	-	-	-	-	-	-	-	-	-	-
Magnesium (Mg)	mg/L	-	**-**	40	-	-	-	25.26	18.11	17.98	9.08	12.15	-	-	-	-	-	-	-	-	-	-
Sodium (Na)	mg/L	-	**200**	120	-	-	-	51.8	27.73	0.9	22.7	18.1	-	-	-	-	-	-	-	-	-	-
Potassium (K)	mg/L	-	**-**	-	-	-	-	4.17	3.46	2.27	9.95	1.6	-	-	-	-	-	-	-	-	-	-
Aluminium (Al)	mg/L	-	**-**	-	-	-	-	0.04	0.03	0.02	0.03	0.04	-	-	-	-	-	-	-	-	-	-

Parameter	Unit	Water Quality Limits			Historical Data[a/b]			National Hydrometeorology Agency Data (2013 - 2022)[c]					WSP Monitoring 2023[d]									
		WHO [1]	EU[2]	TAJIKISTAN [3]	Vakhsh Nurobod 1998-2010	Amu Darya Termez 1996-2001	Amu Darya Samanbay 1996-2001	Vakhsh Nurobod 2013-2022	Vakhsh Obigarm 2014-2019	Khingob River 2013-2022	Surkhob River 2013-2022	Gharm 2019-2020	P1	P2	P3	P4	P5A	P5B	P6	P7	P8	P9
Northing[e]	-	-	-	-	*38°51'26"*	*unknown*	*unknown*	*38°51'26"*	*38°43'5.82*	*38°52.033'*	*38°52.304'*	*39°00'27"*	38°40'17.89	38°39'22.24	38°41'28.15	38°43'35.40	38°51'57.08	38°51'55.68	38°51'25.53	38°51'33.96	38°48'11.17	38°43'5.82
Easting[e]	-	-	-	-	*69°59'40"*	*unknown*	*unknown*	*69°59'40"*	*69°43'49.93*	*70°2.244'*	*70°1.900'*	*70°10'46"*	69°46'27.70	69°45'16.55	69°46'36.55	69°48'32.97	70° 1'30.05	70° 1'31.42	69°59'39.95	69°57'54.38	69°52'32.68	69°43'49.93
Copper (Cu)	mg/L	*2*	-	0.001	-	-	-	0.04	0.01	0.07	0.1	-	-	-	-	-	-	-	-	-	-	-
Chromium (Cr) Total	mg/L	*0.05*	**0.05**	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium 6 (Cr VI)[f] Annual Average	mg/L	*0.05*	**0.05**	0.001	0.017	-	-	0.01	0.01	0.01	0.01	0.0025	-	-	-	-	-	-	-	-	-	-
Chromium 6 (Cr VI)[f] Annual Maximum	mg/L	*0.05*	**0.05**	0.001	0.031	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Fe)	mg/L	-	**0.2**	-	-	-	-	0.02	0.01	0.11	0.03	0.01	-	-	-	-	-	-	-	-	-	-
Manganese (Mn)	mg/L	*0.4*	-	-	-	-	-	0.01	0.03	0.01	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Pb) Annual Average[f]	mg/L	*0.01*	**0.01**	0.1	***0.025***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Pb) Annual Maximum[f]	mg/L	*0.01*	**0.01**	0.1	***0.03***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon (Si)	mg/L	-	-	-	-	-	-	1.86	2.15	3.1	1.15	-	-	-	-	-	-	-	-	-	-	-

Notes: [1]WHO (2017) Guidelines for drinking-water quality. [2]EU (2020) Directive 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption. [3]Water quality standards and norms in the Republic of Tajikistan, Tyuryaev et al. (2009). [a]Vakhsh (National Agency for Hydrometeorology of the Republic of Tajikistan) after Poyry (2014). [b]Amu Darya (Crosa et al., 2006). [c]National Agency for Hydrometeorology, Republic of Tajikistan. [d]WSP Site Visit Monitoring 2023. [e]Locations in italics are approximate. [f]Chromium averages taken from 1980 to 2010. Lead averages taken from 2007-2010.

HISTORICAL DATA: AMU DARYA RIVER

7.4.7 The Vakhsh is a tributary of the Amu Darya, which flows towards the Aral Sea and Pöyry (2014) note that the Amu Darya has a trend towards decreasing water quality as it progresses downstream. There is an increase in the salinity towards the downstream sections of the Amu Darya, with the water type being dominated by sulphate, chloride, sodium, and potassium. Salinity at the Termez monitoring point is 551.4 mg/L and 1170 mg/L at the Samanbay monitoring location. The salinity is attributed by Pöyry (2014) to be geogenic arising from the underlying lithology of the basin, but which is driven and increased by return waters and irrigation activities.

7.4.8 Increases in deoxygenating pollutants, considered by Pöyry (2014) to be indicative of organic matter inputs from irrigated areas of the catchment, also lead to degradation of the Amu Darya River water quality. It is highlighted by Pöyry (2014) that urban wastewater contributions will be minimal as the population density is low and localized.

7.4.9 Water quality for two locations on the Amu Darya (Termez and Samanbay) are included in **Table 7-10** with comparison against WHO, EU, and Tajikistan water quality requirements. Compared against Tajik water quality limits both sulphate and phosphate are elevated.

RECENT DATA: NATIONAL AGENCY FOR HYDROMETEOROLOGY OF THE REPUBLIC OF TAJIKISTAN

7.4.10 Water quality data 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 sample locations. Details of the sample locations were not provided but approximate locations based on river names include:

- Vakhsh River – Nurobod;
- Vakhsh River- Obigarm;
- Khingob River – before confluence;
- Surkhob River – before confluence; and
- Surkhob River – Gharm.

7.4.11 This recently acquired water quality data are included in **Table 7-10**. The data indicate similar concentrations to the previously discussed historical data from Pöyry (2014). Average pH is neutral and ranges between 7.08 to 7.76 across the five monitoring locations. All parameters monitored meet the relevant guidelines from the WHO and EU. Sulphate and phosphate exceed the local Tajikistan water quality requirements, as with the historical data for the Vakhsh and Amu Darya Rivers. Sulphate is generally benign but can combine with settled metals under anaerobic conditions in deeper dams, forming metal compounds such as iron sulphide. It is not a major plant nutrient and is non-toxic, though it contributes to salinity. Phosphate, a plant macronutrient, can deteriorate water quality and cause eutrophication, leading to algal blooms in high concentrations. Sources include agricultural fertilizers, formal and informal sewage outlets, and fish farms. It is most likely that the principal source of phosphate found in the Rogun reservoir is from sewage and the fish farms upstream. While phosphorus from these sources can a risk to water quality, it is highly diluted in the Rogun reservoir, making it a low-risk factor overall.

7.4.12 Further *in-situ* water temperature data were received for the Vakhsh from the National Agency for Hydrometeorology of the Republic of Tajikistan. The average monthly water temperature profiles at

two monitoring stations within the Vakhsh catchment (Gharm and Darband) between 2005 and 2020 are presented in **Table 7-11**.

7.4.13 The water temperatures are shown to increase in the summer months when flow is also at the highest and are close to freezing during the winter months. At the Garm monitoring station, the average monthly water temperatures range from 0.6°C to 11.6°C. At the Darband monitoring station, the average monthly water temperatures range from 1.2°C to 14.0°C.

Table 7-11 - Vakhsh River average monthly water temperature profiles at Gharm and Darband monitoring stations (2005 to 2020).

	Average Monthly Water Temperatures 2005 – 2020 (°C)											
Month	1	2	3	4	5	6	7	8	9	10	11	12
Gharm	0.6	0.6	2.6	6.4	8.5	10.3	11.4	11.6	8.7	5.6	2.6	1.1
Darband	1.2	2.0	5.1	8.2	10.6	12.5	14.0	13.6	11.9	9.3	6.0	3.1

7.4.14 Water temperature will remain the same as the baseline measurements upstream of the Rogun reservoir. However, as the reservoir fills and becomes deeper thermal stratification will occur. Thermal stratification in a reservoir occurs when water forms distinct temperature layers due to solar heating. The upper layer, known as the epilimnion (around 5-10m deep), is warmed by the sun. Below this is the metalimnion, or thermocline, where the temperature changes rapidly with depth and typically ranges from around 10-20m deep. The bottom layer (greater than 20m to the bottom), called the hypolimnion, remains cold and dense. As the turbines draw water from the hypolimnion layer, colder water will be drawn from the reservoir downstream to Nurek which could have an impact on sensitive species in that section of the river. Understanding and managing thermal stratification is crucial to mitigate potential ecological impacts, especially when turbines draw from these colder layers, which can affect sensitive species. This potential impact is assessed in **Section 15-7** of **Volume 2: Chapter 15: Biodiversity** of this ESIA.

WSP SITE VISIT (MAY 2023)

7.4.15 In May 2023, a site visit was conducted by WSP personnel alongside team members of the wider Rogun HPP Project. A detailed description of the visit is included in a separate technical memorandum prepared by WSP (2023a). WSP attended workshops with Project representatives during the visit regarding water quality. As part of the Environmental Monitoring Plan implemented for the Rogun HPP, 10 locations were identified to be routinely sampled for water quality including:

- 3 locations sampled daily (upstream of the dam, downstream of the dam, and seepage); and
- 7 locations sampled quarterly (locations summarized in **Table 7-12**).

7.4.16 In 2017, WeBuild initially monitored 10 locations daily, and 12 locations quarterly (including the 10 daily sample points) but due to tunnels being buried by the dam during construction, the number of sample locations has since been reduced. Details on the 12 sample locations are included in **Table 7-13**.

7.4.17 The samples undergo field parameter analysis and laboratory analysis at the WeBuild laboratory which is accredited by the Tajikistan State Agency National Centre for Accreditation. Submissions to

the National Agency for Hydrometeorology of the Republic of Tajikistan are made monthly, quarterly, and annually. In the format the recent monitoring data was received from the National Agency for Hydrometeorology it is not possible to correlate sites between the WeBuild monitoring program and the recent data from the Agency.

Table 7-12 - Locations of WeBuild routine water quality monitoring program.

Sample Location	Coordinates	Description
1	38° 52.033'N 70° 2.244'E	River Khingob before confluence with River Surkhob
2	38° 52.304'N 70° 1.900'E	River Surkhob before confluence with River Khingob
3	38° 51.645'N 69° 56.902'E	River Vakhsh after the confluence of the River Surkhob with the River Khingob
4	38° 48.382'N 69° 52.377'E	Sangchar stream upstream of confluence with River Vakhsh
5	38° 47.136'N 69° 51.591'E	River Vakhsh after the confluence with Sangchar stream
6	38° 43.591'N 69° 48.479'E	River Vakhsh below the bridge near the village of Sicharog
7	38° 42.937'N 69° 47.114'E	River Obigarm upstream of confluence with River Vakhsh
8	38° 42.584'N 69° 46.962'E	River Vakhsh below the confluence with the River Obigarm
9	38° 42.073'N 69° 46.934'E	Crushing and screening facility (CSF) No. 12
10	38° 41.090'N 69° 46.491'E	Before Cofferdam
11	38° 40.161'N 69° 46.390'E	River Vakhsh, below outlets of Drainage Tunnels DT 1 and 2
12	38° 39.624'N 69° 45.603'E	River Vakhsh below the stockpile No. 26

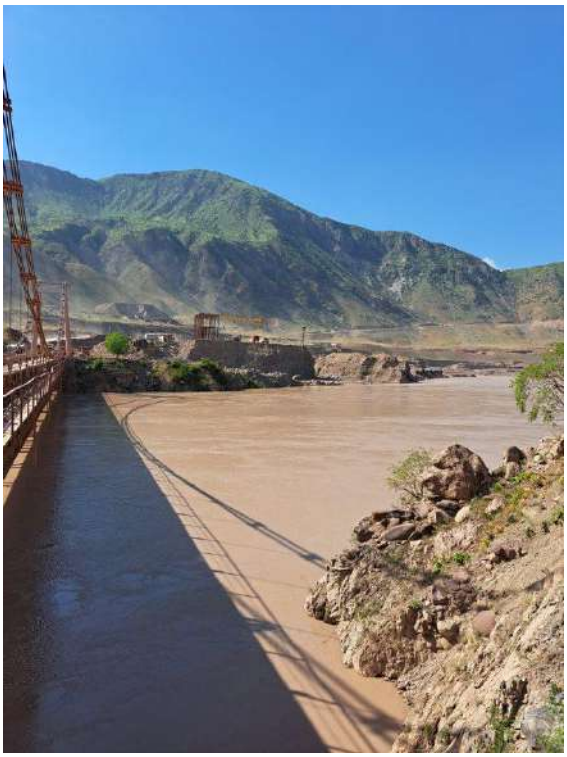
7.4.18 Single water quality measurements were recorded by WSP at 10 locations (some of which coincide with the WeBuild monitoring program) along the Vakhsh river during the May 2023 site visit. Details of the locations sampled by WSP are included in **Table 7-13.**

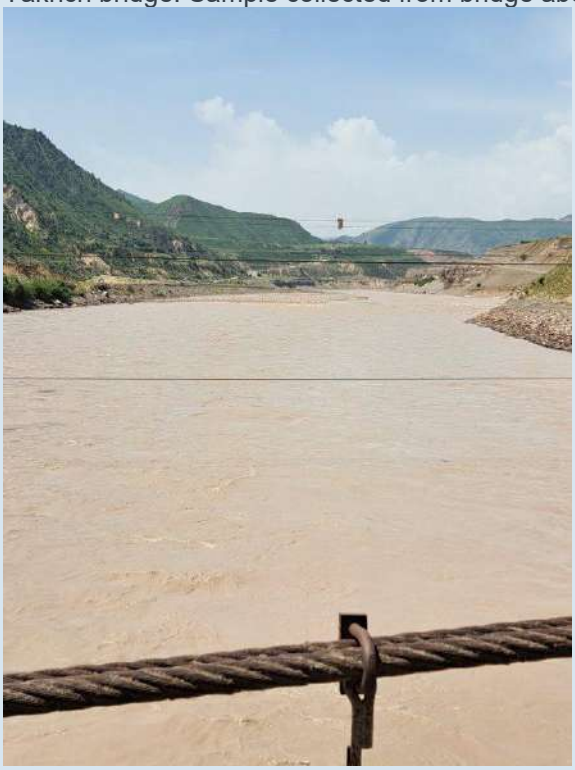
7.4.19 A SmarTROLLTM handheld probe was used to measure parameters including pH, oxidation reduction potential (ORP), conductivity, rugged dissolved oxygen (RDO), temperature (air and water), and total dissolved solids (TDS). For health and safety reasons, most samples were collected in a stainless-steel bucket into which the probe was submerged; however, where access to the river was deemed safe the probe was submerged directly into the river.

Table 7-13 - Water quality sampling locations from WSP site visit, May 2023 (WSP, 2023a).

Date of Sampling	ID	Coordinates	Description
Downstream of the Rogun HPP dam			
02/05/2023	P1	38°40'17.89"N 69°46'27.70"E	Location on the Vakhsh River downstream of the cofferdam at the outlet of Drainage Tunnel DT1. Sample analyzed within a stainless-steel bucket for health and safety reasons. Location corresponds approximately to WeBuild Monitoring Location 11. 
02/05/2023	P4	38°39'22.24"N 69°45'16.55"E	Location on the Vakhsh River, downstream Rogun Dam, below the stockpile No. 26. Sampled with stainless-steel bucket. Location corresponds approximately to WeBuild Monitoring Location 12.

Date of Sampling	ID	Coordinates	Description
			
Upstream of the Rogun HPP dam			
02/05/2023	P2	38°41'28.15"N 69°46'36.55"E	Location on the Vakhsh River, upstream Rogun Dam, in the reservoir (trash trap). Downstream the confluence with the Obigarm River. No trash was floating nearby at time of sampling. Location corresponds approximately to WeBuild Monitoring Location 10. 
02/05/2023	P3	38°43'35.40"N 69°48'32.97"E	Location on the Vakhsh River, upstream Rogun Dam, under Sicharogh bridge. Near the village of Sicharogh. Location corresponds approximately to WeBuild Monitoring Location 6.

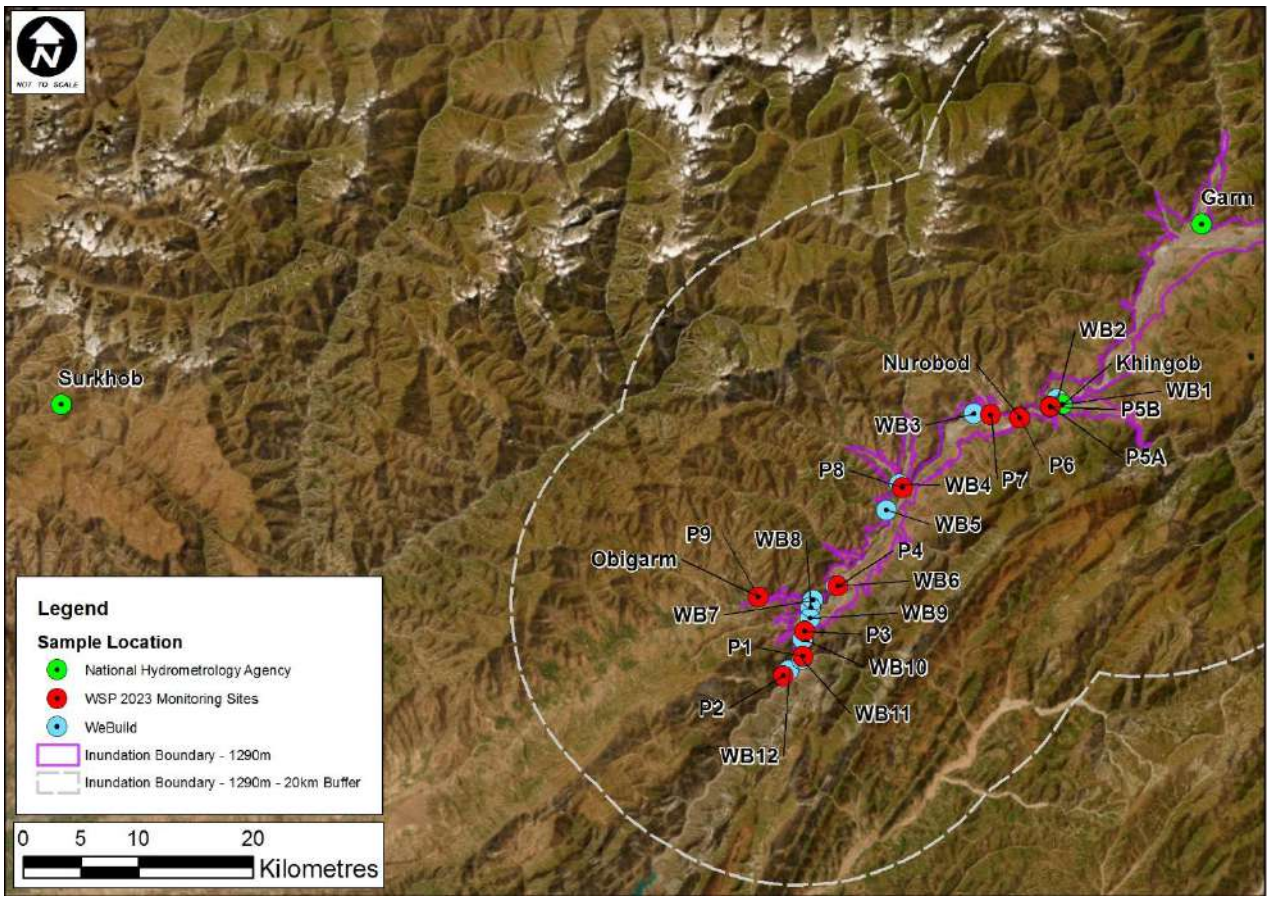
Date of Sampling	ID	Coordinates	Description
			
03/05/2023	P5A	38°51'57.08"N 70° 1'30.05"E	Location on the Surkhob River at confluence with Khingob River, upstream Rogun Dam, under Yakhak bridge. Sample collected close to the bank on side of Surkhob River. 
03/05/2023	P5B	38°51'55.68"N 70° 1'31.42"E	Location on the Khingob River at confluence with Surkhob River, upstream Rogun Dam, under Yakhak bridge. Sample collected close to the bank on side of Khingob River.

Date of Sampling	ID	Coordinates	Description
			
03/05/2023	P6	38°51'25.53"N 69°59'39.95"E	Location on the Vakhsh River, upstream Rogun Dam, after the confluence of the River Surkhob with the River Khingob, under Yakhch bridge. Sample collected from bridge above River. 
03/05/2023	P7	38°51'33.96"N 69°57'54.38"E	Location on the Darband River (Vakhsh River tributary), upstream Rogun Dam, downstream Darband town. Sample collected c. 500 m upstream of confluence with Darband River and Vakhsh Rivers.

Date of Sampling	ID	Coordinates	Description
			
03/05/2023	P8	38°48'11.17"N 69°52'32.68"E	Location on the Vakhsh River, upstream Rogun dam, downstream Mujikharf river and upstream Khakimi River (Vakhsh River tributaries). 
03/05/2023	P9	38°43'5.82"N 69°43'49.93"E	Location on the Obigarm River (Vakhsh River tributary), upstream Rogun dam, downstream Obigarm town. Located beyond the influence of the reservoir waters.

Date of Sampling	ID	Coordinates	Description
			

Figure 7-17 - Water quality sampling locations



7.4.20 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.

7.4.21 Dissolved oxygen (RDO) ranged between 8.1 and 9.9 mg/L, with the two tributaries having the lowest values. ORP values ranged between 60.7 and 97.5 mV.

7.4.22 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. 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. Consequently, the following recommendations are made, which shall be incorporated in the Watershed Management Plan:

- An assessment shall be undertaken to identify the sources of Conductivity, TDS and Total suspended solids (TSS) and whether these are related to the Rogun dam project or not;
- Ensure that appropriate mitigation measures are in place to successfully manage potential changes to or sources of Conductivity / TDS / TSS associated with the Rogun dam project; and
- Monthly spot sampling of Conductivity, TDS and TSS parameters to confirm the satisfactory performance of mitigation measures and inform updates to mitigation measures if required.

7.4.23 This sampling should be undertaken as a minimum until the completion of the construction of Construction Camp 2.

EUTROPHICATION POTENTIAL OF ROGUN DAM RESERVOIR

7.4.24 According to DFZ, the largest settlement(s) for resettled people will be in the Nurobod District. Household and solid waste is to be removed by the local municipal authority to a solid waste facility that will be constructed to Tajikistan standards. Household wastewater will report to a treatment plant in Darband, where treated wastewater is non-potable “technical water” used for irrigation or other purposes, but not discharged to the reservoir or other water body. To DFZ’s knowledge all other resettlements have septic systems, which presumably are subject to Tajik standards but for which DFZ has no real knowledge. Drinking water in New Nurobod comes from flows from springs, which are diverted to one or more tanks. Solids are allowed to settle to a sump, with no chemicals added, and piped to homes. As such, resettlement villages do not pose a significant risk of eutrophication to the reservoir. Further, existing villages around the reservoir perimeter are of low density and pose similarly low risks to water quality in the reservoir. Moreover, Rogun city has its own municipal sewage system which carries water away from the reservoir to prevent leaching. Pöyry (2014) concluded that risk of eutrophication in the Rogun reservoir at later stages is very low by reason of:

- There is little agriculture upstream of the reservoir, and therefore little input of fertilizers, and no large settlements with an important input of wastewater;
- Due to the turbulent nature of the Vakhsh River the inflowing river water will be saturated with oxygen, at around 10 mg/l;

- The low temperature of this glacial fed river would result in a much slower break down of biomass;
- The long period over which the reservoir will be filled will spread the decomposition of biomass over many years;
- There will be no seasonal growth in the annual drawdown zone that could add nutrients to the reservoir; and
- The Nurek reservoir has developed into an oligotrophic (low nutrient content) water body.

7.5 SEDIMENT

7.5.1 The Vakhsh River, with a drainage area of 30,390 km^2 at Rogun HPP, is characterized by a high sediment load, driven by intense erosion processes within the catchment (Pöyry, 2014). 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 (Coyne et Bellier et al., 2014c).

7.5.2 The suspended solids within the river are variable throughout the year, reaching their maximum during the flood season (May to August) following melting periods of snow (May) and glaciers (July-August) (Coyne et Bellier et al., 2014c). Pöyry (2014) reported that at equal discharge values, sediment concentrations are greater during the rising limb of the flood hydrograph compared to the falling limb of the flood hydrograph. The lowest amount of turbidity is during the winter months in the Vakhsh River (Coyne et Bellier et al., 2014c).

7.5.3 Limited sediment data are available for the Rogun HPP site. However, the Nurek dam, located approximately 75 km downstream on the Vakhsh River, provides a valuable analogue to the Rogun HPP. Coyne et Bellier et al. (2014c) state that the most reliable periods of sediment monitoring for the Nurek reservoir, are between 1972 to 1989. During this monitoring period the Nurek reservoir filled by 108 Mm^3/year. Two reports were considered by Coyne et Bellier et al. (2014c) to estimate yearly solid runoff for Rogun HPP;

- HPI (2009). Project of completion of Rogun HPP – report No. 1861-2-2-2 : Natural conditions, Hydro meteorological conditions, Hydroproject Institute; and
- Ministry of Water (2012). Note called “Calculation of Vakhsh rive solid run off”.

7.5.4 As cited by Coyne et Bellier et al. (2014c), the suspended and bed loads presented by HPI (2009) are an extrapolated series based on a limited number of measurements. The calculations made by Ministry of Water (2012) of yearly solid runoff are based on actual measurements from the Tutkaul gauging station. The Tutkaul gauging station is located downstream of the Rogun HPP site, close to the Nurek HPP.

7.5.5 Coyne et Bellier et al. (2014c) estimated annual sediment supplies to be in the order of 62 to 100 Mm^3/year, or 87 to 140 million tons/year equivalent based on their review of data reported by HPI (2009) and Ministry of Water (2012). The higher value of 100 Mm^3/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. It is noted that into the next stages of the Rogun HPP project, the authors recommended sediment sampling should be completed.

7.5.6 Grain size distributions of the sediment load at Rogun were cited by Coyne et Bellier et al. (2014c). The suspended load grain sizes are reproduced in **Table 7-14** while the bed load grain sizes are

included in **Table 7-15**. Pöyry (2014) report that the bed load volume is estimated to be 12% of the volume of suspended solids. Graphs illustrating the relationship between the sediment load and water discharge are included in **Figure 7-18** and **Figure 7-19** (Pöyry 2014).

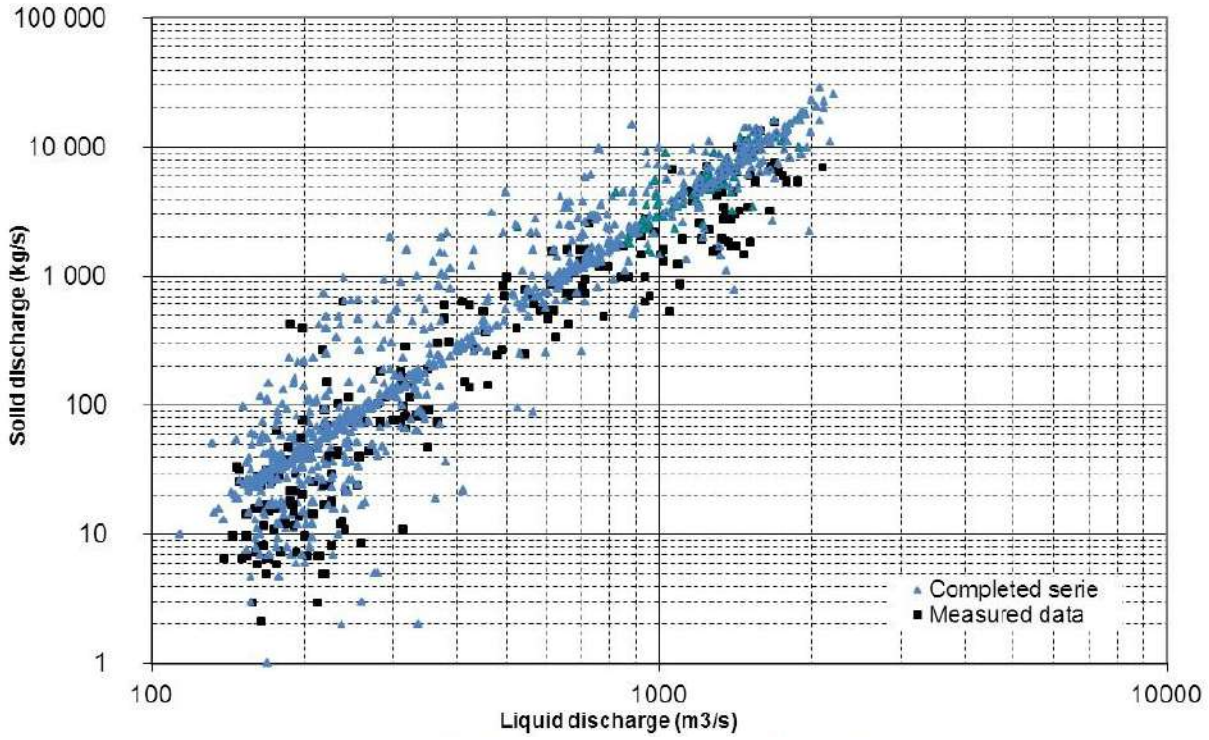
7.5.7 Coyne et Bellier et al. (2014) noted that sampling procedures were not documented, making it difficult to assess the reliability of suspended load measurements. As the graphs combine data from several stations it is not possible to identify whether differences exist between locations. The dominance of data points on the best-fit line also indicate that those data were calculated, rather than measured.

7.5.8 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.

Table 7-14 - Grainsize distribution of the suspended load (Coyne et Bellier et al., 2014c).

D, mm	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.01	<0.01
%	1.17	1.19	13.99	21.25	19.60	42.80

Figure 7-18 - Suspended Solid Load vs. Liquid Discharge on the Vakhsh River (Coyne et Bellier et al. 2014)



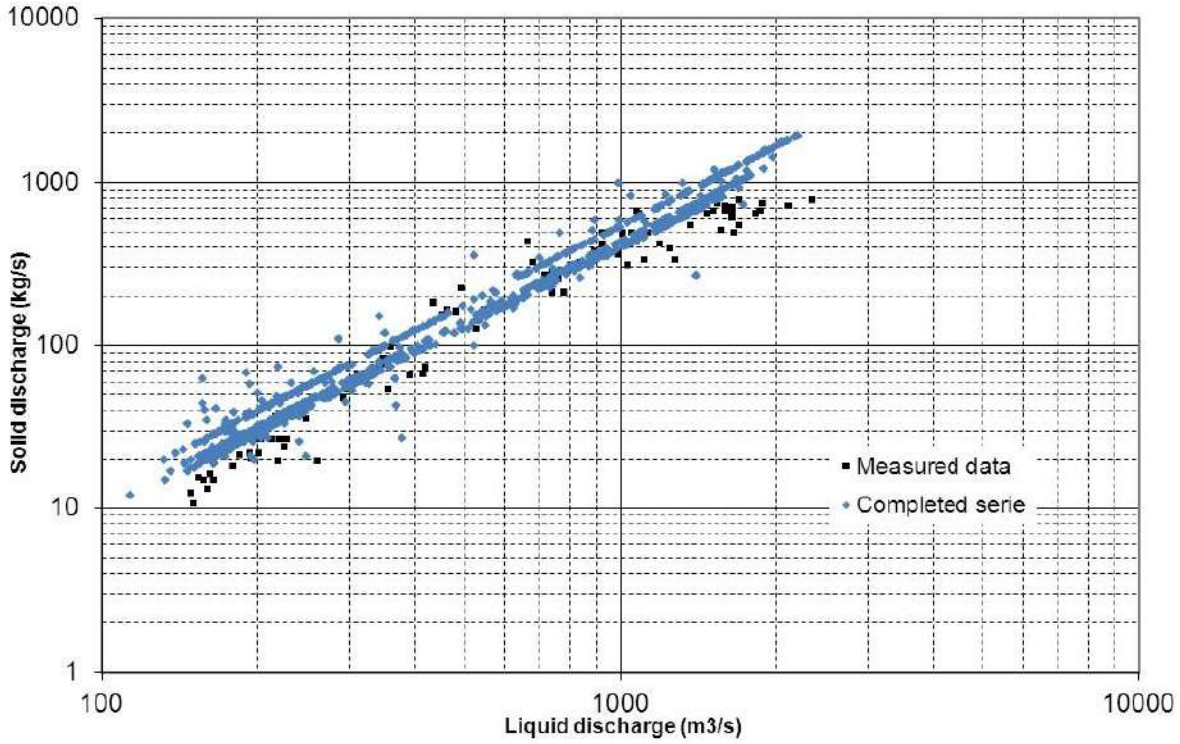
7.5.9 Grain size distributions of the bed load for the Nurek HPP as collated by Coyne et Bellier et al. (2014) are provided in **Table 7-15**. Coyne et Bellier et al. (2014) noted that sampling procedures were not documented, making it difficult to assess the reliability of bed load measurements.

7.5.10 The relationship between bed load and river discharge, assessed by HPI (2009) and presented by Coyne et Bellier et al. (2014), is shown in **Figure 7-19**. Density of bed load material was reported as 2.60 t/m^3 (HPI 2009).

Table 7-15 - Grain size distribution of the bed load (Coyne et Bellier et al., 2014c).

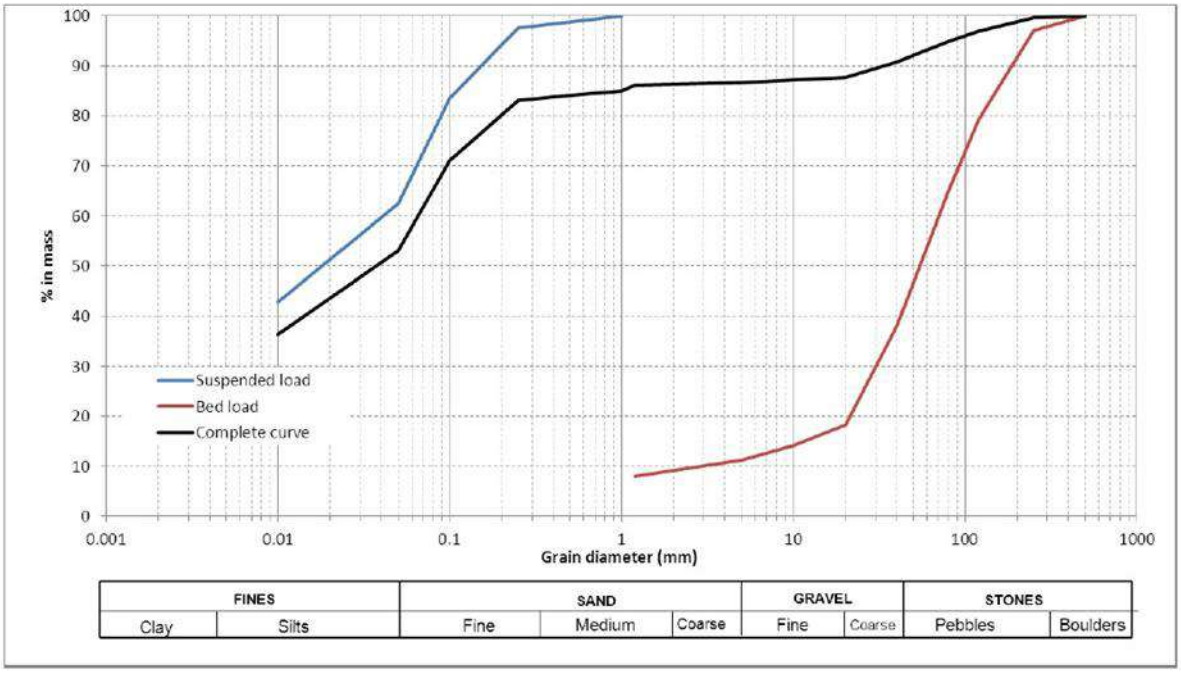
D, mm	500-250	250-120	120-80	80-40	40-20	20-10	5-1.2	<1.2
%	3.0	17.8	14.2	27.1	19.6	4.1	2.9	8.0

Figure 7-19 - Bed Load vs. Liquid Discharge on the Vakhsh River (Coyne et Bellier et al. 2014).



7.5.11 The available information regarding suspended and bed load sediments are generally consistent. However, Coyne et Bellier et al. (2014) evaluated the total sediment load, based on the constituent grain size distributions, and an assumption that suspended load comprised 85% of the total sediment load, with bed load making up the remainder. The resulting composite grain size distribution is shown in **Figure 7-20**.

Figure 7-20 - Composite Grain Size Distribution of Sediment Load on the Vakhsh River (Coyne et Bellier et al. 2014).



7.5.12 Coyne et Bellier et al. (2014c) highlight that for long term sustainable sediment management a clearer understanding of the annual sediment transport volumes is required. The Nurek reservoir therefore represents an important source of data and trends to inform on possible sedimentation rates for the Rogun HPP project. Detailed sedimentation data and bathymetric survey data, for the Nurek reservoir are not available to inform the current assessment.

7.5.13 Coyne et Bellier et al. (2014c) additionally identify longitudinal and transversal cross sections of the sediment deposition in the Nurek reservoir to be important for consideration. It is also recommended to collect samples of the sediment as grab samples (particularly from periods of high river discharge) from the surface of the deposited sediments along three longitudinal alignments every 1000 m. Core samples from the topset and forest slopes would also enable more detailed assessment of sedimentation patterns. Suspended sediment concentrations, particle size distributions at varying depths, and information on annual water levels and river discharges should be considered.

7.5.14 Following construction of the Nurek HPP, most of the sediment transported by the river is now deposited within the reservoir leading to lower sediment loads in the lower catchment (Coyne et Bellier et al., 2014c). If Rogun (upstream) were not to be built the Nurek reservoir would continue to fill with sediment.

7.5.15 Based on surveys detailed by Coyne et Bellier et al. (2014c), the reservoir capacity of the Nurek HPP reservoir is 910 masl with changes over time:

- Decrease of 108 Mm3/year between 1972 and 1989;
- Decrease of 115 Mm3/year between 1994 and 1989; and
- Decrease of 64 Mm3/year between 2007 and 1972.

7.6 GEOMORPHOLOGY

CONSTRUCTION, INITIAL OPERATION AND RESERVOIR FILLING PHASE (2019 – 2036)

7.6.1 The Vakhsh River hydrological setting and hydrology is detailed in the previous Sections 7.2 and Error! Reference source not found.. This section focuses on the current fluvial geomorphology of the V akhsh River.

7.6.2 Upstream of the city of Bokhtar the Vakhsh river flows through mountainous terrain characterized by narrow and constrained river valleys and gorges. From 20 m contour mapping the riverbed is estimated to have an average slope of 0.44% from the Nurek dam to the upstream limit of the proposed Rogun impoundment. The mountainous terrain, and the reliable flow in the river, has been exploited for hydropower production at several sites along the river. This includes the Nurek Dam, which at 300 m is the tallest dam in the world. The Rogun dam will exceed this height at 335 m, by exploiting a narrow gorge upstream of the Nurek Dam. Downstream of the city of Bokhtar the terrain opens out into a wide alluvial plain supporting extensive agricultural activity.

7.6.3 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). Coyne et Bellier et al. (2014) has determined the annual sediment supply in the river at the site of the Rogun dam to be in an order of 62 to 100 Mm^3, the majority of which is suspended solids, with only 12% comprising of bed load. Since the impounding of the Nurek dam in 1972 all the bed load and the majority of the suspended load have been deposited in the resulting reservoir, leaving the river starved of sediment downstream of the dam.

7.6.4 In the mountainous reaches of the Vakhsh the steep unstable valley sides (**Figure 7-22**), and frequent earthquakes in the region, results in a high risk of land and rockslides. These could either temporarily dam the flow in the river leading to an uncontrolled breach and resulting flood wave or can displace large volumes of water upstream of a dam, causing the dam to be overtopped by the resulting flood wave. The resulting risk to the hydropower dams on the Vakhsh, including Rogun, has been studied extensively by several authors including Havenith et al., (2018); Jones et al., (2021); and Torgoev et al., (2017).

7.6.5 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; In these locations the entire channel width can be inundated during high flows, resulting in a much-reduced unit stream power of less than 0.03 kW/m. This variation in stream power governs where bed load is transported or deposited in the river. Where the channel is constrained by the surrounding topography and bedrock there is little deposition of bedload, as in **Figure 7-21** and **Figure 7-22**. Where there is less constraint on the channel the river spreads out, reducing the stream power intensity, resulting in the formation of a braided channel, as in **Figure 7-23** and **Figure 7-24**.

Figure 7-21 - Constrained channel downstream of Rogun dam site (Esri mapping imagery)



Figure 7-22 - Photo of a constrained channel upstream of the Rogun dam site



Figure 7-23 - 1.4 km wide braided channel on Surkhob tributary at Navobod (Esri mapping imagery



Figure 7-24 - Photo of a braided channel at a location upstream of Rogun dam site



7.6.6 Braiding is a characteristic of mountainous rivers with a characteristic flashy hydrology with high proportion of course grained bed load and sufficient stream power for it to be mobilized. The braiding features, such as channel bars, branch islands and accreting islands are mobile and ever changing during the annual floods. Vegetation is unable to establish, due to the ephemeral nature of the braided channel and the annual washing out of fine sediments. Where fine sediments are deposited, and vegetation can establish, the riverbed becomes more stable allowing a more distinct meandering channel to form.

7.6.7 From aerial imaging around 54 km of braided channel has been identified within the proposed 1,290 masl impoundment area of the Rogun dam. The most extensive areas being located on the Vakhsh at Mehrobod and on the Surkhob tributary, at Navobod where the channel is 1 to 2 km wide. Upstream of Navobod 118 km of the Surkhob tributary is braided river channel, which in some locations is up to 3 km wide. Although braided channels that are free of anthropogenic influences are becoming increasingly rare in many parts of the world, this is not the case in Tajikistan. The biodiversity value of braided channels is discussed within the **Volume 2 (A11)** and **Volume 3 (B1)**.

7.6.8 Downstream of the Rogun dam site there is limited opportunity for a braided channel to form due to the narrow, constrained river valley and cascade of hydropower dams. It is not until the river reaches the wide alluvial plain downstream of the city of Bokhtar that there is evidence of channel braiding. However, the braiding features have been stabilized by well-established vegetation suggesting they are not as mobile as those upstream of the Rogun dam site, as shown in **Figure 7-25**. This would be expected due to the upstream dams cutting off the supply of bed load and the regulation of seasonal floods.

Figure 7-25 - Vegetated braided channel downstream of Nurek dam



7.6.9 At the downstream end of the Vakhsh, before it joins the Panj river, the river has formed a meandering channel in a wide flood plain, forming features such as meander scars and oxbow lakes (**Figure 7-26** This unique habitat is protected by the Tigrovaya Balka State National Reserve, its main objective being the conservation of the unique Tugai complex and of the animals living in it. Tugai is the name of a specific type of floodplain habitat in desert areas of Central Asia; it is

characterized by a groundwater level close to the surface, creating the conditions required by a specific vegetation type composed of several specialized tree species, reeds etc. It is also a habitat for many species of animals. Tugai systems have come under increased pressure through intensified human use of these floodplains, Pöyry, (2014).

Figure 7-26 - Meandering channel in the Tigrovaya Balka State National Reserve (Esri mapping imagery)



Between the start of the Nurek reservoir and the Rogun dam site the river flows through a deep narrow valley with no flood plain. The riverbed, at around 150 m to 200 m wide takes up the whole of the valley floor. Exposed sedimentary rock is visible in numerous locations along this reach of the river suggesting limited overburden material beneath the riverbed. The high unit stream power associated with a narrow river channel when subject to high flows suggests that riverbed is highly resistant to scour.

7.6.10 Despite the river being starved of sediment downstream of the Nurek dam, there does not appear to be evidence of significant erosion having taken place since the 1970s from aerial images.

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 masl around 54 km of braided channel, up to 2 km in width, will become permanently inundated along. The large change in water levels in the river valley will result in a change of water table level within the steep valley sides.

FULLY OPERATIONAL PHASE (POST 2038 (FUTURE BASELINE))

7.6.11 As much of the significant changes to river morphology will have been realized during the filling of the reservoir, there will be limited additional incremental change during the fully operational phase. As the Rogun reservoir will be used for water regulation the water level is expected to vary by around 50 m during the year, Pöyry, (2014). This variation would result in a changing water table in the steep valley slopes, possibly increasing the risk of slope stability.

7.6.12 With the available information on sediment loads Coyne et Bellier et al., (2014) has estimated the Rogun reservoir will fill with sediment to within 15 m of the 1,290 masl operating level within 115 years, by which time it will have reached the end of its operational life, unless maintenance is implemented to extend the life of the project or further dams are constructed upstream of Rogun. Coyne et Bellier et al., (2014) proposed that a surface spillway structure could be installed to manage the design flood in the event the dam requires managed closure. The surface spillway would eventually start passing sediment load, and in the absence of ongoing annual maintenance the river would be allowed to carve an incised channel in the rock allowing the river to bypass the dam. The dam could then be safely abandoned and would slowly release the impounded sediments downstream (Coyne et Bellier et al., 2014).

7.6.13 Minimum Environmental Flows baseline is set out in **Volume 2, Annex 7-2** of this ESIA.

8 LANDSCAPE AND VISUAL

8.1 OVERVIEW OF THE SITE AND STUDY AREA

8.1.1 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 (refer to **Figure 8-1**). The river is intensively developed and accommodates five existing hydropower dams, of which the Project is the uppermost.

Figure 8-1 - Topographic Map of Tajikistan



8.1.2 The AoI is defined as a buffer of 1 km and was taken from the proposed FSL 1290 of the reservoir and is shown as the red box in this figure.

8.1.3 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.

8.1.4 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.

8.1.5 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 colonized 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.

8.1.6 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, with the exception of the ancient fortresses at Navdonak village, were found to be in poor condition / damaged by road construction or other development.

8.1.7 The region close to the proposed Rogun Dam site has high hills on both sides which are generally devoid of any vegetation (see **Figure 8-2**, Nos 1&2). **Figure 8-2** 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 8-2 - Landscape view close to Proposed Dam site.





Figure Note: 1 &2 = adjacent hills, 3 = walking bridge, 4 = construction camp

Top Image – Aerial view of the river reach looking upstream.

Bottom Image – photo from proposed Rogun dam location looking upstream

8.1.8 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 8-3**). 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.

Figure 8-3 - Landscape view of area about 10 km upstream of dam site.

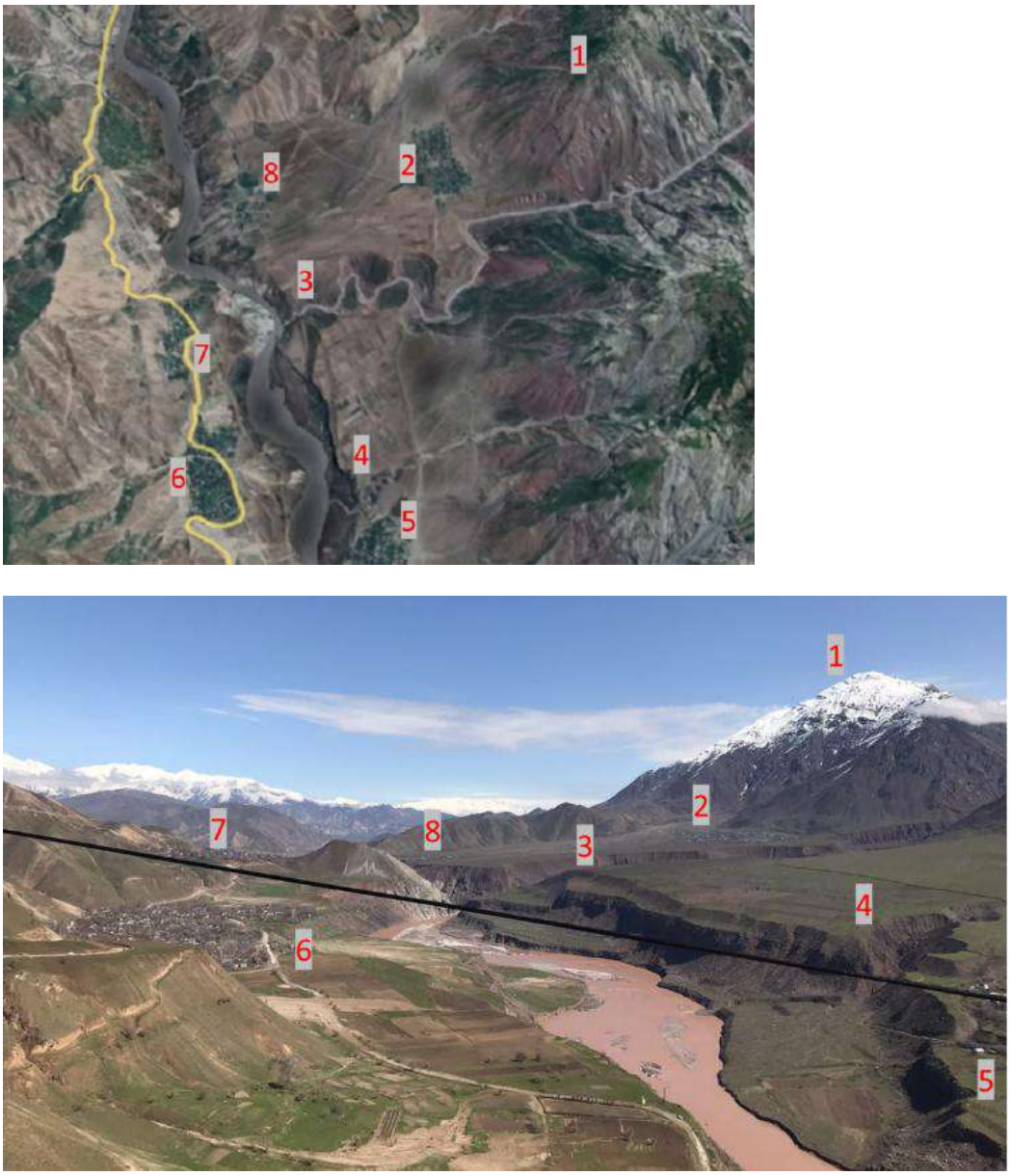


Figure notes: 1= mountain peak; 2= Village Roghuni Bolo, 3&4 = small streams joining the river Vakhsh; 5 = village Bedikho; 6 = village Aligalaboni bolo; 7 = village Kumok; 8 = Village Roghuni poyon

Top Image – Aerial view of the river reach
Bottom image – photo from the road looking upstream at village Aligalaboni bolo

8.1.9 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 – see Number 5 in **Figure 8-4**. 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 (Number 3 in Figure 4) will remain unaffected and thus will not require resettlement. The landscape character of the area is similar to that around the proposed dam site.

Figure 8-4 - Landscape view of area about 15 km upstream of proposed dam site.

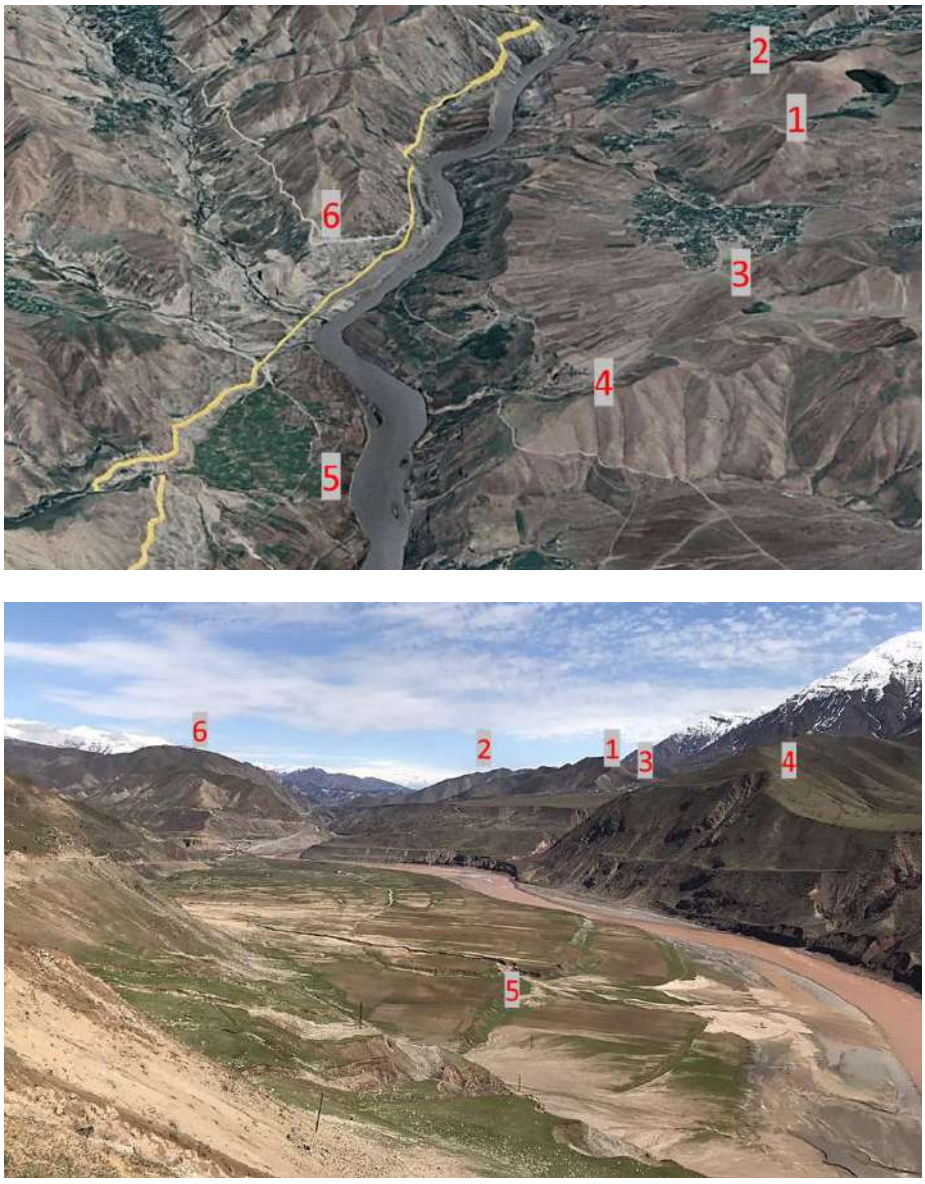


Figure notes: 1, 2, 4 & 6 = Hills having elevation of 1350 m and above; 3 = Village of Sangdevor; 5 = Village of Chorsada; 6 = river plain area used for cultivations

Top Image – Aerial view of the river reach
Bottom Image - photo from the road M41 looking upstream

8.1.10 Approximately 25km upstream of the proposed dam site, close to the village of Ani, there is a wide flood plain characterized by sandbars and braided channels (refer to **Figure 8-5**). 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 8-5 - Landscape view of area about 25 km upstream of proposed dam site.





Figure Notes: 1=mountain peak; 2 = Village of Yakhch, 3= riverbed with meanders over a cross section of 1 km or more, 4 = village of Ayni

Top Image – Aerial view of the river reach
Bottom Image – photo from the road M41 close to village Delvokhak looking upstream

8.1.11 The Surkhob river and the Khingob river join to form the river Vakhsh about 34 km upstream of the proposed dam site (refer to **Figure 8-6**). 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.

Figure 8-6 - 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

Top Image – Aerial view of the river reach
Bottom Image – photo from the road foot bridge looking upstream

8.1.12 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 characterized by high sediment deposits which form distinctive braided channels and sand bars (refer to **Figure 8-7**). 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 program due to the extent of lower-lying land. The existing elevation of the riverbed varies between 1230 and 1260 m amsl.

Figure 8-7 - Landscape view of area between the confluence of the Surkhob and Khingob rivers and Nurobad village (where the river Muksu meets the river Surkhob)



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 8-8).** 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 8-8 - Landscape view of constrained river valley between high hills





9 BIODIVERSITY

9.1 BASELINE DATA COLLECTION

9.1.1 The baseline presented in this report represents the current condition after existing and approved disturbances, such as the partially-completed dam wall with its current inundation to 1070m asl, and therefore Project impacts to be assessed include the filling of the reservoir up until the maximum inundation level (i.e. to 1290m – hereafter referred to as the 'flooding zone'), along with other Project components such as new roads and stockpiling areas. The baseline therefore does not consider any impacts that have already occurred to date, although for context, a review of historic aerial imagery from over the last two decades reveals that the habitat assemblages lost to the now partially-completed project are a continuation of what has been recorded further upstream, with significant modification prevalent throughout. Both terrestrial and aquatic biodiversity baseline conditions are described, within a varying Area of Influence (AoI – described for each receptor/receptor group within **Volume 1: Chapter 15: Biodiversity** of this ESIA). The objective of the baseline data collection was to collect sufficient information to describe the ecological conditions across the Project's AoI (which encompasses the flooding zone and other Project components, together with a conservative estimate of a wider area where Project impacts may reasonably be assumed to occur and across the wider study area as appropriate (e.g. such as the requirement to understand bird movements across the wider area)).

9.1.2 Baseline data collection has relied upon the existing information contained within the 2014 ESIA, supported by additional desktop study and targeted fieldwork. A summary of the baseline and assessment presented within the 2014 ESIA is provided.

9.2 TERRESTRIAL ASSESSMENT (2014)

9.2.1 The 2014 ESIA was informed by an extensive desktop study and a sampling-based suite of vegetation surveys at 25 representative sample sites within close proximity to the Project footprint (these field surveys undertaken in 2011). Exact details regarding survey methods are unclear, although it appears sampling comprised a detailed botanical inventory at each location. No habitat mapping was undertaken, instead species occurrence across the sample sites was described in terms of broad habitat types recorded within altitudinal bands, as follows:

- Floodplain of the Vakhsh River and the riverbanks.
- Elevation from 700 to 1500m asl.: wheatgrass-dominated meadows, transitioning to mesophilic broad-leaved forest at higher altitudes within this band.
- Elevation from 1500 to 2500m asl.: juniper-dominated mesophilic woodland.
- Elevation from 2800 to 3400m asl.: subalpine meadows.
- Elevation from 3400 to 3800m asl.: alpine meadows.

9.2.2 Much of the information presented within the 2014 ESIA relates to areas that are likely to be wholly outside the Project AoI. With regards to habitat composition across the Project itself, the 2011 surveys recorded a habitat assemblage comprising the following broad habitat types:

- River and floodplain habitats which is a natural habitat, with little impact from humans.
- Cultivated land including crops for humans and livestock and therefore lacks natural vegetation.

- Urban areas where the settlements are located, including buildings and roads as well as garden including a high number of fruit trees.
- Pasture habitat which is heavily degraded by grazing by livestock.

9.2.3 With regards to flora of interest, a number of Tajikistan Red Book species were recorded, although none of these were within the Project or its AoI.

9.2.4 The 2014 ESIA concluded that impacts from the Project to habitats and flora would be negligible and not significant due to the prevailing modified habitat conditions and lack of species of conservation interest/value. The exception to this was identification of two floodplain habitats, which will be lost within the flooding zone. It was suggested within the 2014 ESIA that these areas potentially qualify as Natural Habitat (as per ESS6) and will therefore require a No Net Loss (NNL) plan to be developed.

9.2.5 The faunal assemblage reported in the 2014 ESIA comprised two amphibians, 12 reptiles, 37 mammals and 154 bird species, with these records seemingly derived from an extensive desktop study. These species were described with reference to the five altitudinal bands listed above and included a number of species listed on either/both of the Tajikistan Red Book and IUCN Red List (as threatened), such as snow leopard, Himalayan brown bear and Egyptian vulture.

9.2.6 The study 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/described from higher altitudes). It was acknowledged that increased human influence at higher altitudes may have an impact although this wasn't discussed further.

AQUATIC ASSESSMENT (2014)

9.2.7 In 2011, three field surveys were completed to inform the 2014 ESIA. These included surveys of the Obi Garm and Chorsada areas (May 5-9), Rogun Reservoir area (July 18-23) and Nurek Reservoir (September 12-27). The fieldwork considered fish and benthic organisms and concluded that 12 fish species were expected to occur within the Project AoI.

9.2.8 During these studies, three fish species were confirmed to be present within the existing Rogun Reservoir, with a further two native species believed to occur within the area. These include the Common Marinka (*Schizothorax intermedius*), Small Turkistan Sheatfish (*Glyptosternon oschanini*), Amu-Darya Trout (*Salmo trutta oxianus*), Tibetan Stone Loach (*Triplophysa stolickai*) and Eastern Crested Loach (*Paracobitis longicauda*) (**Table 9-1**).

9.2.9 Further to this, three introduced species were reported to occur within the Project area, these include Rainbow Trout (*Oncorhynchus mykiss*), Brown Trout (*Salmo trutta afario*) and Common Carp (*Cyprinus carpio*).

9.2.10 Benthic organisms were also sampled as they are an important food source for many fish. Data included 2 species of Acaridae (mites), 2 species of Oligochaeta (worms), 2 species of Trichoptera (caddisflies), 6 species of Ephemeroptera (mayflies), 12 species of Diptera (flies) and 1 species of Mollusca (snails) (ESIA, 2014).

Table 9-1 - Characteristics of caught fish during 2011 (2014 ESIA)

Scientific name	English name	Виды рыб	Number caught	Length (cm)	Weight (g)
Schizothorax intermedius	Common marinka	Обыкновенная маринка	5	12.5 – 15.0	57 – 70
Salmo trutta oxianus	Amu-Darya Trout	Форель амударьинская	3	13.3 – 26.5	76.6
Glyptosternon oschanini	Small Turkistan Sheatfish / Turkestan Catfish	Туркестанский Сом	4	7.2 – 14.1	35.0

9.2.11 It should be noted that since the completion of the 2014 ESIA, there have been nomenclature updates to three of the species:

- Turkestan Catfish (*Glyptosternon reticulatum*). Records for this species from Afghanistan, Tajikistan and Kyrgyzstan have now been assigned to *G. oschanini* (B. Karimov, 2020).
- The Tibetan Stone Loach (*Nemacheilus stoliczkai*) has been assigned *Triplophysa stolickai* (Daniels, 2022).
- The Eastern Crested Loach (*Nemacheilus malapterurus longicauda*) has been assigned *Paracobitis longicauda* (Frethof, *et. al*., 2014).

9.2.12 The 2014 ESIA concluded that fish diversity and abundance within the Project AoI was low, and that fish were not economically important for the local population. These conclusions were based on the fact that longitudinal connectivity has already been lost as a result of downstream dam construction (such as Nurek), which prevents fish migration. Additionally, the Vakhsh River has a very high sediment load, which may be limiting to fish.

9.3 DESKTOP STUDY

9.3.1 The desktop study included review/interrogation of the 2014 ESIA as discussed, with an update to this information. Additionally, several online databases and publicly available resources were reviewed. These are summarised within the following sections.

RED BOOK OF TAJIKISTAN

9.3.2 The second edition of the Red Book of the Republic of Tajikistan (TRB) was reviewed to inform the assessment on the value/sensitivity of flora and fauna recorded through the desk study/field survey exercise. The TRB was updated in 2017 and so any updates would not have been included within the earlier 2014 ESIA.

IUCN RED LIST OF THREATENED SPECIES

9.3.3 The 2024-1 edition of the International Union for Conservation of Nature's Red List of Threatened Species was reviewed to inform the assessment of the global conservation status of species recorded or expected to occur within the Project AoI as identified through the desktop studies or field surveys.

REVIEW OF PUBLISHED LITERATURE / AVAILABLE ONLINE RESOURCES

9.3.4 A substantial array of published literature has been reviewed to inform this assessment. These papers / articles are referenced throughout where applicable. In addition to the review of those resources that are readily available (i.e. through online search engines), a detailed exercise of engagement with in-country ecologists has been undertaken to inform the assessment. This has involved seeking direct advice from national experts, as well as the identification and review of national papers / reports to provide a more informed interpretation of these resources (some of which are in Tajik/Russian).

9.3.5 A component of the desk study has been the review of eBird records for the birds relevant to this study. This resource captures amateur ornithologist records from across the world and is a useful supplementary resource when undertaking baseline data collection. Similarly, data obtained from a review of the Global Biodiversity Information Facility (GBIF) (GBIF, n.d.) has also been used where considered appropriate.

INTEGRATED BIODIVERSITY ASSESSMENT TOOL (IBAT) REPORT

9.3.6 A biodiversity screening reporting from the IBAT website[5] provided a high-level appraisal of likely, key biodiversity sensitivities present across the Project site, and a 50km study area. This report is a standard tool for flagging potential presence of Critical Habitat/Natural Habitat triggers and is an important component in the scoping process for additional study (e.g. field survey).

REVIEW OF GOOGLE EARTH

9.3.7 Google Earth was also reviewed to inform the general appreciation of the habitat baseline and gain an understanding of the wider landscape context of the AoI, as well as the changes over time. Historical imagery over multiple years dating back to 2003 was used to qualitatively assess changes within the landscape (i.e. changes to vegetation cover within the floodplain, changes to the river channel, etc.).

REMOTE SENSING

9.3.8 A remote sensing exercise was undertaken using readily available mapping data, to accurately map/classify habitat polygons across the Project and for a buffer distance of 2km. The process for habitat classification utilized remotely sensed aerial imagery and a suite of tools within the industry leading ESRI GIS software. Pre-processing of aerial imagery was first conducted to ensure a continuous dataset both spectrally and temporally giving a consistent base dataset to perform the automated classification technique. Two methods were considered here, untrained and trained classification. In this instance trained classification was utilized which enables the user to define spectral ranges across habitat types such as established vegetation, grassland, open water and bare earth while taking into account nuances such as topography, shading and profile. The tool builds this knowledge into the classification process to cover a large area quickly and produce raster-based results on the user's input. The model and process was then re-run and refined based on conversations and additional data with specialists and field teams and this included manual amendments if needed. A final output was generated by translating the raster data to polygons to allow a seamless coverage that enables area calculations and querying.

[5] https://www.ibat-alliance.org/

9.3.9 This process underwent ongoing iteration following site visits and review of satellite imagery to assist with defining the boundaries of the various habitat types; in particular those of greatest sensitivity.

STAKEHOLDER LIAISON

9.3.10 An ongoing component of the desktop study was consultation with knowledgeable stakeholders to provide both contextual and specific biodiversity information relevant to the Project. This occurred through dedicated meetings whilst in-country with organizations such as the Committee for Environmental Protection, Forestry Agency, and the Directorate of the Flooding Zone of Rogun HPP, as well as ongoing RfI submissions with these organizations. Information obtained has been included throughout this assessment where considered relevant.

- Bozor Abdurahimov - Committee for Environmental protection under the Government of the Republic of Tajikistan
- Sharifzoda Davlatali - (Deputy Director) Forestry Agency Under the Government Republic of Tajikistan
- Umidjon Ulugov (and associated staff members) - (Tajikistan country coordinator) Environmental Health & Pollution Management Institute
- Dr Talidjan Khabilov - Director of the Institute of Natural Sciences of the Khujand State University, Tajikistan, who provided bat survey data from historic studies undertaken at the Rogun construction site.

9.3.11 Discussions have also been held with in-country experts that have been responsible for collecting the baseline information, given their expertise in the region. This includes nationally recognized botanists and zoologists.

9.3.12 Finally, discussions have also been had with various stakeholders involved in conservation projects in Tajikistan with regards options for the Project to deliver NNL. To date this has included the following:

- Solijon Mirzoev: Committee for Environmental protection under the Government of the Republic of Tajikistan (CEP)
- Sharifzoda Davlatali, Solijon Mirzoev, Makhsudsho Nematov, and Yusufzoda Abdujabbor: State Forestry Agency under the Government of the Republic of Tajikistan
- Ministry of Agriculture
- Ministry of Water and Energy Resources
- Aslam Manuakov, Khurshed (Kodya) Abduqodiri, Behruz Ilnazarov, and Martin Jaeger: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- Manuchehr Bakoev: Kreditanstalt für Wiederaufbau (KfW)
- Ubayd Gulamadshoev: Tajikistan representative of Fauna and Flaura International (FFI)
- Johannes Kaltenbach, Annett Leuteritz, Joachim Boenisch: Deutsche Welthungerhilfe e. V. (Welthungerhilfe / WHH)
- Boris Orlowsky & Shinan Kassam: Caritas

- Zurab Jincharadze & Sophie Nguyen Khoa Man: Helvetas
- Manuchehr Fezakov: Aga Khan Development Network
- Sergey Chutkov: 3zero / Acted.

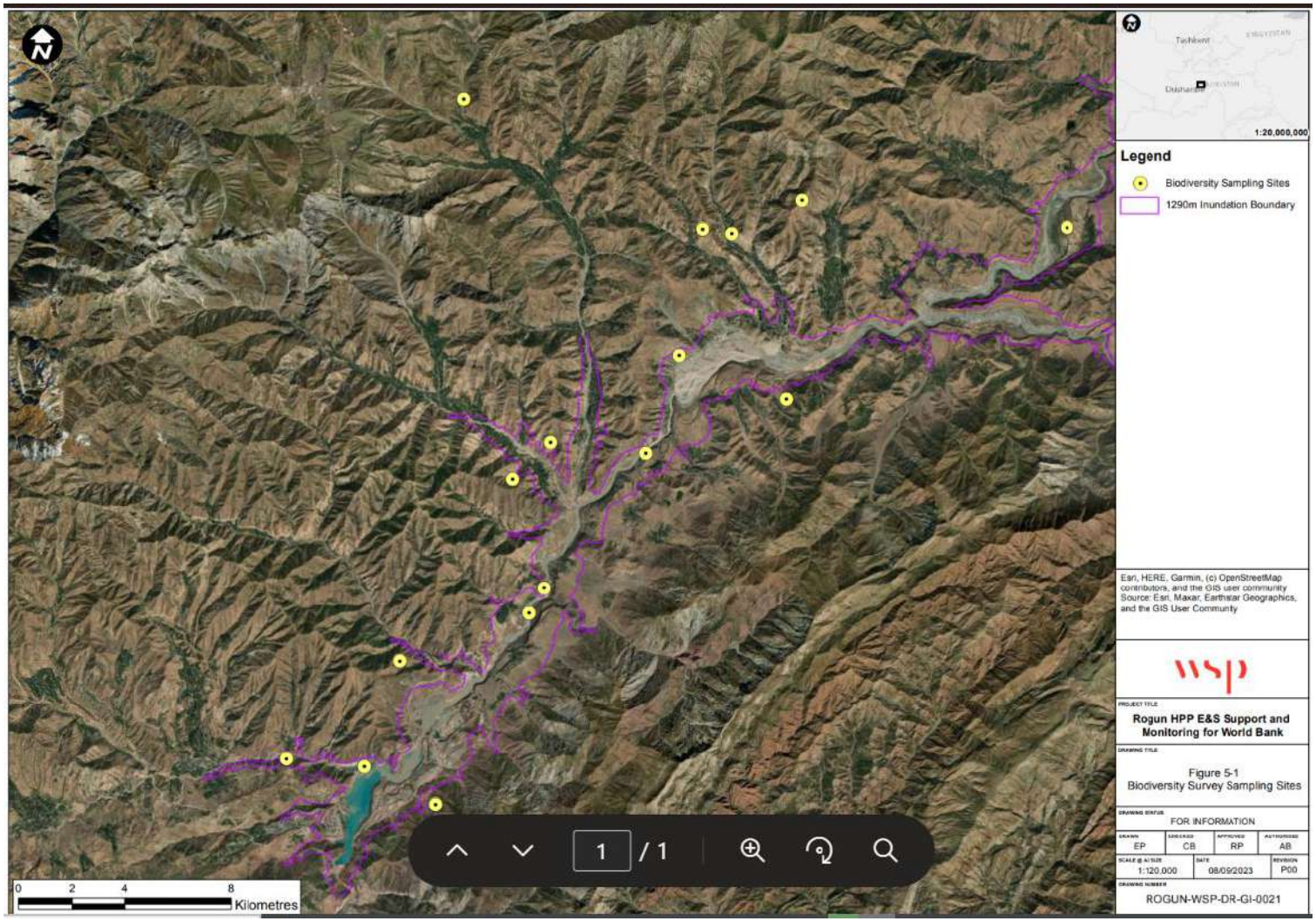
FIELD SURVEYS

9.3.13 A field survey scope was developed that reflected the nature/extent of existing information for the Project as presented within the 2014 ESIA. In line with the requirements of ESS6 an appropriate level of field survey was scoped and undertaken to address any gaps or components that require further or seasonal consideration. Detail regarding the fieldwork undertaken is provided within the following paragraphs.

9.3.14 Surveys in the vicinity of the Project were undertaken at 15 representative sampling sites, based upon surveyor expertise and to provide information from each habitat type across the AoI, as illustrated on **Figure 9-1**. Additional 'ground-truthing' of other pre-identified areas was also undertaken and is described where relevant (such as to obtain more detailed information regarding the most sensitive habitat areas).

9.3.15 Surveys were undertaken in late-spring and autumn 2023, to identify any seasonal variation in the biodiversity baseline that will require consideration within the Project mitigation plans. The survey team comprised various specialists and was led by Dr. Alikhon Latifi.

Figure 9-1 - Biodiversity sampling sites



HABITAT SURVEYS

9.3.16 Habitats were mapped through a combination of the remote sensing exercise described above, supplemented with 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 (which is the spatial basis for habitat descriptions from this point forward). Habitats were mapped into broad habitat types in line with descriptions provided within the 2014 ESIA but updated where considered appropriate, using resources such as the IUCN habitat classification system (IUCN, 2012) and the Illustrated Flora of Tajikistan and adjacent areas (Nowak, 2020).

FLORA SURVEYS

9.3.17 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 since data were last collected to inform the 2014 ESIA. At each location, noteworthy species were recorded (such as those included on the TRB and/or IUCN Red List); in addition, habitat suitability was assessed for species with the potential to be present based upon desktop study results and surveyor expertise. If the habitat was found to be suitable for these species, but they were not observed at the time of survey, they were added to the list of species as a precautionary approach.

9.3.18 Surveys were completed by experienced botanists, including those who have previously been engaged on the Project (i.e., as part of the 2014 ESIA studies).

9.3.19 In addition, updates to the botanical data were made during additional targeted field survey visits, in relation to habitats of greatest sensitivity to increase the ecological understanding of these areas. These took place in April, September and October 2023.

FAUNA SURVEYS

9.3.20 Prior to the surveys, the desk study undertaken informed a list of target species, which included amphibians, reptiles, birds and mammal species. These target species included rare and vulnerable species (including those listed on the TRB and IUCN Red List) as well as species specific to ecosystems present within the AoI. Surveys were then undertaken in April and May 2023, focusing on the 15 representative sample sites.

9.3.21 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 as well of signs of presence and habitat suitability. Surveys were undertaken during spring, when herptiles are most active, and during dry/calm weather conditions for all surveys.

9.3.22 Bird surveys comprised walked transects of up to 1km in length and 50m wide. Birds were recorded as encountered, including at distances beyond the transect width, with the aid of binoculars and a spotting scope; bird calls were also surveyed. Supplementing this was net-trapping of birds in suitable locations. During October and November 2023, migratory bird surveys were undertaken from three vantage points (VP) overlooking the main expanse of braided channel habitat. These surveys comprised scanning the airspace for flight activity by migrating birds, together with recording use of the braided channel habitats as stopover features for migrating birds.

9.3.23 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. For some species/species groups, this also comprised night-time surveys with spotlights to observe those animals with more nocturnal behavior such as porcupines and bats. Some trapping was undertaken for small mammals/rodents.

9.3.24 A search for bats, including roost sites, was undertaken alongside the above surveys; however, more detailed bat survey effort was not completed due to the abundance of desk study information available (including from Rogun construction site) and the difficulty in accessing areas of greater potential interest to bats, such as cliffs/crevices on higher slopes.

9.3.25 Surveys were completed by experienced zoologists, including those who have previously been engaged on the Project (i.e., as part of the 2014 ESIA studies).

Aquatic Surveys

9.3.26 Access to the Vakhsh River within the Project area is limited due to the steep terrain. The river features deep, turbid, and fast-flowing waters, and as such, the river is not accessible by boat or conducive for wading across and therefore is not suitable for traditional survey techniques such as electrofishing or netting.

9.3.27 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.

9.3.28 To this end, limited sampling using a range of equipment was conducted at four locations upstream of the Rogun HPP construction site. The areas sampled included Subordination, Yust, Sangdevo and Ali-Galabo (**Figure 9-2**). Sampling was completed using equipment that could safely be operated from the shoreline, and included, cast nets and rod and line (hooks).

9.3.29 To enhance our understanding of the aquatic biodiversity within the Vakhsh River system, water samples were collected for Environmental DNA (eDNA) analysis. This method is particularly effective for sampling aquatic biodiversity in environments where traditional techniques are impractical. eDNA analysis stands out as a highly appropriate and comprehensive approach for establishing a robust baseline of aquatic biodiversity.

9.3.30 At each sampling point, a sub-set of samples were collected along the bank, to maximize the chance of recording genetic material from different species that may utilize different habitats within the river. The sub-samples were combined to form a single composite sample (± 3 liters), from which water could be filtered at each site. Samples were filtered according to the collection and processing protocol prescribed by NatureMetrics. The process involves pushing approximately 2.5 litres of water through a filter with a syringe. Once complete, the provided preservative was added and the filter sealed, and labelled for transport back to the UK, where the sequencing was undertaken. All permits for export and import were obtained for transportation of the filters.

9.3.31 The study design considered the following areas (**Figure 9-3**):

- The Vakhsh River below the Rogun HPP, upstream of the Nurek Reservoir.
- Upstream of the flooding zone in the 3 main rivers coming into the proposed Rogun impoundment.
- Within Nurek Reservoir.

- Within the Rogun flooding zone for comparative purposes and to track changes over time.

9.3.32 Downstream of the Nurek Reservoir was not sampled, as from a fisheries perspective it is considered a connectivity barrier within the landscape. As such, it was not assessed as there are no predicted material impacts there and was scoped out as a result. This is set out in **Table 15-3 - Receptor/Impact Summary Table** of **Volume 2: Chapter 15: Biodiversity**, of this ESIA.

9.3.33 Whilst on site, 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.

WSP SITE VISITS

9.3.34 WSP specialists visited pockets of the AoI on three separate occasions, during March, May and September/October 2023. These site visits provided landscape context and further insight into the Project to support the writing of the baseline report and assessment of impacts. The time in country was also used to collect additional data on a more anecdotal basis and provided the opportunity to meet with stakeholders and visit key habitat areas in order to verify understanding of species assemblage and habitat condition in these areas.

Figure 9-2 - Fish sample sites

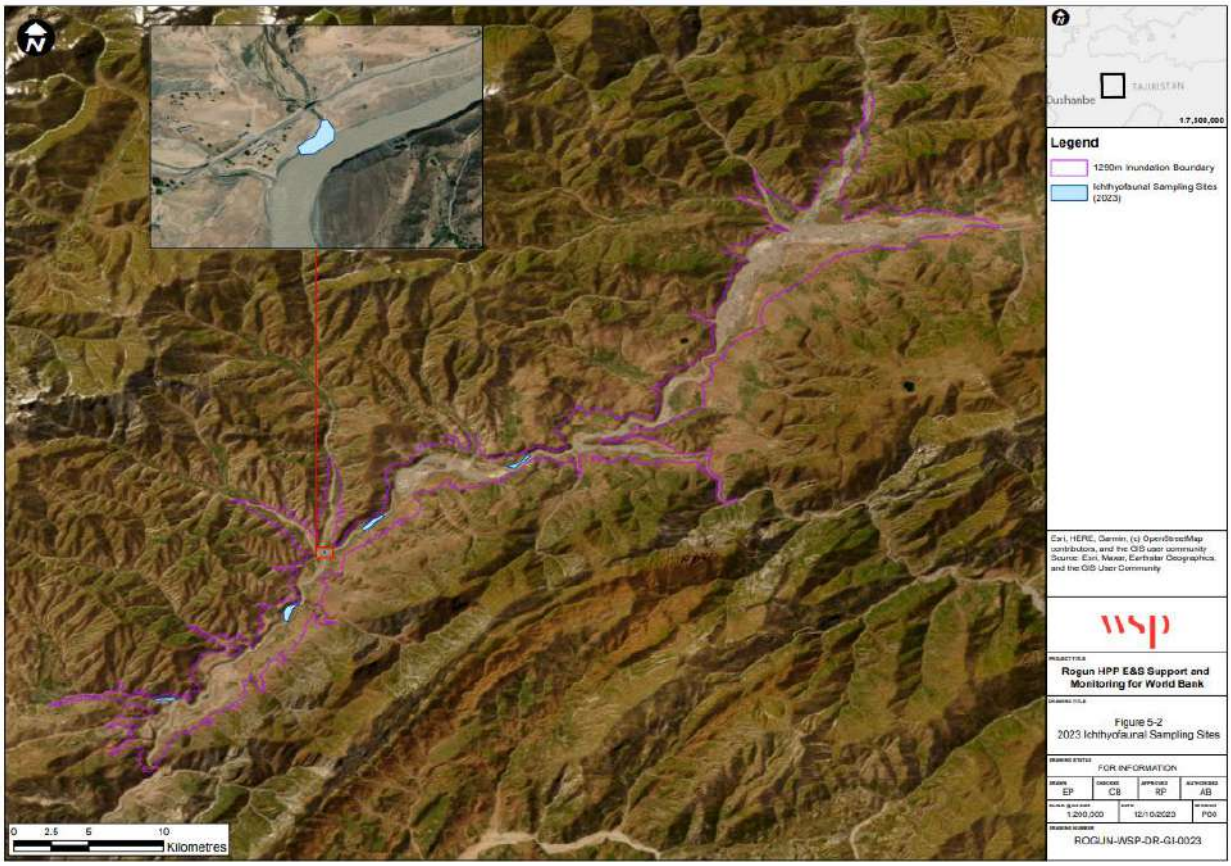
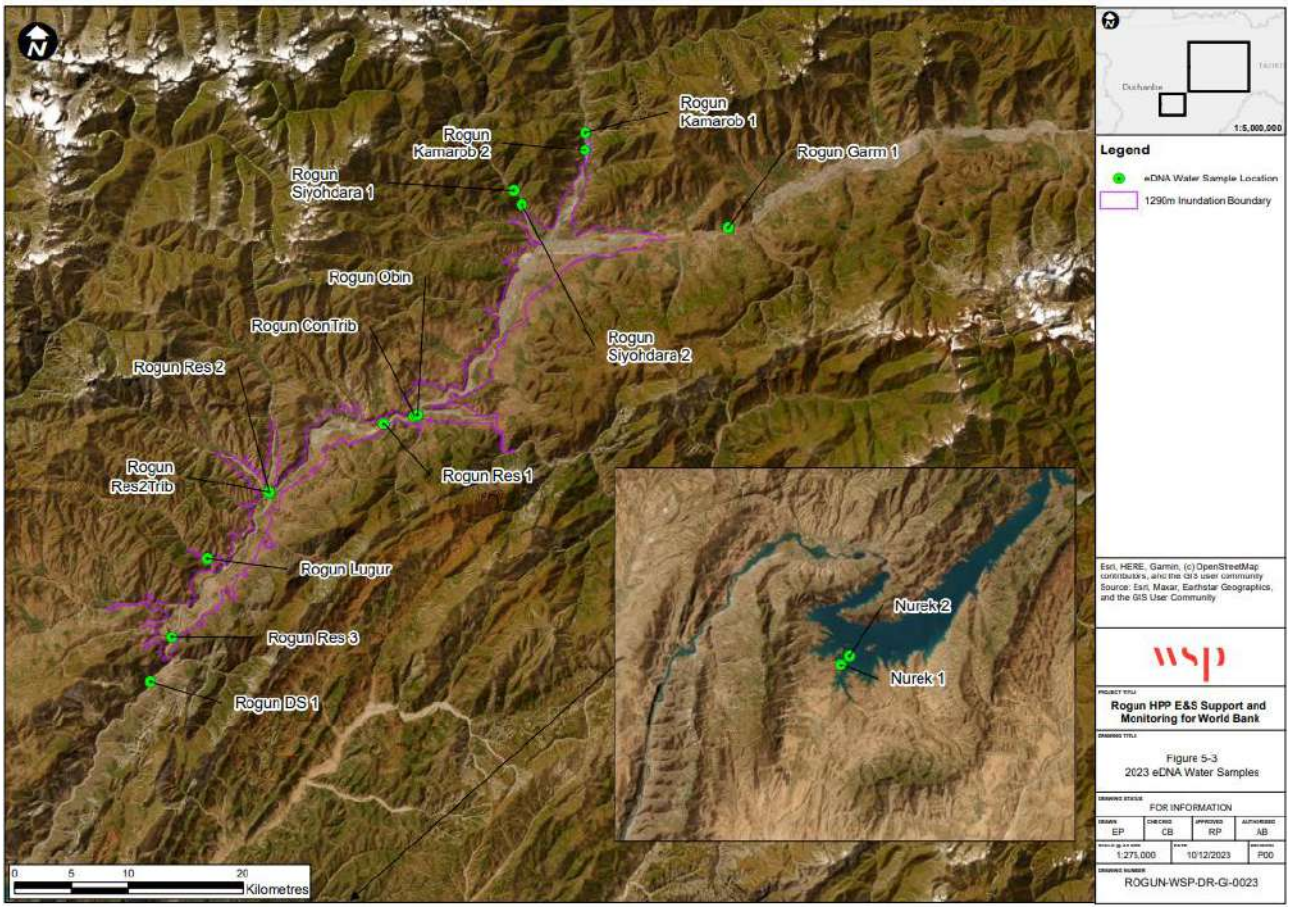


Figure 9-3 - eDNA samples



BASELINE STUDY LIMITATIONS AND ASSUMPTIONS

9.3.35 The baseline data collection exercise has focused upon an update to the findings presented within the 2014 ESIA in order to reflect a current baseline that exists within the context of a partially-developed project, within a heavily modified landscape. As such, the field survey components comprise a more targeted approach to surveys than would be expected for a 'new' project. Additionally, there are areas of the AoI that are difficult to survey from an access/H&S perspective. As such, it is acknowledged that for some terrestrial species groups (most notably bats), the level of survey effort has been lower than would be expected to fully align with GIIP. To appropriately address this limitation, a precautionary approach has been taken to assessment of impacts in places (and this is referenced accordingly). This has also informed requirements for ongoing survey, which would be necessary regardless given how the main impacts to biodiversity (i.e. from flooding) will be realized incrementally over a number of years.

9.3.36 With regards the aquatic biodiversity baseline, there were significant constraints to completing 'traditional' survey effort within the Project AoI as described above. As such, the inclusion of eDNA analysis was incorporated into the study design.

9.3.37 After collection and sequencing, the eDNA sequences are compared to a library of species' DNA which exists from previously collected (known) samples, otherwise known as the 'reference database'. If the target species are not available in the reference database, the sequencing will not yield any results as there is nothing to compare the results to. Due to the lack of previous studies and information within the Study Area, many species are likely to be missing from the reference database. Although this is a limitation of the technology, it was understood in the survey design and provides further insight into a relatively unstudied and inaccessible system.

9.4 CURRENT BASELINE

9.4.1 The baseline presented in this report represents the current condition after existing and approved disturbances, such as the partially-completed dam wall with its current inundation to 1070m asl, and therefore Project impacts to be assessed include the filling of the reservoir up until the maximum inundation level (i.e. to 1290m – hereafter referred to as the 'flooding zone'), along with other Project components such as new roads and stockpiling areas. The assessment therefore does not consider any impacts that have already occurred to date, although for context, a review of historic aerial imagery from between 2011-2023 reveals that the habitat assemblages lost to the now partially-completed project are a continuation of what has been recorded further upstream, with significant modification prevalent throughout. Both terrestrial and aquatic biodiversity impacts are considered, within a varying Area of Influence (AoI – see **Volume 1, Chapter 15 (Biodiversity)** of this ESIA.

9.4.2 Detail within this section is provided for aspects of the current baseline that have materially changed since the 2014 ESIA; otherwise, a high-level summary is provided, with the previous studies cross-referenced as appropriate.

SITE CONTEXT

9.4.3 Tajikistan is situated within the temperate zone, although it 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. This results in an unusually high level of species diversity for a country in the temperate zone. There are over 23,000 species of flora fauna found

within Tajikistan of which approximately 1,900 are endemic. Much of this diversity is associated with areas where human influence is absent/minimal and one of the most significant ongoing threats to biodiversity within the country is the ongoing/increasing modification of habitats and ecosystems as a result of anthropogenic pressures, most notably overgrazing by domestic livestock.

9.4.4 Tajikistan is a mountainous country (approximately 93% of the country is above 1000m in altitude, with over 50% above 3000m), with most ecosystems falling into one of seven broad mountain categories (**Figure 9-4**). At lower altitudes, most ecosystems comprise modified habitats in which agriculture and urban areas are dominant.

Figure 9-4 - Tajikistan ecosystems schematic (as taken from Safarov, 2003)

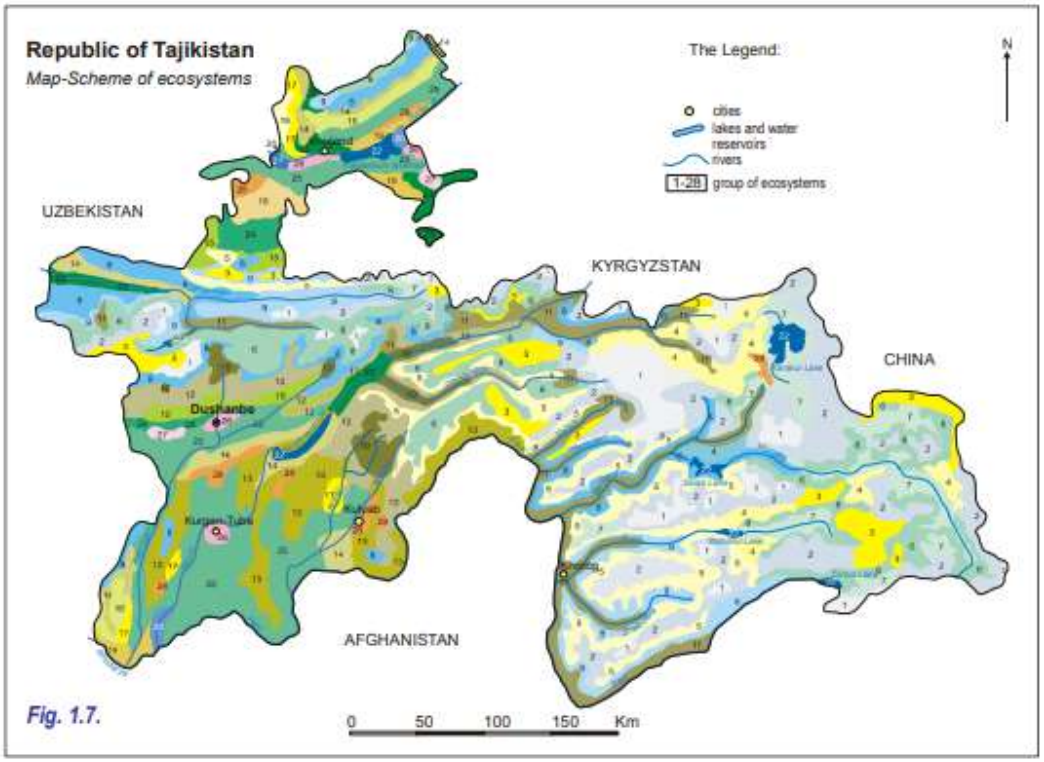


Fig. 1.7. **Legend to «Map-Scheme of ecosystems»**

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

9.4.5 The Project is located within a heavily modified landscape, broadly classified as an agroecosystem of gardens, forest-plantations, personal plots (number 23 on the schematic above), on the Vakhsh River in the southern region of Tajikistan.

9.4.6 The Project is located in the Upper Amu Darya Freshwater Ecoregion, which encompasses the basins of the upper Amu Darya tributaries: Pyandzh (Piandj), Surkhandarya, Kafirnigan, Vakhsh, and Kunduz (FEOW, 2019). It also includes the upper Zeravshan, upper Tedzhen, Murghab rivers, and river drainages in northern Afghanistan west from Kunduz. The ecoregion encompasses mostly mountainous areas ranging from 240 m to over 7100 m asl in the Pamir Mountains (FEOW, 2019).

9.4.7 Habitats across the areas now lost to/affected by the partially-completed dam structure and associated infrastructure/works are considered to be a continuation of those still present upstream of the existing impoundment. The longitudinal connectivity of the Vakhsh River has already been interrupted by the construction of numerous downstream dams, including the Nurek Reservoir (see **Figure 9-5**). As such, the focus of this assessment is to describe the existing baseline conditions, which have been heavily influenced Project's history (construction first began in 1976) and location (Vakhsh HPP cascade), supported by relevant information collected as part of the 2014 ESIA.

9.4.8 The Vakhsh HPP cascade comprises Rogun (under construction), Nurek (approximately 17 km downstream), Baipaza, Sangtuda 1, Sangtuda 2 and Golovnaya, which extends to approximately 150 km downstream of Rogun.

Figure 9-5 - Nurek Dam, 304 m (997 ft).



PROTECTED AREAS

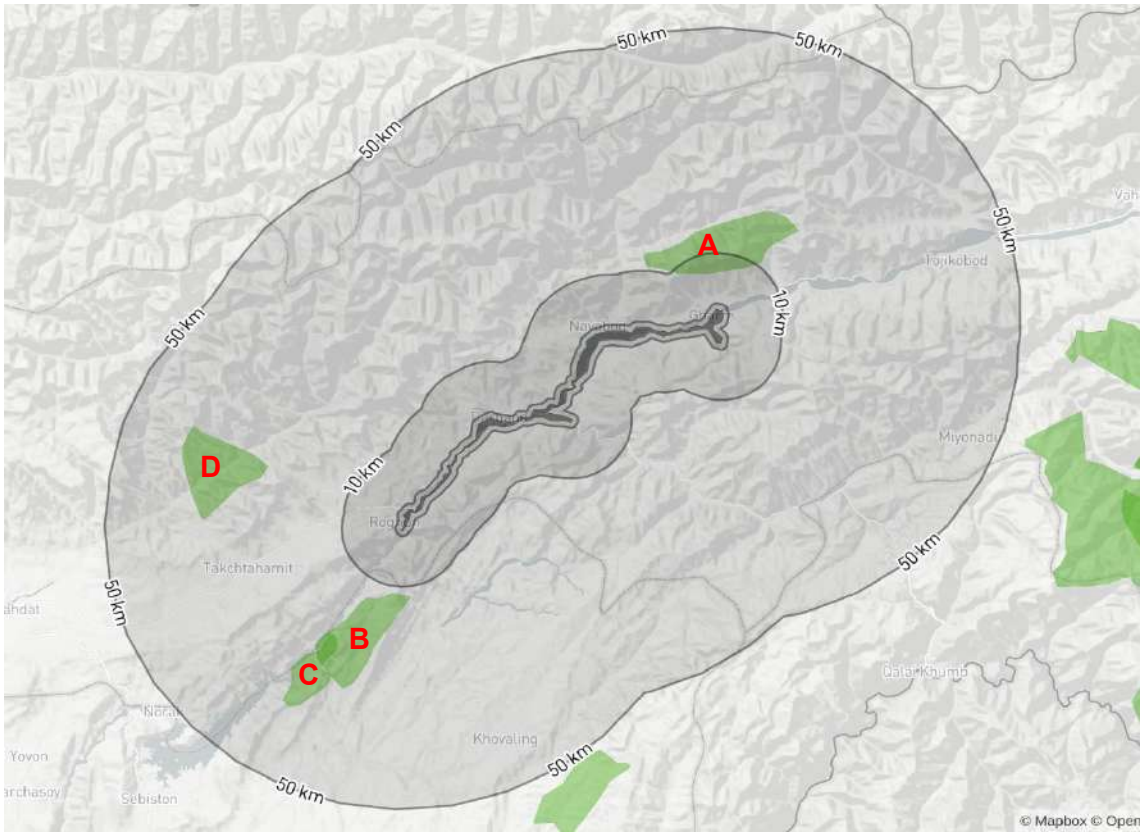
9.4.9 There are no protected areas located within the area that will be affected by the Rogun HPP dam wall and flooded reservoir. However, there are four protected areas located within 50km of the Project; these are detailed in **Table 9-2** and illustrated on **Figure 9-6**.

Table 9-2 - Protected Areas

Site Name	Designation (w/ IUCN Management Category[3])	Approximate location relative to the Project	Summary
Kamarovsky (A)	Nature Refuge (IV)	Located c. 10km north of eastern extent of the Project	
Nurek Species Management Area (B)	Species Management Area (IV)	Located c. 12km downstream of the Project on both sides of the upper part of the Nurek Reservoir	Nurek Species Management Area was created to protect local juniper and other forest types, and therefore provide suitable habitat for species of wildlife found within this area.
Sarikhosor (C)	Natural Park (IV)	Located c. 15km downstream of the Project	
Romit (D)	Nature Refuge (Ia)	Located c. 50km to the west of the Project.	

9.4.10 No other IBAs/KBAs or Ramsar sites are located within 50km of the Project.

Figure 9-6 - Protected Areas within 50km of the Project (taken from the IBAT report).



HABITATS

9.4.11 There has been no significant change to the habitat composition recorded during the 2014 surveys, although studies during 2023 have highlighted the presence of an additional habitat category within the maximum flooding zone. This area is a relatively small area of woodland that was likely missed because of mapping discrepancies and miscalculations during the previous habitat mapping undertaken for the 2014 ESIA.

9.4.12 Corroboration on habitat composition was obtained during field surveys in 2023, and this is provided within the following paragraphs, expanding upon a summary of previous studies where appropriate. The habitats are illustrated on **Figure 9-7**.

9.4.13 Most of the habitats present across the AoI (and including the new settlement areas) have been modified by humans as part of settlements and agriculture land use, with some areas also comprising built-up areas. Along with remnant natural/semi-natural habitats, this has resulted in a landscape that comprises the following habitat types (in order of relative extent across the AoI):

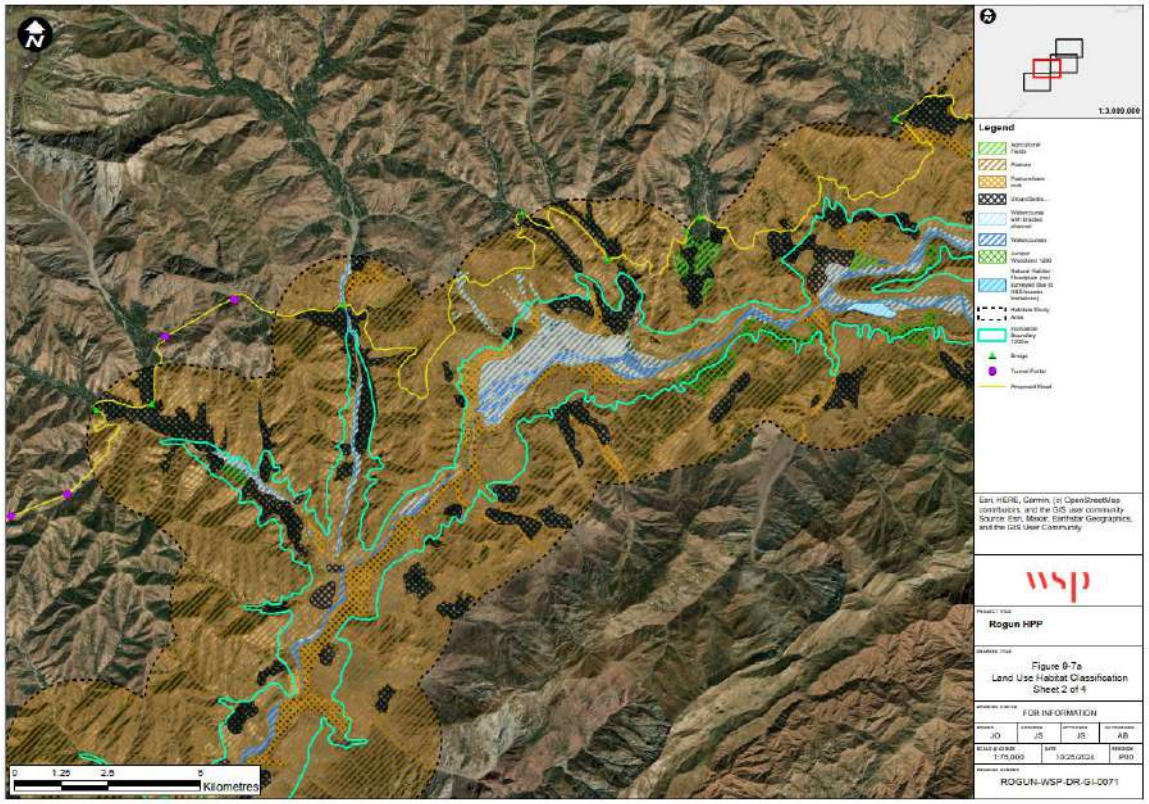
- Pasture/degraded grassland habitat which is heavily degraded by grazing by livestock; includes eroded hillsides.
- River and floodplain habitats which is natural/semi-natural habitat, with little impact from humans.
- Urban areas where the settlements are located, including buildings and roads as well as gardens including a high number of fruit trees and smallholding agriculture.
- Cultivated land including crops for humans and livestock and therefore lacks natural vegetation.
- Mesophilic juniper woodlands on the valley sides, with signs of modification but retaining most of their natural species' composition.

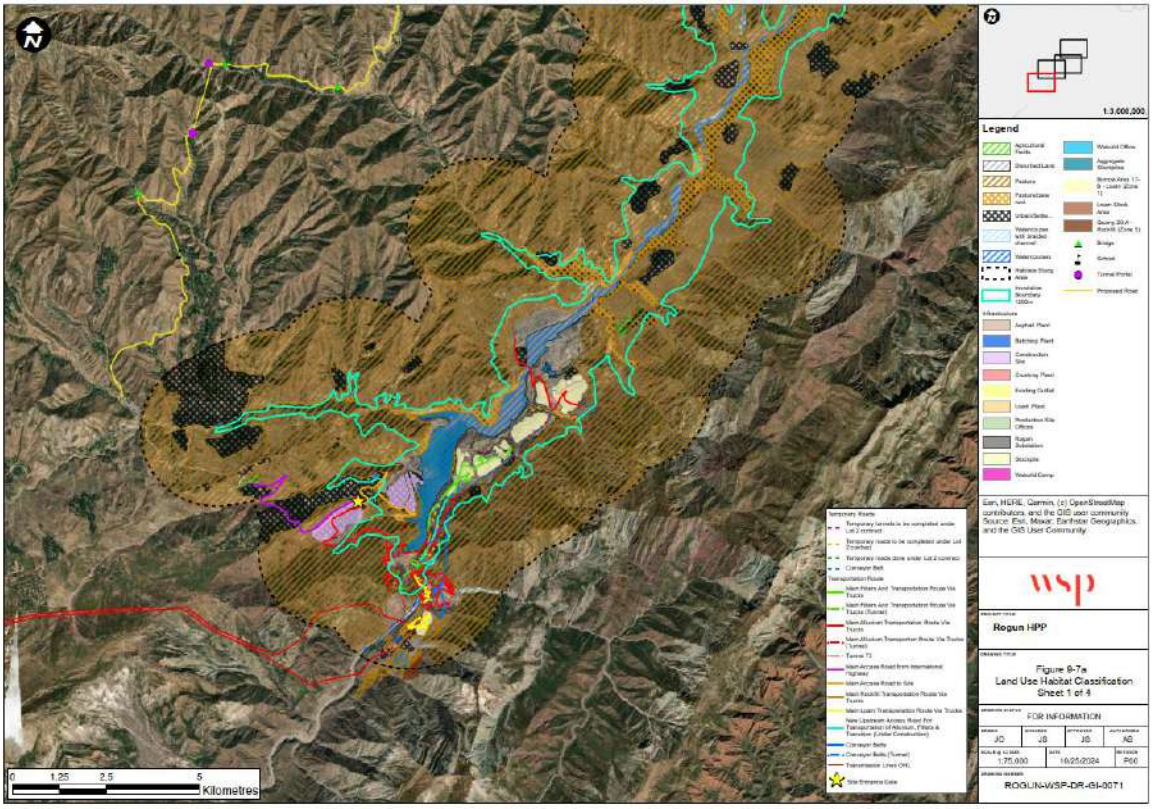
9.4.14 A high-level summary of overall habitat composition within the AoI is provided in **Table 9-3** (as adapted/updated from the 2014 ESIA).

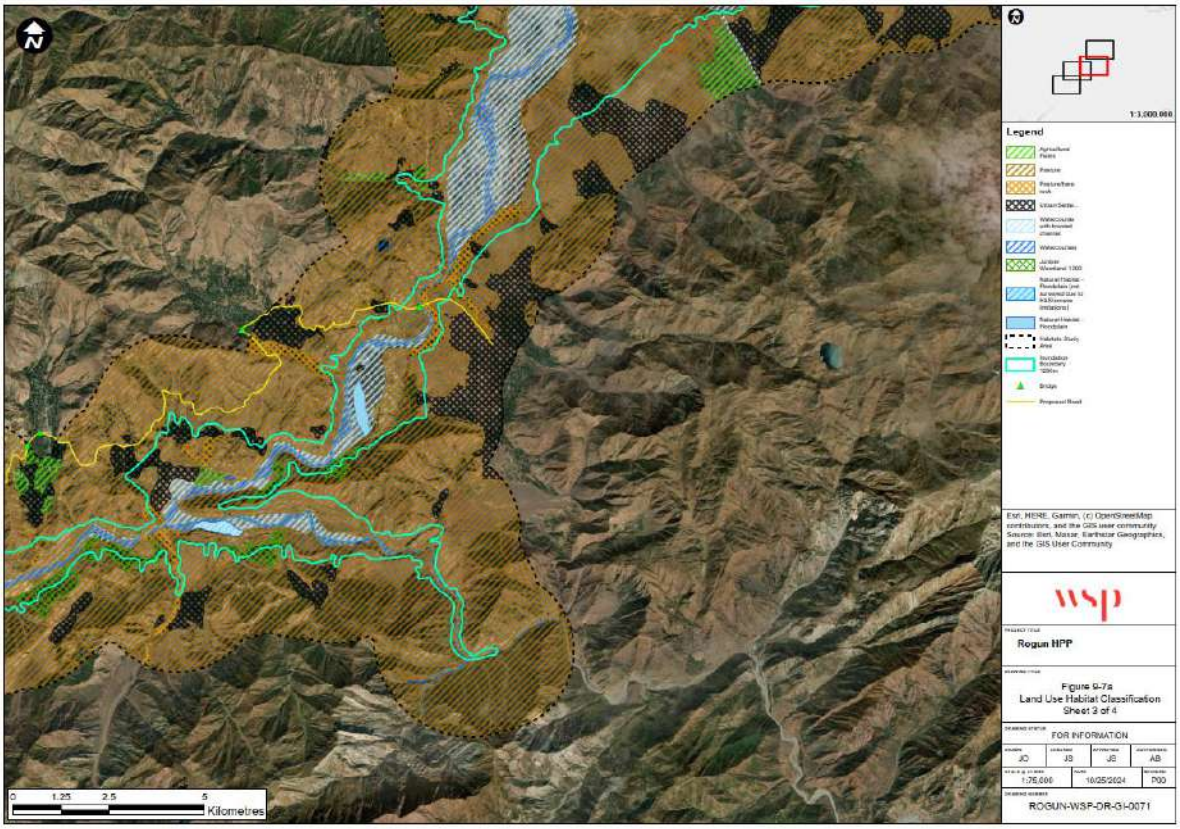
Table 9-3 - Habitat composition

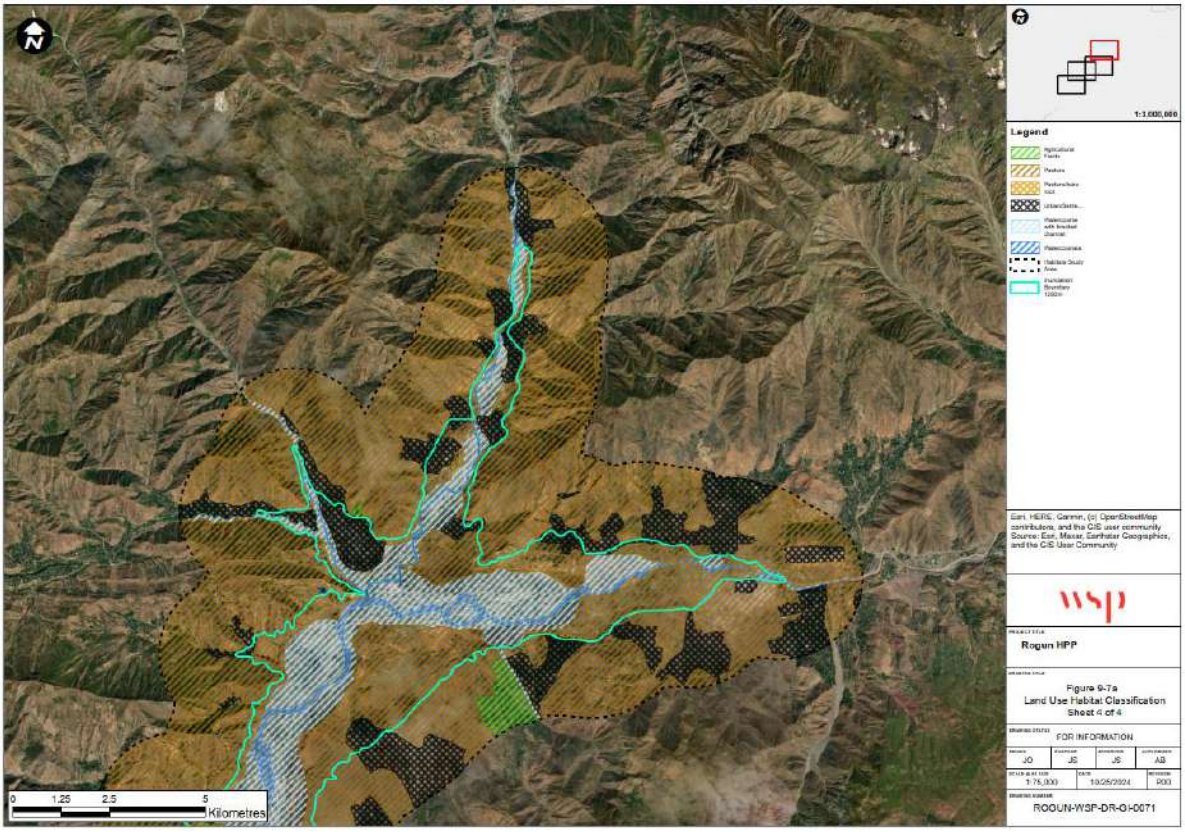
Habitat type	Area (ha)	Relative coverage within AoI (%)
Pasture/degraded grassland	8690	44.6
River/floodplain	4850	29.9
Urban areas (inc. associated land)	1441	8.8
Agriculture	978	6
Woodland	283	1.7
TOTAL	**16242**	**100**

Figure 9-7a - Habitat mapping






Legend
Rogun HPP
Figure 9-7a
Land Use Habitat Classification
Sheet 3 of 4
FOR INFORMATION
ROGUN-WSP-DR-GI-0071
0 1.25 2.5 5
Kilometres


Legend
Rogun HPP
Figure 9-7a
Land Use Habitat Classification
Sheet 4 of 4
FOR INFORMATION
ROGUN-WSP-DR-GI-0071
0 1.25 2.5 5
Kilometres

Pasture/Degraded Grassland

9.4.15 Pasture/degraded grassland is the predominant habitat across the AoI and comprises a short sward habitat of grasses and occasional common herbs (such as Crocus sp.) Species diversity is very low due to ongoing human influence (see Figure 9-8 and Figure 9-9).

Figure 9-8 - Pasture/degraded grassland habitat near Mehrobod



Figure 9-9 - Degraded grassland habitat near Mehrobod (eroding cliffs also visible)



9.4.16 Pasture/degraded grassland habitat is maintained through continual grazing pressure as part of livestock farming within the region. Much of the land being used for new settlements comprises

pasture (as described within the 2014 ESIA), including new settlements at Saidoni Nav, Yoli Garmoba and some parts of Moinkaj, Rudaki and Darband.

9.4.17 This habitat also includes areas of bare ground, which reflects the heavily degraded nature of the habitat, which results from the seasonal movements of large livestock herds within large parts of the Vakhsh valley.

Cultivated land

9.4.18 Similar to the above, cultivated land persist through ongoing human influence, and the habitat supports no notable flora. Some areas of historically cultivated land are included within the new settlement areas including Chorsada 2, Toichi, Namuna 2, Sebiston and parts of Moinkaj, Rudaki and Darband.

Urban areas

9.4.19 Given the favorable topography of the Vakhsh River valley within the AoI (relative to the wider mountainous terrain) there are numerous established settlements. These do not support any natural habitat or notable flora.

River and floodplain habitat

9.4.20 As described within the 2014 ESIA, floodplain and braided channel habitats are present across the Vakhsh River valley within the AoI, with the most notable areas being located at the following locations:

- Adjacent to the settlement of Mehrobod
- Around the confluence of the Vakhsh and Obikhingou rivers and extending north
- Adjacent to the settlement of Navobod

9.4.21 Most floodplain habitats have been modified through ongoing human influence, including building of settlements (see Figure 9-11), together with extensive pasture use and grazing. As a result, these areas are not thought to support species of increased conservation interest (both fauna and flora).

9.4.22 There are two exceptions to the above, totaling c. 68ha: one being an area of floodplain habitat close to the confluence of the Vakhsh and Obikhingou rivers (within the Obikhingou River), which potentially aligns with floodplain pre-identified within the 2014 and is considered to be Natural Habitat (as per ESS6) (see Figure 9-10); and another ‘new’ floodplain area identified approximately 6km upstream of this confluence (see Figure 9-12). Here, there are far fewer signs of habitat modification, with an established scrub community present, comprising dominant tamarisk *Tamarix ramosissima*, with hawthorn *Crataegus azarolus,* buckthorns *Hippophae rhamnoides* and *Rhamnus dolichophylla* all abundant. Other large scrub species include Russian olive *Elaeagnus angustifolium* and barberry *Berberis vulgaris.* The floodplain is also interspersed with grasses (including common reed *Phragmites australis*) and herbs (including liquorice *Glycyrrhiza glabra*), together with pockets of seasonally inundated channels/hollows. The newly identified area appears to be present as a result of recent geomorphological changes, which could also explain why it has persisted in a relatively unmodified state when compared to other floodplains in the AoI. Furthermore, the relative inaccessibility of both areas may mean that it they are unsuitable for livestock grazing. When comparing satellite imagery from recent years, it is clear that the new area was previously part of the braided channel; however at some point over the last 20 years, a significant amount of sediment has been deposited here, which appears to have elevated it to a position where it is not routinely

inundated (Figure 9-13 and Figure 9-14 show changes to channel conditions over 20 years). This habitat had not been previously identified (i.e., within the 2014 ESIA) and was the subject of a dedicated field survey during October 2023 to provide a more robust understanding of its composition and structure.

9.4.23 It is unlikely that this floodplain has been formed as a result of purely natural processes, instead it seems that a change to land use on the left bank has resulted in bank de-stabilization that has caused a significant landslip, with the dislodged sediment/material being deposited at the above floodplain location (see Figure 9-15 and Figure 9-16). However, the resulting habitat is considered to be relatively unmodified. These figures illustrate the bank collapse (red circles), and the downstream disposition (green circles), as a result.

9.4.24 There is also an area downstream of this confluence, which is heavily modified and devoid of any natural vegetation communities.

Figure 9-10 - Floodplain Natural Habitat

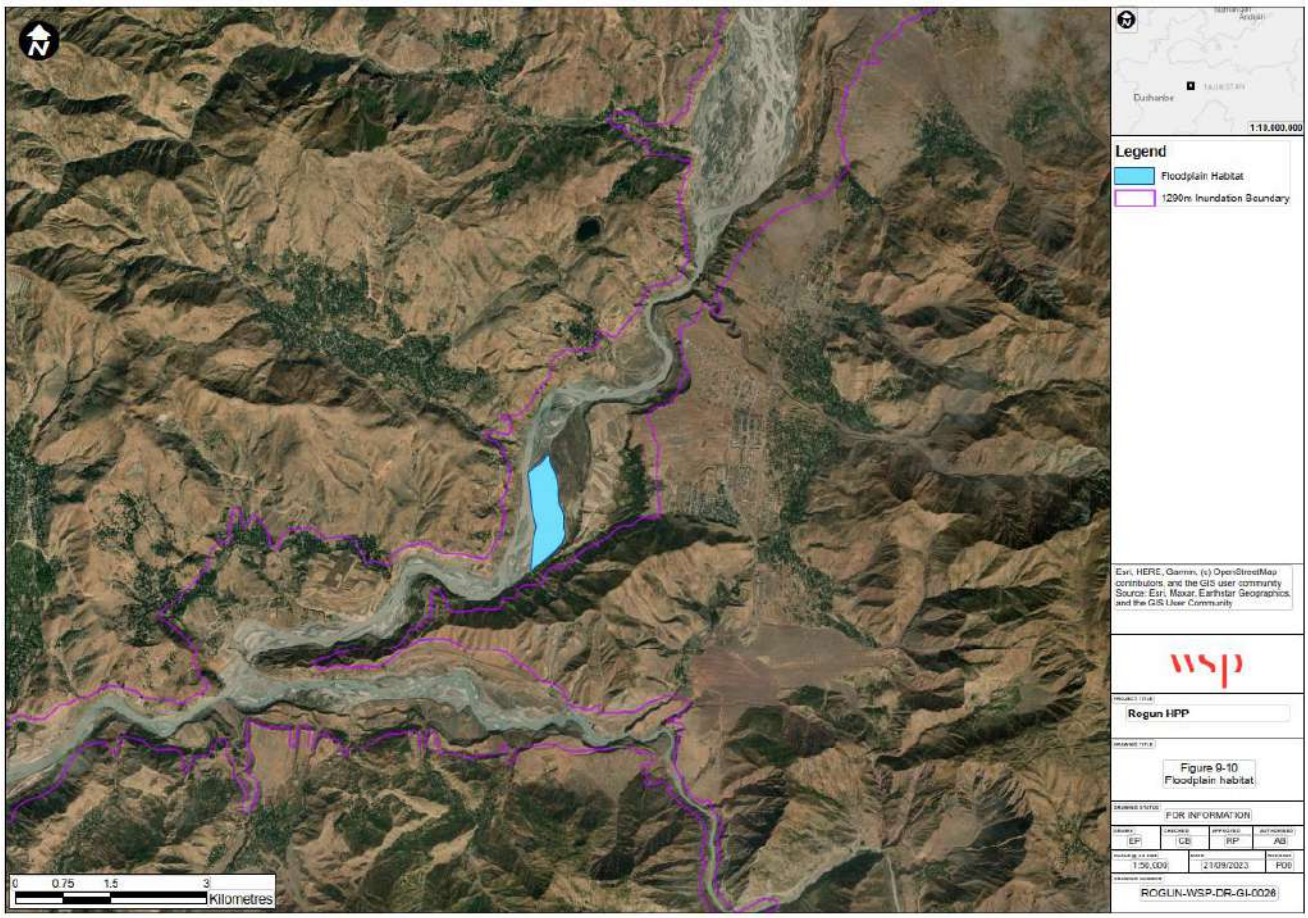


Figure 9-11 - Modified floodplain habitat at Chorsada



Figure 9-12 - Floodplain habitat upstream of the Vakhsh/Obikhingou confluence



Figure 9-13 - 2003 floodplain status

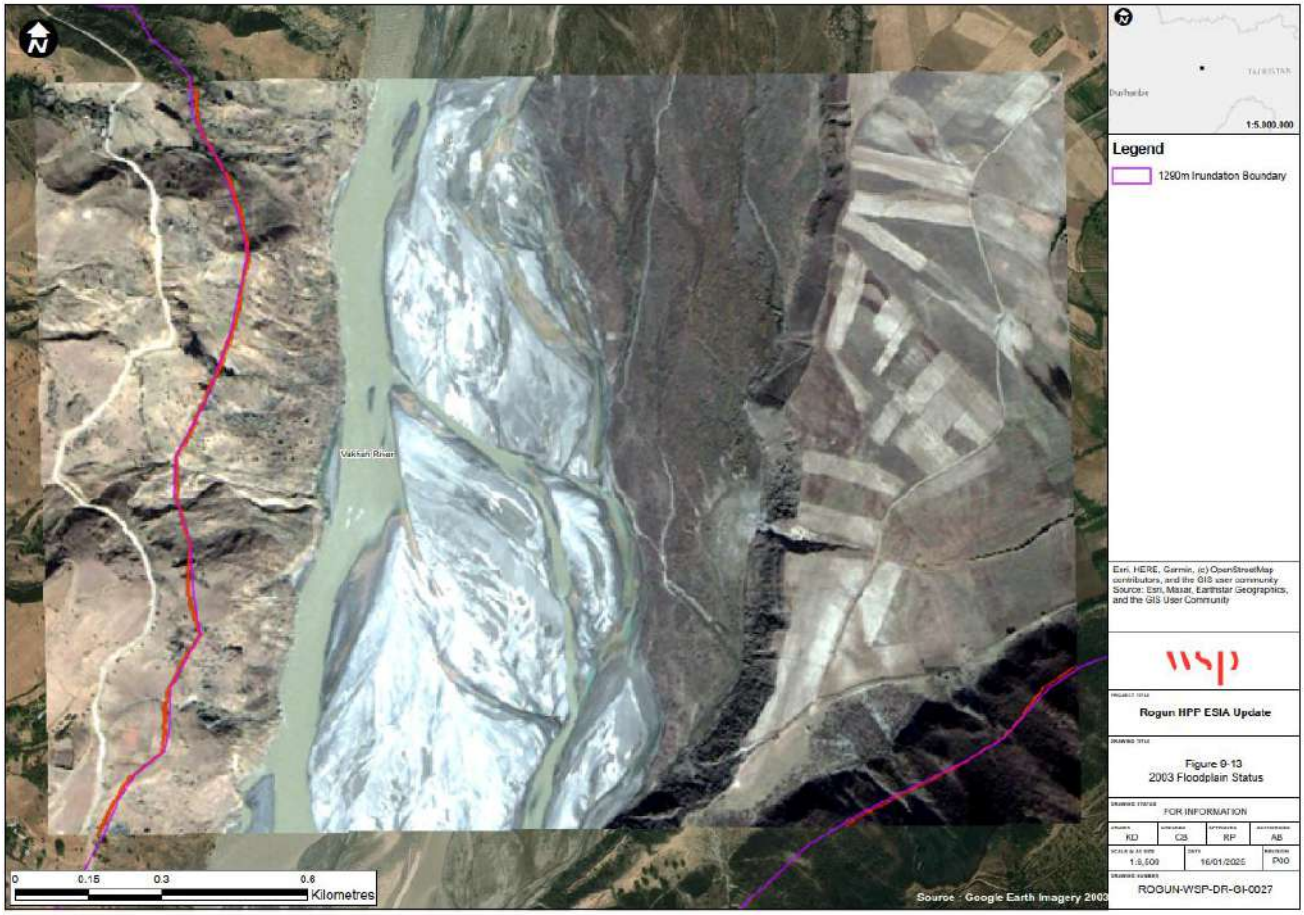


Figure 9-14 - 2023 floodplain status



Figure 9-15 - 2003 left bank status

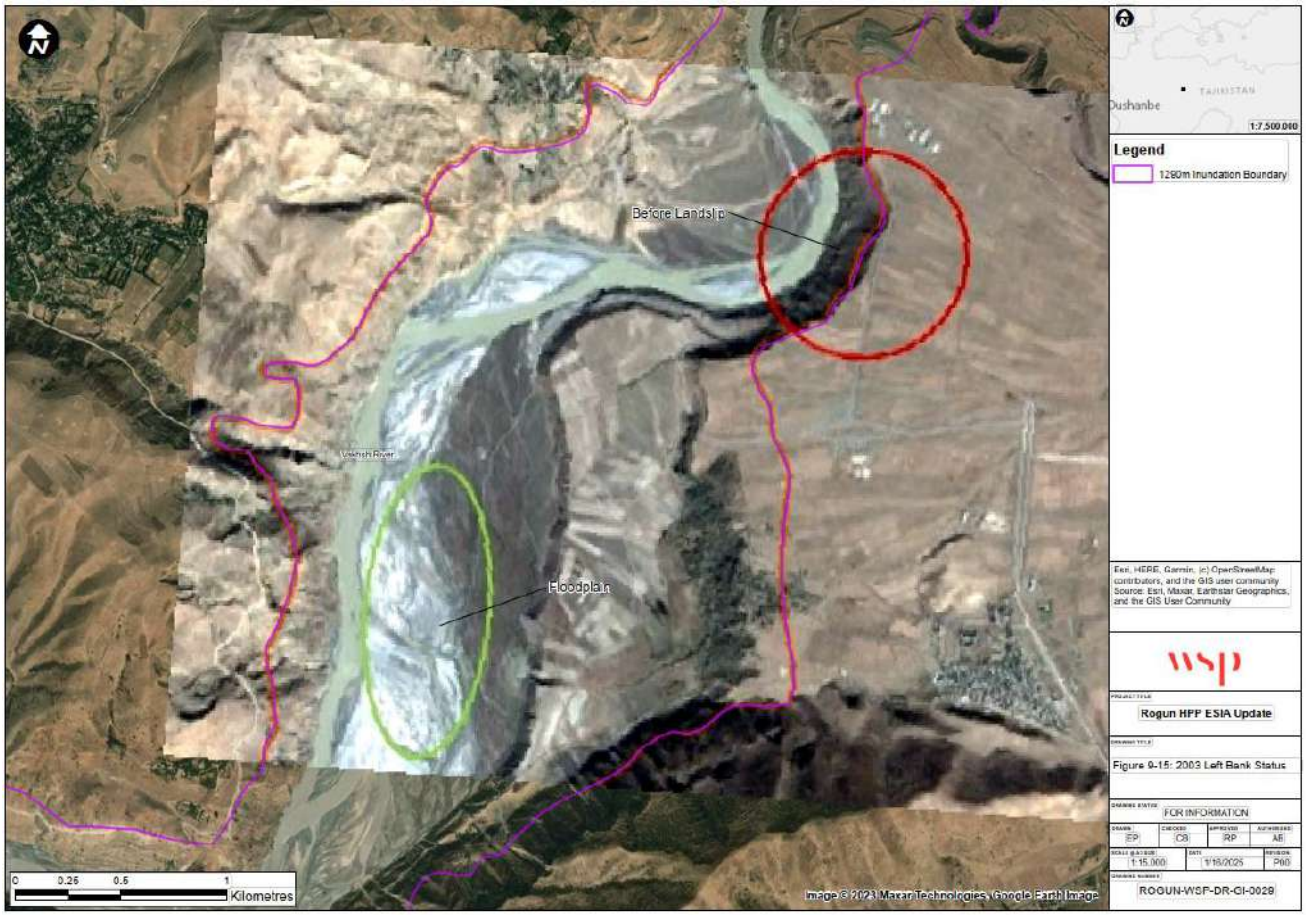
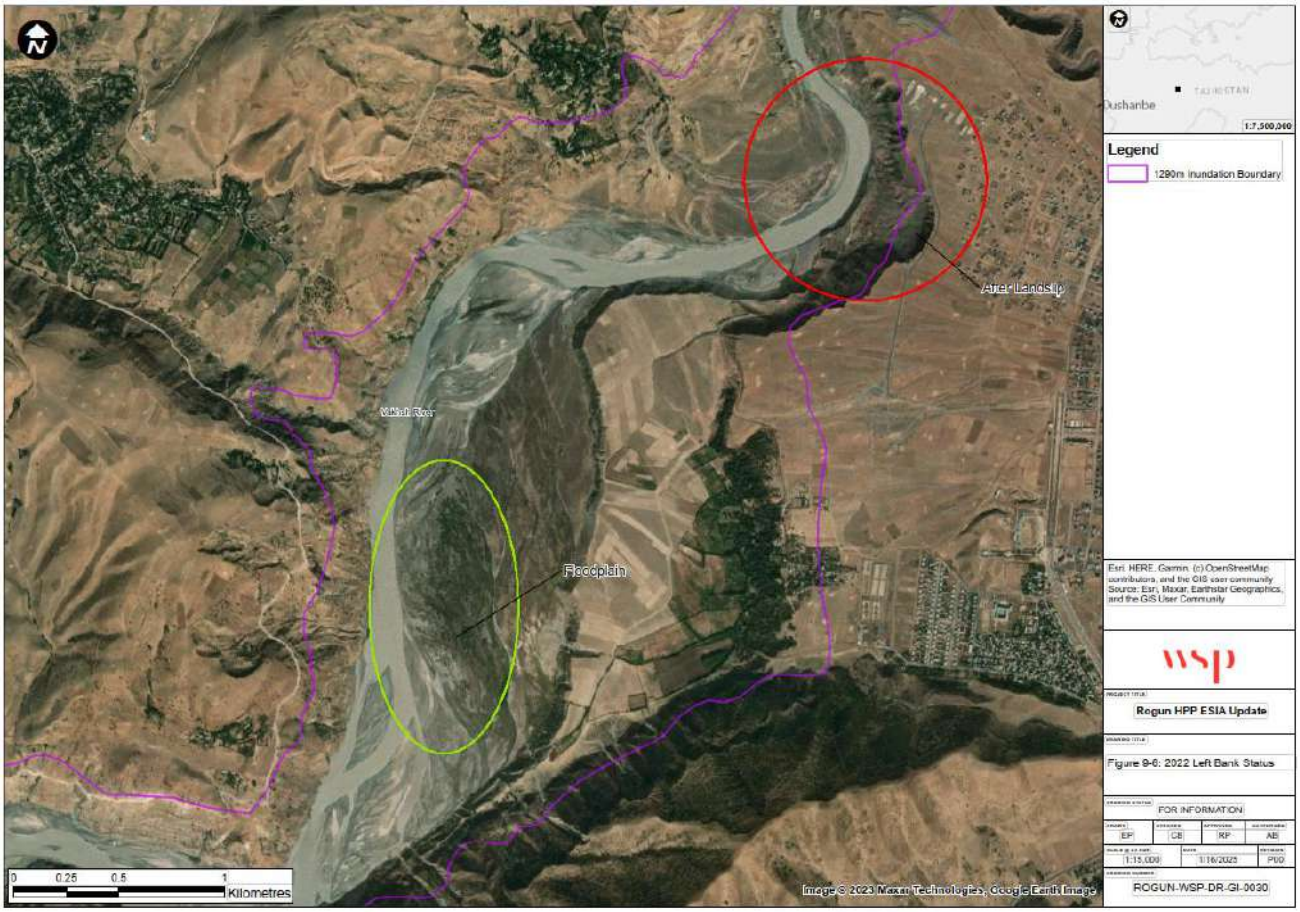


Figure 9-16 - 2022 left bank status



9.4.25 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.

9.4.26 Please refer to **Section** Error! Reference source not found. for information on turbidity in the Vaksh r iver.

9.4.27 More specifically, high turbidity has been shown to have physiological effects on fish, which include gill trauma (abrasion), blood chemistry and reduced reproduction and growth (Bash *et. al*., 2001).

9.4.28 The substrate of a river is defined by the organic and inorganic materials making up the riverbed. The inorganics include a range of sizes, from fine silts/sands, through gravels and pebbles to boulders and bedrocks. The organic materials are dominated by leaf litter, aquatic plants and wooded debris. The velocity of the water, determined by gradient erodes and deposits the different materials to form a heterogenic substrate or habitat.

9.4.29 Substrate heterogeneity is an important factor in determining both abundance and diversity of biota, with more stable substrate showing higher diversity and abundances (CBD, 2012). As particle size increase, so does physical complexity, so clay or sandy substrates would be considered poor sue to their stability, whereas cobbles and rocks would be more stable. A mixed substrate would obviously be the best with a variety of habitats and microflow patterns available for different biota.

9.4.30 The Vakhsh River is primarily made up of alluvial cobbles and boulders, with areas of deposited sediments as described above. In high velocity area such as gorges, the scouring affect is high, while in open channel areas, deposition occurs, to the extent that in the Novabad area, a 1.4 km wide braided channel has formed (Figure 9-19). This is further exacerbated by slope stability as shown in Figure 9-16 Within the Vakhsh River, the cobbles and boulders will provide the primary habitat for aquatic organisms.

9.4.31 Within the river channel, and along the banks, little to no vegetation was observed, with no riparian buffer zone bordering the river, and with eroding cliffs present within many sections (see Figure 9-9). The organic component within the channel was also limited with no leaf litter, root wads or woody debris observed. As a result, no canopy and little cover was present at site.

9.4.32 The confined portions (gorges) of the river channel were not accessible due to the steep banks and loose soils. Water velocities were generally higher as a result of the narrow channel, and it is expected that these sections offer the deepest water. Substrate is expected to largely be comprised of rock as smaller particles would be washed downstream (Figure 9-17).

Figure 9-17 - Confined channel of the Vakhsh River with steep banks.



9.4.33 Open gorges are present when the river valley opens, allowing the channel to somewhat meander or widen. This has resulted in the deposition of cobbles and boulders, as well as the accumulation of silt within the interstitial spaces where flow is reduced (Figure 9-18).

Figure 9-18 - Open gorges of the Vakhsh River with alluvial cobbles and boulders



9.4.34 A third habitat type, braided channels are linked to incoming tributaries and bank collapse where the river channel widens and deposition of silt within the channel occurs. The largest of these is a 1.4 km wide braided channel at Novabad (Figure 9-19). The water depth in the braided channels is relatively shallow when compared to the other habitat types, and the substrate material is made up of smaller particles such as silt, sand and gravels. Although this does offer a different habitat type for aquatic organisms, the conditions (e.g. Mobile sediments, little cover and turbidity) are not ideal for aquatic macroinvertebrates or fish. An investigation of aquatic macroinvertebrates showed that the

diversity and abundance of taxa was greater in the clearer tributaries than in the turbid waters of the main channel, where more tolerant species (e.g. Simuliidae) were dominant.

Figure 9-19 - Braided channels within the Vakhsh River



9.4.35 Within the Project area tributaries that do not have large catchments or that have catchments that are still relatively intact, had lower turbidity that the main Vakhsh River (Figure 9-20). Within the landscape, these tributaries are generally short in length, have a high gradient and substrate is comprised primarily of cobbles and boulders. Although fish migration up the tributaries will be limited as a result of the gradient, the lower portions are expected to be important for fish as refuge areas off the main Vakhsh River channel, as they offer clear, cooler waters.

Figure 9-20 - Tributaries of the Vakhsh River



9.4.36 Overall, based on the low habitat diversity and unfavorable conditions (e.g. High turbidity) within the Vakhsh River, a diverse aquatic community is not expected within the Project AoI. These observations align with the 2014 ESIA.

Woodland

9.4.37 Remnant mesophilic juniper woodland habitat is present within the AoI at five locations on the left bank of the Vakhsh River. This habitat partially aligns with the mesophilic broad-leaved forest described within the 2014 ESIA as occurring from 1500m to 2500m asl, although following surveys in 2023, a distinct woodland habitat at these five locations from approximately 1000m asl is considered more appropriate. This is a characteristic native woodland type for the region, occurring within this subalpine belt (known as 'archevniki') in which tree cover is relatively sparse. The woodland recorded from the AoI here can be further classified within this category as thermophilous woods, dominated mainly by *J. polycarpos* var. *seravschina*, which is an endemic tree to Middle Asia (Nowak & Nobis 2020).

9.4.38 The juniper woodland represents a habitat that would have formerly extended across much of the Vakhsh River valley but has been reduced in extent by ongoing human influence; mainly grazing pressure and collection of firewood/timber. Alongside *J. seravschina*, at slightly higher altitudes there is frequent Turkestan maple *Acer turkestanicum*, walnut *Juglans regia*, sycamore *Acer pseudoplatanus*, and smaller tree and scrub species such as juniper *J. commune*, wormwood *Artemisia* sp., *Clematis* sp. Afghan redbud *Cercis grifilhii,* apple species (including *Malus sierversi*), cherry *Prunus* sp. almond and hawthorn *Crataegus* sp.

The woodland areas are illustrated on

Figure 9-21, with the combined extent of approximately 283ha being recorded from flooding zone.

Figure 9-21 - Mesophilic juniper woodland



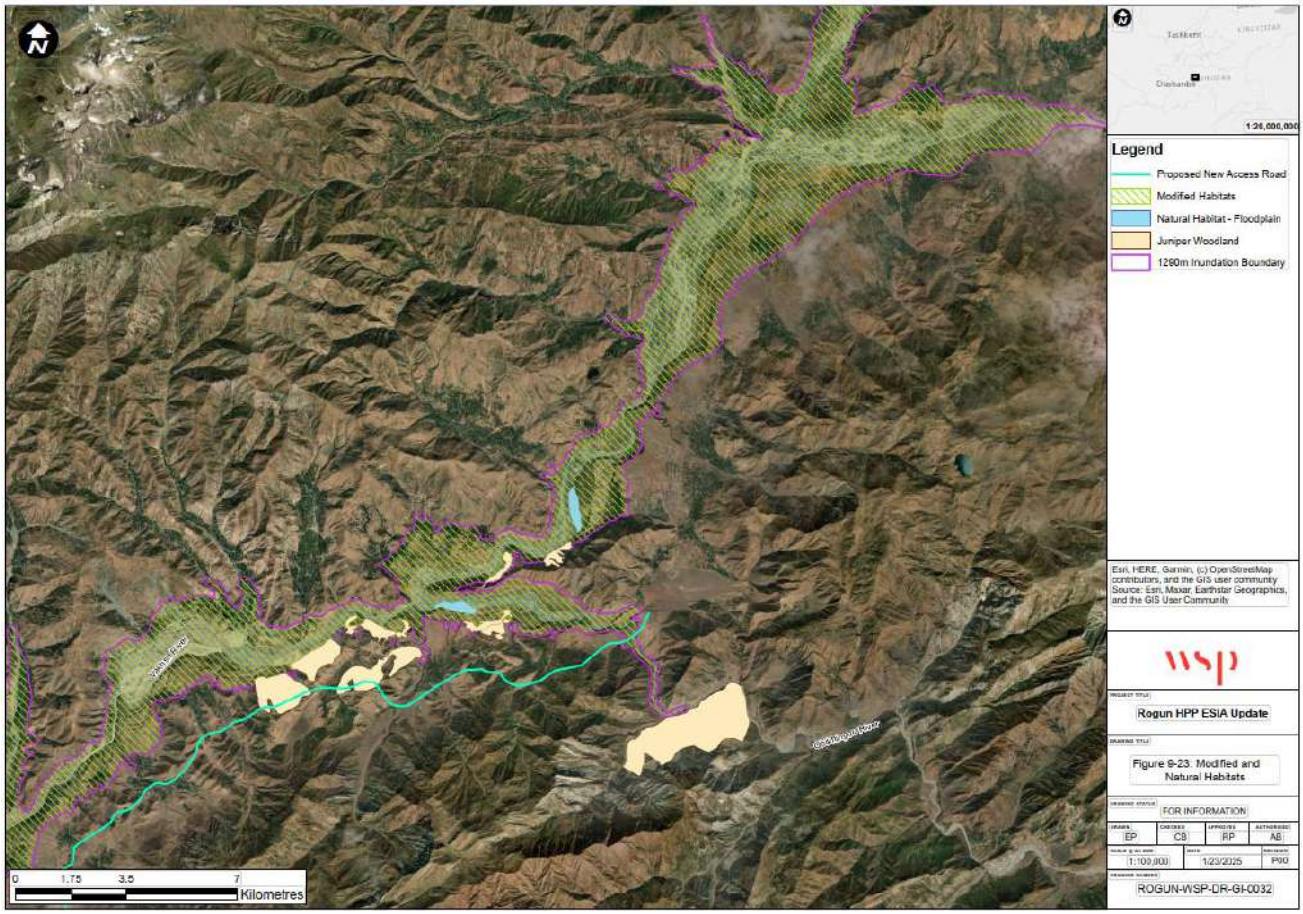
Figure 9-22 - Remnant juniper woodland



CRITICAL HABITAT / NATURAL HABITAT

9.4.39 No Critical Habitat has been identified within the AoI (as per ESS6). Two, non-critical, natural habitats were identified, by virtue of the absence/partial absence of modification and the presence of natural plant assemblages. Namely, floodplains habitat (upstream of the confluence of the Vakhsh and Obikhingou rivers, within both channels) and juniper woodland. Ful details regarding this assessment is provided within the Critical Habitat Assessment (**Volume 2, Annex 15-1** of this ESIA). For clarity, these areas are illustrated on **Figure 9-23**.

Figure 9-23 - Modified and Natural Habitats



FLORA

9.4.40 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.

9.4.41 The 2014 ESIA described 63 species as being present across the Project site and wider area, with most 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. No species on the IUCN Red List (or CITES) have been identified across the Project site and wider area. **Table 9-4** provides details on these species, including locations of their likely/confirmed presence.

Table 9-4 - Notable flora records

Species name	Habitat and distribution	Conservation status
Allium rosenbachianum	Occurs in sparsely forested areas with open grassland habitat in the Khakimi gorge in the vicinity of Tagikamar village outside the AoI.	TRB EN
Allium stipitatum	Occurs within thermophilic juniper woodland outside the flooding zone (and therefore potentially present within this habitat elsewhere).	TRB EN
Allium suworowii	Occurs in sparsely forested areas with open grassland areas in the Khakimi gorge in the vicinity of Tagikamar village outside the AoI.	TRB EN
Bunium persicum	Occurs in grassland habitat amongst the scree slopes of the Surkho, Vakhsh and Karateginsky ridges outside the AoI.	TRB VU
Ferula tadshikorum	Occurs in grassland habitat amongst scree slopes of the Vakhsh ridge of the Javoni gorge outside the AoI.	TRB EN
Cousinia leptocampyla	Occurs within the thermophilic juniper woodland. Recorded during 2023 field surveys outside the AoI but given habitat preferences is potentially present here.	TRB VU
Cousinia agelocephala	Occurs in sparsely forested areas with open grassland areas and thermophilic juniper woodland. Not recorded here but given habitat preferences is potentially present here.	TRB VU
Ostrowskia magnifica	Occurs in sparsely forested areas with open grassland habitat, along the Lugur gorge in the vicinity of the villages of Lugur bolo ridge Karateginsky outside the AoI.	TRB CR
Iris darvasica	Occurs in sparsely forested areas with open grassland habitat, along the Lugur gorge in the	TRB EN

Species name	Habitat and distribution	Conservation status
	vicinity of the villages of Luguri poyon and Luguri bolo ridge Karateginsky outside the AoI.	
Iris hoogiana	Occurs in sparsely forested areas with open grassland habitat in the Khakimi gorge in the vicinity of Tagikamar village outside the AoI.	TRB EN
Juno nicolai	Occurs in grassland habitat amongst the scree slopes of the Vakhsh ridge above the village of Rogun within the AoI (and flooding zone).	TRB EN
Crocus korolkowii	Occurs in grassland/pasture habitat in the vicinity of the villages of Rog, Sichirog. Hakimi and others, including within the AoI (and flooding zone).	TRB EN
Fritillaria eduardii	Occurs within open woodland at the confluence of the Surkhoba and Khingoba rivers in the vicinity of Labichar village, within the AoI (and flooding zone). A single stand was recorded during 2023 field surveys.	TRB CR
Tulipa korolkowii	Occurs in grassland habitat amongst the scree slopes of the Javoni gorge outside the AoI.	TRB EN
Tulipa praestans	Occurs within open woodland at the confluence of the Surkhoba and Khingoba rivers in the vicinity of Labichar village within the AoI.	TRB CR
Eremurus aitchisonii	Occurs in open woodland areas, on scree slopes of the Vakhsh ridge above the village of Yakhak outside the AoI.	TRB VU
Anemone bucharica	Occurs in the belt of short sward grassland/pasture in the almond groves of the Karateginsky ridge in the vicinity of the village of Sichirog outside the AoI.	TRB EN
Vitex agnus-castus	Occurs in open woodland areas, on scree slopes of the Karateginsky ridge near the banks of the Vakhsh River within the AoI.	TRB CR

9.4.42 No invasive plant species were noted during studies to inform the 2014 ESIA (with no mention of whether they were considered as part of the baseline studies), or from field surveys in spring 2023, although it is known that invasive plants are increasing in presence/extent across in the country (as per a CBD progress assessment undertaken 2018[6]). During WSP's visit in September/October 2023 extensive presence of Bathurst burr *Xanthium spinosum* was recorded (likely missed from the spring surveys due to having a late-growing season here), in particular within modified floodplain and braided channel habitats throughout the flooding zone. This species is a highly invasive weed that is capable of growing under a range of environmental conditions. It readily establishes in cultivated land, pastures, meadows and riverbanks and can threaten native or endemic wildlife (Pitcher, 1989).

[6] As accessed at: https://chm.cbd.int/database/record?documentID=247303

FAUNA

9.4.43 The following sections describe the faunal baseline as described from the field surveys, and includes data captured in the field and those obtained through eDNA analysis (the eDNA sampling exercise revealed non-aquatic fauna from three separate animal groups: mammals, amphibians and birds. No other animal groups were represented with the bioassays used).

Mammals

9.4.44 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.

9.4.45 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; these are presented in **Table 9-5**.

9.4.46 Nine common/widespread species were recorded during field surveys, with two (least weasel *Mustela nivalis* and Eurasian otter *Lutra lutra*) being included within the TRB. The remaining seven field survey records are as follows:

- Red fox *Vulpes vulpes flavescens*
- Wild boar *Sus scrofa*
- Tolai hare *Lepus tolai*
- Golden marmot *Marmota caudata*
- Pygmy field mouse *Sylvaemus uralensis*
- Northern mole vole *Ellobius talpinus*
- Common vole *Microtus arvalis*
- Eurasian otter *Lutra lutra*

9.4.47 Bats were recorded in low numbers from the AoI during both walkover surveys in spring 2023 as well as from the eDNA survey, although most of the habitat is generally considered sub-optimal as a result of ongoing habitat loss/degradation across most areas. No roosts/potential roost site/features were identified, and these are likely to be relatively limited in number/extent when considering the large survey area, partly due to the lack of many significant features such as caves and mature trees, but also the history of habitat modification that has occurred within the Vakhsh River valley, in particular the loss of woodland but also the associated slope stability that has followed, with many areas displaying evidence of mobile substrate that would not offer roost potential. However, roost sites may be present, potentially including hibernation and maternity roosts within discrete features such as rock/cliff crevices, localised caves and in disused buildings; and as such a slightly more precautionary approach is adopted here with regards species presence.

Table 9-5 - Notable mammal records

Species name	Habitat and distribution	Conservation status
Lesser horseshoe bat *Rhinolophus hipposideros*	A relatively scarce cave-dwelling species that forages across habitat mosaics including trees, scrub and open habitats. None were recorded during 2023 field surveys, although it is likely that the AoI provides foraging habitat for the species.	TRB VU HD Annex IV*
Bokhara horseshoe bat *Rhinolophus bocharicus*	See lesser horseshoe bat. No known records within the AoI, with the closest records being downstream of the Nurek reservoir. Regional endemic.	TRB VU
Desert long-eared bat *Otonycteris hemprichii*,	A lightly-studied species that utilizes crevices for roosting but has also been found in built up areas (including in Dushanbe), and towns within the Vakhsh valley. Considered to be rare but potentially present across the AoI within localised stable cliff features (noting that most slopes have relatively mobile substrate characteristics).	TRB VU
Geoffroy's bat *Myotis emarginatus*	A globally widespread cave-dwelling species (often in mixed colonies with *Rhinolophus* sp.) that feeds over short vegetation in search of flies and spiders. None recorded during 2023 field surveys. As above, the AoI likely provides suitable foraging habitat for this species.	TRB VU HD Annex IV*
Whiskered bat *Myotis mystacinus*	A rare species across Tajikistan that roosts in uninhabited buildings, trees, caves, often foraging around inland water. None recorded during 2023 field surveys. As above, the AoI likely provides suitable foraging habitat for this species.	TRB VU HD Annex IV*
Savi's pipistrelle *Pipistrellus savii*	A relatively common species in Tajikistan that has varied roosting habitats and forages across numerous habitat types, including built-up areas/settlements. None recorded during 2023 field surveys. A single record returned from the eDNA analysis from a sample collected at the confluence of the Obikhingou and Vakhsh rivers. As above, the AoI likely provides suitable foraging habitat for this species.	TRB VU HD Annex IV*
Eurasian otter *Lutra lutra seistanica*	A species with decreasing range in Tajikistan where it is considered rare (Conroy et al. 1998). The species inhabits the riparian zone	TRB VU HD Annex IV*

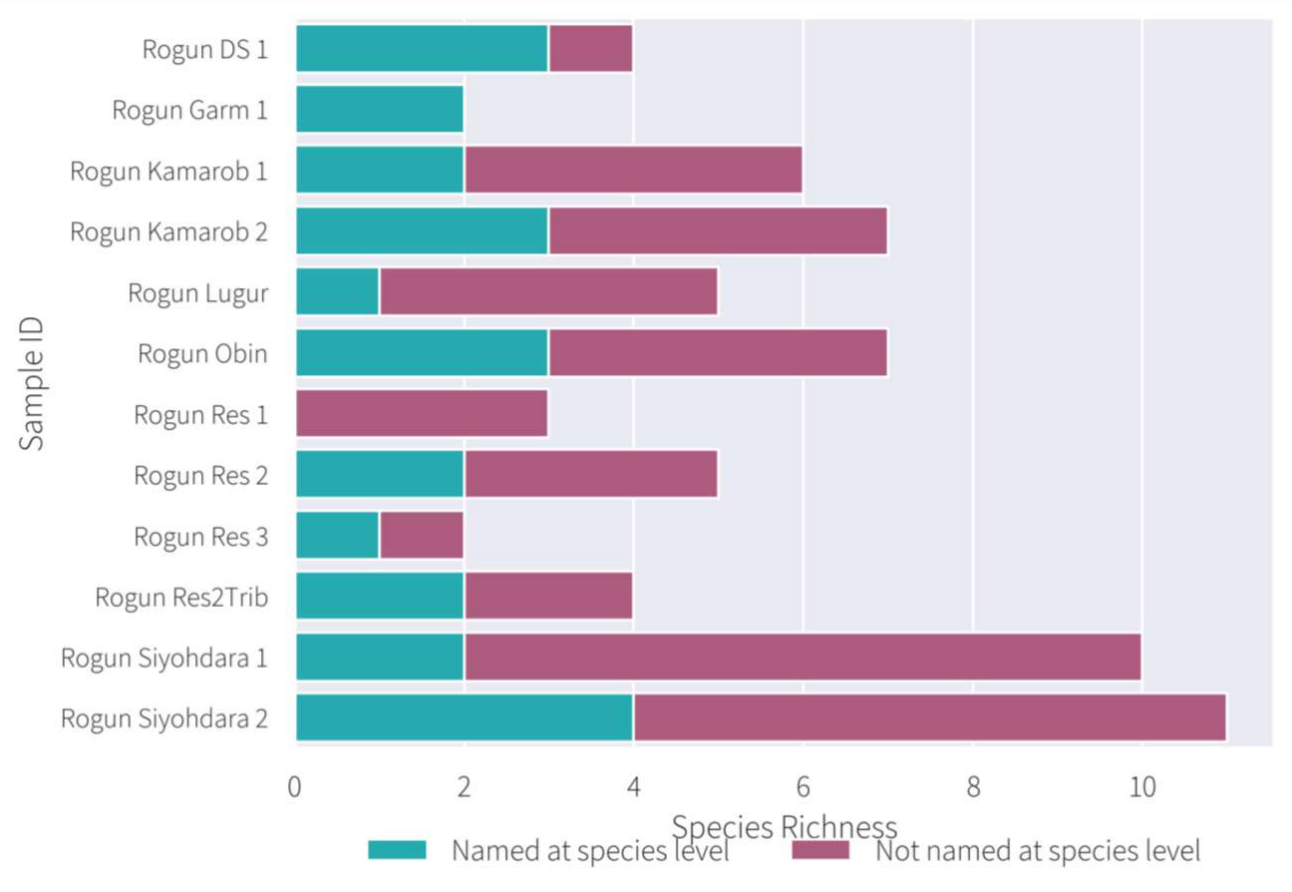
Species name	Habitat and distribution	Conservation status
	of rivers, and around inland and marine waterbodies. None were recorded during spring 2023 field surveys, although it is thought to be present within the Vakhsh catchment (as per Yoxon & Yoxon 2019) and was recorded during WSP's September/October 2023 visit within the Obikhingou river (with prints and spraints recorded), with unconfirmed eDNA records from two sample locations also, so is present within the AoI, albeit likely at low densities.	
Snow leopard *Panthera uncia*	A rare, central Asian endemic species which occurs at altitudes of over 3000m in habitat generally comprising rugged, broken terrains and rocky outcrops. None recorded during field surveys and the AoI is generally sub-optimal for the species. Occasional foraging at lower altitudes within the AoI may occur (e.g., to predate on livestock).	IUCN VU TRB EN
Least weasel *Mustela nivalis*	A globally widespread species that occurs across numerous habitat types. Recorded during 2023 field surveys and considered present across the AoI.	TRB EN
Himalayan brown bear *Ursus arctos isabellinus*	Relatively common across the mountainous regions of Tajikistan, although also occurs in a wider array of habitat types such as steppes, forests and alpine meadows. None were recorded during spring 2023 field surveys, and much of the AoI is sub-optimal due to limited foraging resource. However, at times it is likely that individual bears will occur within the AoI, and paw prints were observed upstream of the AoI on a mudbank next to the Sangikar river during WSP's visit in September/October 2023. eDNA records for this species were also recorded.	TRB VU
Indian crested porcupine *Hystrix indica*	This species is wide-ranging and has a broad habitat tolerance, including rocky hillsides, shrubland, grasslands, forests, arable land, plantations, and gardens. None were observed during field surveys in 2023, although suitable habitat exists across the AoI.	TRB VU
Forest dormouse *Dryomys nitedula*	A globally widespread (although rare in Tajikistan) woodland species that also inhabits rocky habitats.	TRB VU

Species name	Habitat and distribution	Conservation status
	None were recorded during field surveys in 2023, and the habitats across the AoI are generally sub-optimal. However, the species may make use of the remnant woodlands present here.	

9.4.48 *Habitats Directive Annex IV – protection against deliberate killing and disturbance and maintaining/restoring conservation status of these species.

9.4.49 The analysis of eDNA from water samples collected within the project area, identified 36 species of mammals, from 11 Families. Of the 36 species detected, 17 were identified down to Species level, 12 to Genus level, 6 to Family level and 1 unidentified at an Order level.

Figure 9-24- Species richness at each sample location - mammals



9.4.50 The species/animal groups with the greatest amount of genetic material (both in terms of frequency of occurrence, and sample volume) are generally those that will likely be fairly numerous and present in close to the proximity to the watercourses sampled. Animals such as mice, voles, mustelids (such as weasel and marten) and fox have been detected with the highest levels of genetic material, which although not a reliable indicator of abundance, does provide some confidence as to the level of activity from these species. Conversely, those species/animal groups with less frequent/smaller sample volumes likely reflect greater scarcity or low abundance. The latter

is likely true of otter, which have quite extensive home ranges (up to around 30km of river length[7]) and so will have fewer animals shedding genetic material. In the case of otter, the relatively low (and unconfirmed) nature of the eDNA results from only two sample locations, likely also reflects the general scarcity of this species in the region.

[7] Taken from: Nancy Hung, Chris J. Law, **Lutra lutra** (Carnivora: Mustelidae), **Mammalian Species**, Volume 48, Issue 940, 30 December 2016, Pages 109–122, https://doi.org/10.1093/mspecies/sew011

Table 9-6 - eDNA results summary: mammals.

№	Family	Scientific name	English name
Artiodactyla			
1	Bovidae	*Bos grunniens*	Yak
2	Bovidae	*Capra sibirica*	Siberian Ibex
3	Bovidae	*Capra*	
4	Bovidae		
Carnivora			
6	Canidae	*Vulpes vulpes*	Red Fox
7	Canidae	*Vulpes*	
8	Mustelidae	*Martes foina*	Beech Marten
9	Mustelidae	*Martes*	
10	Mustelidae	*Mustela erminea*	Stoat
11	Mustelidae	*Mustela nivalis*	Least Weasel
12	Mustelidae	*Mustela*	
13	Mustelidae	*Meles*	
14	Ursidae	*Ursus arctos*	Brown Bear
15	Ursidae	*Ursus*	
Chiroptera			
16	Vespertilionidae	*Hypsugo savii*	Savi's Pipistrelle
Lagomorpha			
17	Leporidae	*Lepus europaeus*	European Hare
18	Leporidae	*Lepus tibetanus*	Desert Hare
19	Leporidae	*Lepus*	
20	Leporidae		
Perissodactyla			
21	Equidae	*Equus asinus*	Donkey
Rodentia			
22	Cricetidae	*Blanfordimys juldaschi*	Juniper Vole
23	Cricetidae	*Blanfordimys*	
24	Cricetidae	*Cricetulus migratorius*	Grey Dwarf Hamster
25	Cricetidae	*Microtus*	
26	Cricetidae		
27	Muridae	*Apodemus uralensis*	Ural Field Mouse
28	Muridae	*Apodemus*	
29	Muridae	*Mus musculus*	House Mouse
30	Muridae	*Rattus rattus*	Black Rat
31	Muridae		

32	Muridae		
Soricomorpha			
33	Soricidae	*Crocidura sibirica*	Siberian Shrew
34	Soricidae	*Crocidura*	
35	Soricidae	*Marmota*	
36	Soricidae		

9.4.51 Of the 36 species detected, only one (that was described to species level) was unexpected based upon desk study and field data recorded to date – Siberian ibex *Capra sibirica*. While present within the 2014 and 2023 ESIA desk study exercises, this species' presence within the flooding zone and wider AoI is not considered likely. The species is known to inhabit mountainous areas across Central Asia and is generally found above the tree line at elevations of greater than 500m, most commonly above 2000m, and up to 5500m. Three potential eDNA occurrences for this species were recorded, with two of these from the upper areas of the study area: Rogun Garm 1 and Rogun Kamarob 2; and one from near to the dam: Rogun Res 2. Whilst it is feasible that genetic material could have been transferred from higher altitudes to the sample sites in the upper reaches of the study area, the location of a potential Siberian ibex DNA close to the Rogun dam (together with the lower support level for each of these samples) would suggest that domesticated goat is the most likely source of this DNA (ibex are genetically close to domesticated goats, with some species able to hybridize).

9.4.52 Of the other mammal species detected, there was confirmation of the presence of increased interest to the Project such as a brown bear (recorded from seven separate locations), with the greatest amount of genetic material recorded at the location where prints were identified during the sample collection. This incidental record of brown bear was made during the eDNA sampling exercise, along the Siyohdara River in the upper reaches of the study area, with fresh prints recorded alongside the watercourse at this location (Figure 9-25).

Figure 9-25 - Brown bear prints



9.4.53 Similarly, otter prints were identified close to the confluence of the Vakhsh and Obikhingou rivers, and while no confirmation of otter was obtained from the eDNA analysis, there were records of an unknown mustelid species, which could feasibly be otter (from three separate locations).

Figure 9-26 - Otter prints



Amphibians

9.4.54 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 species were also recorded during the 2023 field surveys and are common and widespread within the region (and not included on any conservation lists, e.g., IUCN Red List), in areas where standing water is present.

9.4.55 One amphibian from the Bufonidae Family – Xinjiang toad *Bufotes pewzowi* was recorded for the eDNA sampling, and this represents a new species to the known/predicted amphibian assemblage present across the Project AoI. This species is listed as Least Concern on the IUCN Red List and is commonly found across Central Asia, east from Uzbekistan into Mongolia and China.

Reptiles

9.4.56 A diverse reptile fauna is present across Tajikistan, with 46 species confirmed as being present, 22 of which are endemic to the region. A total of 13 species were recorded from the literature review as being present in the Vakhsh River Valley, which is one more than was presented within the 2014 ESIA. Most of the habitat present across the flooding zone is sub-optimal for reptiles given the very short sward length of the degraded grassland habitat and the general lack of shelter elsewhere. However, pockets of suitable habitat do exist, especially around the settlements and in the less accessible valley/gorge areas. 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 (e.g., included on IUCN Red List or TRB). Four exceptions to this are detailed in **Table 9-7**:

Table 9-7 - Notable reptile records

Species name	Habitat and distribution	Conservation status
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, with the species occupying a variety of habitats including gorges, hollows, ephemeral vegetation, gardens and along field edges. Considered to be locally common across the AoI.	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, so long as suitable sheltering features are present. The species shows a preference for slopes. Considered to be locally common across the AoI outside of the pasture habitats.	TRB EN
Tartar sand boa *Eryx tataricus*	Two records were made during 2023 field surveys, within valleys to the east of the AoI. Suitable habitat exists across the AoI, although the species is considered to be rare here.	TRB EN

Species name	Habitat and distribution	Conservation status
Blunt-nosed viper *Vipera lebetina*	Two records were made during 2023 field surveys, with one being immediately adjacent to the flooding zone, east of Mehrobod. Suitable habitat exists across the AoI, although the species is considered to be rare here.	TRB VU

Figure 9-27 - Asian tortoise Testudo horsfieldii



Birds

9.4.57 Tajikistan supports a diverse bird assemblage, with over 380 species having been recorded, four of which are regional endemic species. The country is within the broad Central Asian Flyway and supports several migratory species. The greatest species diversity is from the west of the country, where habitat diversity is relatively higher (including the Vakhsh valley) and reflecting the generally lower altitudes. Despite this diversity, only 14 species are known to occur that are listed as Threatened on the IUCN Red List, and there are no country endemic species (Birdlife, 2023).

9.4.58 A total of 158 species were recorded from the literature review as being present in the Vakhsh River Valley, which is seven more than were presented within the 2014 ESIA. Of these, 47 species were recorded during field surveys.

9.4.59 Most species recorded are considered to be common and widespread, which reflects the prevalence of habitat modification that has occurred; although 18 species of the 158 recorded are listed on the

TRB and/or the IUCN Red List. No regional endemics were recorded. Additionally, a number of species recorded will be present as migrating birds; both those migrating to the region to breed or overwinter (such as Egyptian vulture), and those that migrate through the area during spring/autumn within the broad movement through the Central Asian Flyway. **Table 9-8** provides further information for these species.

Table 9-8 - Notable bird records

Species name	Numbers observed during VP surveys	Habitat[8] and distribution	Conservation status
Egyptian vulture *Neophron percnopterus*	10	Summer migrant to the region, which typically nests on ledges or in caves on cliffs, which are relatively scarce within the AoI. It forages over open, lowland habitats and scavenges in human settlements, both of which are present within the AoI. Two records of single birds from the spring 2023 surveys, outside of the AoI, and further records were made during WSP's visit in September/October 2023 when a single subadult bird was recorded immediately upstream of Chorsada, and a group of 11 birds (of various age classes) were recorded gathered on the ground near Mehrobod, presumably preparing to roost. No evidence of breeding within 2km of the Project, although it is considered likely that breeding does occur here. A maximum of three birds observed on four separate occasions from each of the VPs. Egyptian vulture breeding in Tajikistan and leave for wintering grounds in September/October. The records will likely be of birds migrating through the area.	IUCN EN TRB EN Migrant
Saker falcon *Falco cherrug coasti*	-	A resident breeding species within Tajikistan that forages over open habitats where rodents/small mammal are key prey items in the region. The species mainly nests in mature trees, cliffs, pylons and similar structures, much of which is absent from the AoI. Two records of single birds from the 2023 surveys, both within the AoI; no evidence of breeding within 2km of the Project.	IUCN EN TRB EN
Cinereous vulture *Aegypius monachus*	7	A resident breeding species and passage migrant within Tajikistan. This species occupies a variety of habitats but with a preference for wooded areas (where it most often nests). It also forages over dry,	TRB VU

[8] As adapted from species-specific Birdlife references (BirdLife 2023) and the Red Book of Tajikistan (2014), unless otherwise stated.

Species name	Numbers observed during VP surveys	Habitat[8] and distribution	Conservation status
		open areas including steppe and bare mountains, which are present within the AoI. Two records of single birds from the 2023 surveys, outside of the ZoI; no evidence of breeding within 2km of the Project. Up to three birds on four separate occasions from VP 1 and VP2 in October and November. No notable migratory behavior, and cinereous vulture are largely resident in Tajikistan.	
Bearded vulture *Gypaetus barbatus*	6	A resident breeding species within Tajikistan that occupies vast home ranges, often dictated by the presence of large predators (whose prey remains the species feeds on). Breeding sites mainly comprise remote cliffs, ledges or caves, which are mainly lacking within the AoI. Two records of single birds from the spring 2023 surveys, both within and outside the AoI and two further records from autumn 2023 surveys; no evidence of breeding within 2km of the Project. A maximum of two birds observed together during VP surveys, with observations made from each of the three VPs in October. All birds observed in flight. No indication of migratory behavior (bearded vultures are resident in Tajikistan and do not undertake any significant migratory movements).	TRB EN
Golden eagle *Aquila chrysaetos*		A resident breeding species within Tajikistan that is widely distributed within the country. The species forages across open areas and is inversely associated with woodland/forest presence. Breeding sites mainly cliffs and ledges, although mature trees are also sometimes used. Such features are mainly lacking within the AoI. No records were obtained from the spring 2023 field surveys, although suitable foraging habitat for the species was confirmed from the AoI, in particular away from the settlements/built-up areas (the species is intolerant of human disturbance). This suitability was confirmed during WSP's site visit in September/October 2023 when several golden eagle territories were recorded from the Sangikar river valley in the far north of the AoI.	TRB VU
Short-toed snake-eagle *Circaetus gallicus*		A breeding and passage migrant within Tajikistan that is found across many habitats, mainly influenced by prey availability (snakes and other reptiles). The species requires some level of mature	TRB EN Migrant

Species name	Numbers observed during VP surveys	Habitat[8] and distribution	Conservation status
		tree cover within its range and is tree-nesting. The AoI appears partially optimal for this species. No records were obtained from the 2023 field surveys, and the species is considered to be rare across the AoI.	
Himalayan sparrowhawk *Accipiter nisus*		A resident breeding species in Tajikistan that is widely distributed within mainly-forested areas where it forages and nests. Habitat suitability within the ZoI appears limited to the remnant juniper forests. No records were obtained from the spring 2023 field surveys, although a single bird was observed within the AoI during WSP's site visit in September/October 2023, and any population present here is likely to be small.	TRB EN
Osprey *Pandion haliaetus*		A rare passage migrant, with no records of breeding within the Vakhsh catchment. Requires waterbodies with live fish that can be readily predated. No records were obtained during the 2023 surveys although it's likely to occur migrate through the Vakhsh River valley.	TRB EN Migrant
Ibisbill *Ibidorhyncha struthersii*		A rare resident breeding species in Tajikistan, which requires particular floodplain habitat, breeding at high altitudes and then overwintering at lower altitudes. The species is very poorly studied, although it is known to require exposed, unvegetated floodplain habitat, in particular with braided channel and island features. The species was recorded within the Sangikar tributary outside of the flooding zone but within the AoI. Here, a pair of birds was observed, and the tributary is considered to provide good conditions for this species; similar conditions are absent from the main Vakhsh river within the AoI.	TRB EN
Blue whistling thrush *Myophonus caeruleus*		A rare resident breeding species that inhabits rocky, mountainous valleys above 1000m, with prevalent mosses and lichens. The habitats across the AoI appear sub-optimal for this species. No records were obtained from field surveys in 2023.	TRB VU
White-capped water-redstart *Phoenicurus leucocephalus*		A rare resident breeding species that occurs around fast-flowing watercourses. Records were made of this species during 2023 field surveys.	TRB VU

Species name	Numbers observed during VP surveys	Habitat[8] and distribution	Conservation status
Streaked laughing thrush *Garrulax lineatus*		A relatively common species across the AoI, occurring within scrubby habitats and amongst scattered trees. Records were made of this species during 2023 field surveys.	TRB VU
Indian paradise flycatcher *Terpsiphone paradisi*		A breeding resident species that occupies a wide range of habitats, including those associated with rural settlements (such as gardens). Not recorded during 2023 field surveys, although considered likely to be present in small numbers across the ZoI due to the suitable habitat present.	TRB VU
Common pochard *Aythya ferina*	37	A breeding resident in Tajikistan, although likely that some level of migration within the population also occurs. The species requires open water and abundant emergent vegetation, and so the habitat across the AoI is broadly sub-optimal. The species has been recorded from reservoirs downstream of Rogun (close to Nurek[9]). Not recorded during 2023 spring field surveys, although feasible that the current Rogun reservoir may be of use to the species on passage. Up to 12 birds observed on four separate occasions from each VP, in October and November. Flock size and behavior suggests migration along the Vakhsh valley. Some feeding/resting observed.	IUCN VU Possible migrant
European turtle-dove *Streptopelia tutur*		A fairly uncommon resident breeding species in Tajikistan, often associated with scrubby habitat, but also making use of steppe, forest edges, scrubby wasteland and agricultural fields (among other habitats), depending on its location. No records were made during the 2023 field surveys, and although the habitat is broadly sub-optimal (scrub vegetation is only sparsely present) it is expected that the species will be present within the AoI, albeit at low numbers	IUCN VU
Griffon (Himalayan) vulture	5	Relatively widespread mountainous species within Tajikistan, which resides at altitudes of 2500-4500m (undertaking annual vertical migration). Observed incidentally in the upper Vakhsh catchment during eDNA sampling surveys and also during migratory	IUCN LC TRB VU

[9] Record obtained from eBird – accessed at www.ebird.org

Species name	Numbers observed during VP surveys	Habitat[8] and distribution	Conservation status
		bird surveys. No indication that the AoI provides any important habitat for the species. Three observations (one of three birds) from VP1 in October and November, including birds landing on ridges above the inundation zone. No indication of migratory behavior, and this species is largely resident in Tajikistan.	
Brown-headed gull	3	Flock of three birds observed from VP1 in November, flying up the river valley. This species is a rare breeder in Tajikistan, with its breeding range restricted to the Pamir region in Tajikistan. Birds migrate south to their wintering grounds through Tajikistan. No indication of significant movement through the inundation zone, although given the low breeding numbers in the country, large flocks would not necessarily be expected.	TRB EN Migrant

9.4.60 It is worth noting that none of species listed above have any significant affinity with the AoI (that would suggest the AoI offered any notable importance to the species beyond surrounding areas); their presence/likely presence will be as part of a large home range, or because of migratory behavior which is dictated more by prevailing topography. The legacy of habitat modification across the AoI will have played an important role in reducing the relative importance of the AoI for the notable bird species listed above.

9.4.61 The analysis of eDNA from water samples collected within the project area, identified 31 species of birds, from 16 Families. Of the 31 species detected, 13 were identified down to Species level, 10 to Genus level, 4 to Family level and 4 unidentified at an Order level.

9.4.62 Of the 31 species detected (to species level), none were unexpected based upon desk study and field survey data collected for the Project to date. Indeed, many of the species identified were recorded visually (either anecdotally, or through dedicated bird surveys) for the Project, which likely reflects their relatively common nature.

9.4.63 **Table 9-9** provides details on the species identified.

9.4.64 As with the eDNA results for mammals, the nature/extent of bird species/groups detected is also likely a useful indicator of the relative frequency/abundance of the species, along with clear increase in records/volume of genetic material for birds associated with the aquatic environment.

9.4.65 The most commonly occurring bird within the samples was a duck, which was expected and was recorded from eight separate sampling locations. The next most common was a species of dove/pigeon, which again is logical due to the species' common and abundant occurrence across the study area. Other commonly recorded species such as flycatchers is likely representative of the birds' attraction to the river as a result of their prey also being abundant here.

Table 9-9 - eDNA results: birds

№	Family	Scientific name	English name
Accipitriformes			
1	Accipitridae	*Milvus migrans*	Black Kite
Anseriformes			
2	Anatidae		
3	Anatidae		
4	Anatidae		
Charadriiformes			
5	Scolopacidae		
Columbiformes			
6	Columbidae	*Columba*	
7	Columbidae	*Streptopelia orientalis*	Oriental Turtle Dove
8	Columbidae		
Galliformes			
9	Phasianidae	*Alectoris chukar*	Chukar Partridge
10	Phasianidae	*Tetraogallus*	
Gruiformes			
11	Rallidae	*Gallinula chloropus*	Common Moorhen
12	Rallidae	*Rallus aquaticus*	Water Rail
Passeriformes			
13	Acrocephalidae	*Acrocephalus scirpaceus*	Eurasian Reed Warbler
14	Corvidae	*Pica pica*	Eurasian Magpie
15	Corvidae		
16	Corvidae		
17	Fringillidae	*Carduelis carduelis*	European Goldfinch
18	Laniidae	*Lanius collurio*	Red-Backed Shrike
19	Muscicapidae	*Muscicapa striata*	Spotted Flycatcher
20	Muscicapidae	*Myophonus caeruleus*	Blue Whistling Thrush
21	Muscicapidae		
22	Oriolidae	*Oriolus oriolus*	Eurasian Golden Oriole
23	Phylloscopidae		
24	Sylviidae		
25	Turdidae		
26	Turdidae		
Podicipediformes			
37	Podicipedidae	*Podiceps nigricollis*	Black-Necked Grebe

Fish

9.4.66 Although approximately 36 fish species are known to be present within the Vakhsh River, many of them are now only found downstream of Nurek or the Vakhsh HPP Cascade, with the upper reaches of the Vakhsh River known to have much lower species composition than the lower parts of the river (Mirzoev, 2019). Sampling in the river upstream of Rogun in 2011 and 2023, determined that 21 fish species are likely to occur within the Rogun Project AoI. Of these 21 species, 10 have been sampled, with 3 being recorded in 2011 (ESIA, 2014), and 9 being recorded during the two 2023 field surveys, and 17 detected through the application of eDNA (**Table 9-10**).

Of the 21 fish species expected to occur in the Project AoI:

- Twelve (12) 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, and both *Salmo trutta oxianus* and *Glyptosternon oschanini* (previously referred to as *G. reticulatum*) have been confirmed in the study area.
- One (1) is Vulnerable on the IUCN Red List, although from the Aral Sea basin, *Cyprinus carpio* inhabits slow-flowing and still waters, such as lowland rivers and large, well vegetated lakes. This species has been introduced in all types of waterbodies.
- 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.
- Twelve (12) 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 as Critically Endangered on the IUCN Red list.
    - The Small Amu-Darya shovelnose sturgeon *Pseudoscaphirhynchus hermanni* and Amu Darya shovelnose Sturgeon *Pseudoscaphirhynchus kaufmanni*, listed as CR are not known to occur within the Vakhsh River upstream of the cascade of impoundments and were not detected during eDNA analysis (**Volume 1: Chapter 15.1** of this ESIA).
- No (0) migratory species as listed under CMS are expected to occur within the Project AoI.
    - As above, both the Amu-Darya shovelnose sturgeon and Amu Darya shovelnose Sturgeon are listed in Appendix II and are potamodromous.
- None (0) are listed under CITES.
    - As above, both the Amu-Darya shovelnose sturgeon and Amu Darya shovelnose Sturgeon are listed under Appendix II: International trade monitored.

9.4.67 For the purpose of this ESIA, the vulnerable status of the Turkestan Catfish *Glyptosternon oschanini* as presented in the TRB under *G. reticulatum* will be carried through as a precautionary approach.

9.4.68 The analysis of eDNA from water samples collected within the project area, identified 22 species of fish, from 6 Families. Of these 22 species, five (5) species were excluded by the laboratory based

on distribution and their unlikely occurrence in Tajikistan. These were interrogated based on in-country literature and are discussed below.

9.4.69 Of the 17 remaining species, 8 were identified down to Species level, 5 to Genus's level, 3 to Family level and 1 unidentified at an Order level.

9.4.70 Considered analysis of the results, species identified in the field and distributions, provided enough information to assume the following:

- Species
  - *Salmo trutta* (Brown Trout), detected at 8 sites within the Rogun Reservoir. Known to occur in the Nurek Reservoir. Possibility of Amudarya trout.
  - *Alburnus alburnus* (Common Bleak), detected at one site at the Nurek Reservoir. Assumed to be introduced for aquaculture.
  - *Paracobitis longicauda* (Eastern Crested Loach), detected at 2 sites within the Rogun Resivour. Found in Nurek Reservoir.
  - *Carassius auratus* (Goldfish), detected at both site at the Nurek Reservoir. Assumed to be introduced for aquaculture.
  - *Ctenopharyngodon Idella* (Grass Carp), detected at both site at the Nurek Reservoir. Assumed to be introduced for aquaculture.
  - *Channa argus* (Northern Snakehead), detected at 1 site within the Rogun Reservoir. There is anecdotal evidence of the species being introduced within the Vakhsh drainage.
  - *Hemiculter leucisculus* (Sharpbelly), detected at both site at the Nurek Reservoir. Assumed to be introduced for aquaculture.
  - *Pseudorasbora parva* (Stone Moroko), detected at one site at the Nurek Reservoir. Known to occur in the Nurek Reservoir.
- Genus
  - Cyprinus could be *Cyprinus carpio*. Detected in both Nurek samples and known to have been stocked in the reservoir.
  - Triplophysa could be *Triplophysa stolickai* (Tibetan loach). Detected throughout the Rogun Reservoir Study Area at 10 sites and was previously believed to occur within the study area.
  - Glyptosternon could be *Glyptosternon oschanini* (Turkestan Catfish). Detected thought out the Rogun Reservoir study area at 12 sites and captured during the 2011 fieldwork as part of the 2014 ESIA, and in 2023.
  - Hypophthalmichthys could be *Hypophthalmichthys molitrix* or *Hypophthalmichthys nobilis*, both reported on site in 2023. Detected at one site (Rogun Obin). Both species are known to have been stocked in Nurek.
  - Schistura from the Nemacheilidae Family could be *Iskandaria pardalis* (Turkestan loach). Detected at 4 sites and captured on site during the 2023 fieldwork. The Nemacheilidae (stone loaches), are a family of cypriniform fishes that inhabit stream environments of Eurasia.

- Family
  - Cyprinidae recorded in high abundance[10] at all sites is likely *Schizothorax intermedius* (Common Marinka), as this is widespread and common in the study area, detected at 13 sites in the Rogun Reservoir and within the Nurek Reservoir.
  - Salmonidae could be *Salmo trutta oxianus* (Amudarya trout). Detected at 2 sites and captured on site during the 2011 fieldwork as part of the 2014 ESIA.As mentioned above, the occurrence of Salmo trutta could represent the Amudarya trout as it is a subspecies, meaning that this Salmonidae detection could be Rainbow trout (*Oncorhynchus mykiss*), which also have the potential to occur within the study area.

9.4.71 The sequences for the following four (4) species were a 100% match to known refence material, however, were removed from the analysis based on distribution. Due to the high level of species introduction, these were checked, and the following was concluded:

- *Esox Lucius* (Northern Pike) - Rogun Kamarob 2
  - *Esox lucius* are native to North America and Eurasia. In Eurasia, it is known from the Caspian, Black, Baltic, White, Barents, Arctic, North and Aral Seas and Atlantic basins, southwest to Adour drainage. Widely distributed in central Asia and Siberia eastward to Anadyr drainage (Bering Sea basin). Although its distribution does not extend into Tajikistan, the National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity in Tajikistan (2003) does make mention of the species. Pike spawn in flooded marsh areas and requires submerged vegetation, it is unlikely to occur in the mountain headwaters of the Kamarob where it was detected.
- *Couesius plumbeus* (Lake Chub) - Rogun Res 3
  - *Couesius plumbeus* are native to North American. They can be found widely throughout Canada and in the north-temperate latitudes of the United States. There are no records in Tajikistan or Eurasia.
- *Lepomis macrochirus* (Bluegill) - Rogun Siyohdara 1
  - *Lepomis macrochirus* are native to North America and have been introduced widely in places such as Hawaii, Africa, Asia, South America, and Europe. There are no records in Tajikistan or surrounding countries. As this species prefers to live in lakes and slow-moving streams, it is unlikely to occur in the mountain headwaters of the Siyohdara where it was detected.
- *Gasterosteus aculeatus* (Three-spined stickleback) - Rogun Kamarob 1
  - *Gasterosteus aculeatus* are found across the northern hemisphere. In Europe it is found between 35 and 70°N. In Asia, the distribution stretches from Japan and the Korean peninsula to the Bering Straits. Freshwater populations are restricted to coastal areas in both Asia and North America. With no records in Tajikistan, the Three-spined stickleback is unlikely to occur within the study area.
- *Clupea harengus* (Atlantic Herring) – Rogun DS 1

9.4.72 *Clupea harengus* are native to the Atlantic Ocean and are found in the pelagic zone of marine waters, as well as coastal zones of throughout their geographic reach. With a single record in Asia (Uzbekistan in 1949), it is unlikely that Atlantic Herring will occur within the study area.

[10] Inferred by a stronger eDNA signal. This signal may be linked to abundance of species in the environment but should be interpreted only as a coarse measure because the signal is also impacted by biological (e.g., biomass, life stage, activity, body condition), environmental (e.g., temperature, pH, salinity, conductivity), and technical factors (e.g., primer bias, PCR stochasticity).

Figure 9-28 - Species Richness (fish) as detected through eDNA

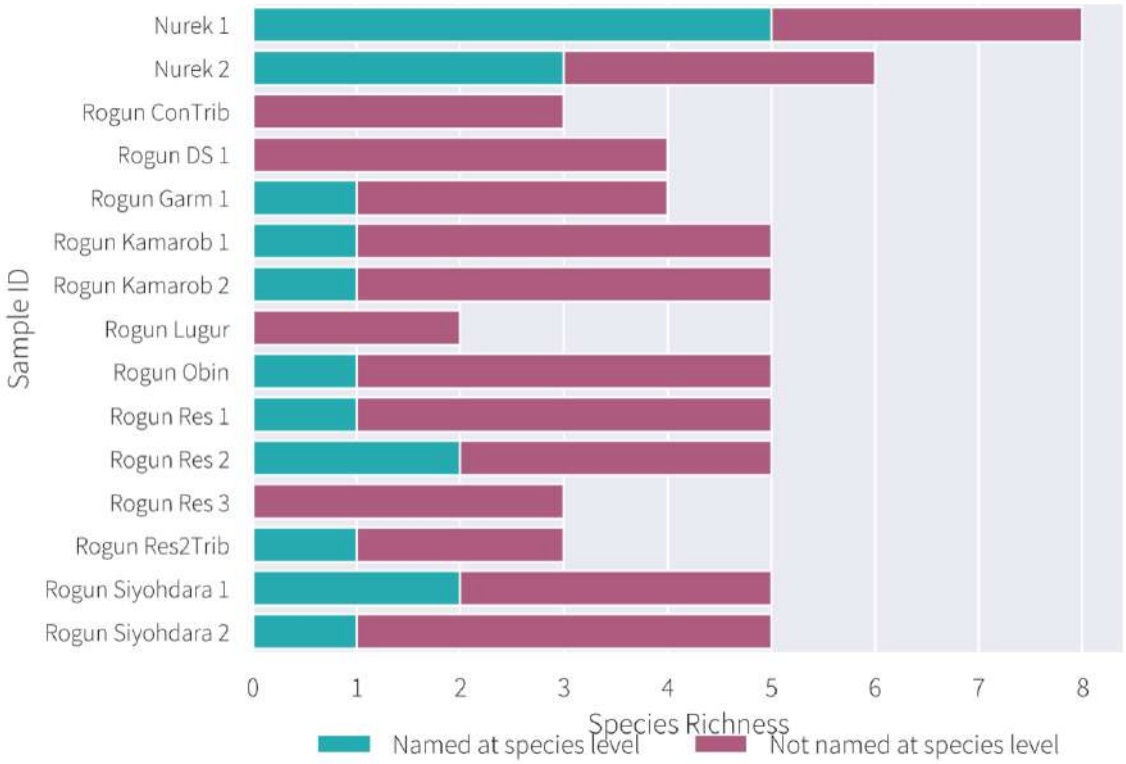


Table 9-10 - Fish species expected and recorded within the Rogun HPP AoI - Updated February 2024

№	Scientific name	Russian name	English name	Habitat and Distribution	2011 (2014 ESIA)	WSP 2023 (May)	WSP 2023 (Oct)	eDNA	Potential[11]	Introduced[12]	IUCN	RBT
	Salmonidae	**Лососевые**	**Salmonids**									
1	*Salmo trutta oxianus (subsp.)*	Амударьинская форель	Amudarya trout	Occurs in the upper reaches of the Amu Darya and in its tributaries, lakes and mountain reservoirs. Favours clear, well oxygenated cool waters.	✓·			✓*			-	**VU**
2	*Salmo trutta spp. aralensis* (Aral Sea and Amu Darya River stock)	Аральский лосось	Aral bulltrout	Aral Bulltrout's specific habitat was the Aral Sea. During the reproduction period it lays eggs in the upstream of Amu Darya River basin and its inflowing streams. Based on the weighted evidence this species is considered extirpated from the Amu Darya.							**CR**	**EN**
3	*Salmo trutta (fario)*	коричневая форель	Brown Trout	Found in streams, ponds, rivers and lakes. Lacustrine populations undertake migration to tributaries and lake outlets to spawn on gravel. Prefer cold, well-oxygenated upland waters.				✓·		✓	**LC**	-

[11] Potential – Species that have not been verified to occur within the Rogun HPP AoI, but through literature or higher order eDNA analysis have the potential to be present.
[12] Introduced – Species that are non-native

№	Scientific name	Russian name	English name	Habitat and Distribution	2011 (2014 ESIA)	WSP 2023 (May)	WSP 2023 (Oct)	eDNA	Potential[11]	Introduced[12]	IUCN	RBT
4	*Oncorhynchus mykiss*	Радужная форель	Rainbow trout	Inhabit clear, cold headwaters, small to large rivers and lakes. Spawns in small or moderately large, well-oxygenated shallow rivers with a gravel bottom.					✓·	✓	-	-
	Cyprinidae	**Карповые**	**Carps**									
5	*Schizothorax intermedius*	Обыкновенная маринка	Common marinka	Inhabits rivers and lakes in highlands. Spawning migration to incoming streams and breeding takes place in gravel and sandy beds.	✓·	✓·	✓·	✓*			**LC**	-
6	*Capoeta heratensis*	Самаркандская храмуля	Samarkand khramulya	Inhabits fast flowing streams and rivers, but also found in lakes. Algae-scraping cyprinid that feed off rocks.			✓·				-	-
7	*Alburnoides taeniatus*	Быстрянка пёстрая	Striped bystranka	Widespread in the Central Asia in Amu-Darya, Zeravshan, Syr-Darya, and Chu River. Inhabits sections of rivers and reservoirs with fast, clear flowing water.			✓·				**DD**	-
8	*Hypophthalmichthys nobilis*	Толстолобик пёстрый	Bighead carp	Introduced to numerous countries and has achieved a near global distribution. Found in rivers and lakes where it feeds on zooplankton and favors shallow waters and slow currents. Breeds in very deep, very turbid and warm water above 18°C (usually 22-30°C), with high current and high oxygen concentrations.			✓·	✓*		✓	**DD**	-

№	Scientific name	Russian name	English name	Habitat and Distribution	2011 (2014 ESIA)	WSP 2023 (May)	WSP 2023 (Oct)	eDNA	Potential[11]	Introduced[12]	IUCN	RBT
9	*Ctenopharyngodon idella*	Белый амур	Grass Carp	Native range from the Amur basin, Russia, to Xijiang, China and most major Pacific drainages in between. Used in aquaculture in Europe, Asia and North America. Inhabits lakes, ponds, pools and backwaters of large rivers, preferring large, slow-flowing or standing water bodies with vegetation.			·	✓·		✓·	**LC**	
10	*Hypophthalmichthys molitrix*	Толстолобик белый	Silver carp	Lives in rivers, lakes and ponds. Found in warm-water sections of rivers and lakes with extensive vegetation, in channels sprouted with grass between ponds with a gentle current. Breed in rivers or tributaries over shallow rapids with gravel or sand bottom, with turbid, warm water above 15°C (usually 18-26°C), with high oxygen concentrations.			✓·	✓*		✓·	**NT**	-
11	*Cyprinus carpio*	Сазан	Common carp	Hardy and tolerant of a wide variety of conditions. Favors large water bodies with slow flowing or standing water and soft bottom sediments, but also thrives in large turbid rivers. Breeds along shores or in backwaters.			✓·	✓*		✓·	**VU**	-

№	Scientific name	Russian name	English name	Habitat and Distribution	2011 (2014 ESIA)	WSP 2023 (May)	WSP 2023 (Oct)	eDNA	Potential[11]	Introduced[12]	IUCN	RBT
12	*Alburnus alburnus*		Common Bleak	Occurs in Europe and Western Asia and locally introduced in Spain and Italy, in Lake Abrau (Black Sea coast of Russia) and in the Irtysh River. Inhabits open waters of large lakes and medium to large rivers. Spawns in shallow riffles or along stony shores of lakes, occasionally above submerged vegetation.				✓·		✓·	**LC**	
13	*Carassius auratus*	золотая рыбка	Goldfish	Native to eastern Asia but has an expanded range to most of the world. Prefer bodies of water with slow or no movement.				✓·		✓·	**LC**	
14	*Hemiculter leucisculus*		Sharpbelly	The species has an east Asian distribution. It is distributed from the Amur River basin in the north to the Huong River basin in the south.Known to be introduced in Iran, Afghanistan, Uzbekistan and the former Soviet Union, where it has displaced local species. Usually found in large and medium-sized rivers in shallow water over sandy bottom, but sometimes occurs in pools along the bed of mountain streams. Highly tolerant to water pollution.				✓·		✓·	**LC**	

№	Scientific name	Russian name	English name	Habitat and Distribution	2011 (2014 ESIA)	WSP 2023 (May)	WSP 2023 (Oct)	eDNA	Potential[11]	Introduced[12]	IUCN	RBT
	Cobitidae	**Вьюновые**	**Loaches**									
15	*Pseudorasbora parva*	Амурский чебачок	Topmouth Gudgeon / Stone Moroko	Found in a wide variety of habitats including cool flowing water, vegetated channels and lakes. Usually breed under stones in habitats with still or very slow-flowing water.				✓·	✓·	✓·	**LC**	**-**
16	*Triplophysa stolickai (Synonym: Nemacheilus stoliczkai)*	Тибетский голец	Tibetan loach	Found in mountain streams and springs, as well as standing waters. Lives amongst rocks in swift-flowing streams and slow water currents of gravel and mud bottoms and submerged waterweeds				✓*	✓·		**LC**	**-**
17	*Paracobitis longicauda (Synonym: Nemacheilus malapterurus longicauda)*	Гребенчатый голец	Eastern crested loach	Inhabits streams with moderately to fast flowing water in both mountainous and lowlands. Prefers coarse gravel and boulders substrate.				✓·	✓·		**-**	**-**
18	*Iskandaria pardalis (Synonym: Nemacheilus pardalis)*	Туркестанский голец	Turkestan loach	Endemic to Central Asia where it is found in the upstream rivers of the Amu Darya drainage. Prefers fast flowing running water with rocky or sandy substrate.			✓·	✓*			**LC**	**-**
	Sisoridae	**Сомообразные**	**Catfish**									
19	*Glyptosternon oschanini*	Туркестанский Сом	Small Turkistan sheatfish / Turkestan Catfish	Predominant found in mountain rivers and streams under stones and rocks. Favours rapids.	✓·		✓·	✓*			**LC**	**VU**
	Gobiidae	**Бычковые**	**Goby**									

№	Scientific name	Russian name	English name	Habitat and Distribution	2011 (2014 ESIA)	WSP 2023 (May)	WSP 2023 (Oct)	eDNA	Potential[11]	Introduced[12]	IUCN	RBT
20	*Rhinogobius similis*	Амурский бычок	Amur goby	Native to Japan and China. Inhabits the upper and middle sections of rivers with sandy and rocky substrate.		✓·	✓·	·		✓·	**LC**	-
	Channidae		**Snakeheads**									
21	*Channa argus*	змееголов	Northern SnakeHead	Native to East Asia. Inhabits many types of freshwater habitats, from lakes and ponds to slow-moving rivers and streams. Prefer shallow still or slow-moving waters with mud bottoms and plenty of aquatic vegetation. Known to have establish themselves in the countries of Kazakhstan, Turkmenistan, and Uzbekistan.				✓·		✓·	**LC**	

Figure 9-29: Amu Darya Trout from 2011 survey (ESIA, 2014)



Salmo trutta oxianus, a sub-species of the Brown Trout that was captured in 2011 and has a designation of Vulnerable in the TRB. The specimens were captured in the Mudzhiharv Creek where the water was relatively clear (ESIA, 2014) and was detected during eDNA sampling. The Amu Darya Trout is endemic to the Amu Darya River. It is found in Qaratogh, Kofarnihon, Vakhsh, Surkhob, Kamarov, Obikhingov rivers and their tributaries, and in Nurek Reservoir (Red Book, 2017).

9.4.73 The most commonly reported species within the Project area was the Common Marinka (*S. intermedius*), which is targeted by local fisherman (Figure 9-30). Common Marinka is a widespread species that inhabits a wide range of rivers and also occasionally lakes, but it is usually found in flowing waters (Karimov and Mamilov, 2020). The species is variable and some of its subpopulation possibly should be recognized as separate species. For example, *S. intermedius* and *S. fedtschenkoi* both are considered as synonyms of *S. curvifrons* by Froese and Pauly (2013), but all three are recognized as valid species in the Catalog of Fishes (2023).

Figure 9-30 - Common Marinka caught by local fishermen



9.4.74 Downstream, within the Nurek Reservoir, a total of 16 fish species were recorded between 1979 – 1982 (ESIA, 2014). See **paragraph** Error! Reference source not found. for further information.

9.4.75 It should be noted that there have been nomenclature updates to two further species of fish, these include:

- The Turkestan loach *Nemacheilus pardalis* which has a valid status of *Iskandaria pardalis* (Turdakov 1941).
- The Samarkand khramulya *Capoeta capoeta heratensis* which has a valid status of *Capoeta heratensis* (Keyserling 1861).

Freshwater Diversity (Excluding Fish)

9.4.76 The 2011 aquatic studies sampled benthic organisms as they are an important food source for many fish. Data included 2 species of Acaridae (mites), 2 species of Oligochaeta (worms), 2 species of Trichoptera (caddisflies), 6 species of Ephemeroptera (mayflies), 12 species of Diptera (flies) and 1 species of Mollusca (snails) (ESIA, 2014).

9.4.77 During the October 2023 site visit, an exploratory investigation for aquatic macroinvertebrates was conducted. The clear water of the tributaries showed to have the highest diversity of taxa, and included sensitive species such as Blephariceridae, Heptageniidae, Tricorythidae and Hydropsychidae. Within the turbid waters, the rocks were often covered in silt, with more tolerant taxa such as Simuliidae present.

9.4.78 The analysis of eDNA from water samples collected within the project area, identified 483 species of freshwater Animalia, comprised Arachnida, Clitellata, Gastropoda, Hexanauplia, Insecta and

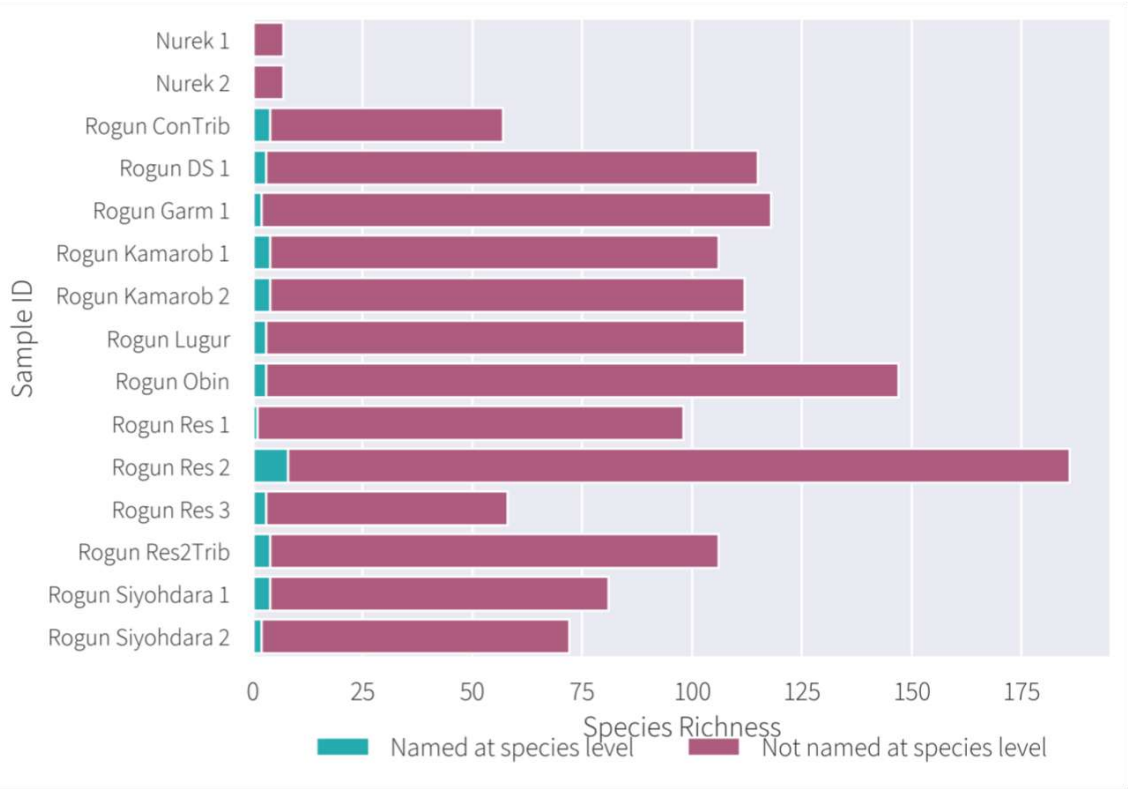
Ostracoda. Of these 483 species, 16 were identified down to Species level, 81 to Genus level, 295 to Family level and 8 unidentified at an Order or Phylum level.

9.4.79 No species designated Vulnerable, Endangered or Critically Endangered were detected in the samples. No invasive species were detected in the samples.

9.4.80 Diptera (Flies) were dominant across all sites.

9.4.81 Hexanauplia (Copepoda and Thecostraca) and Lepidoptera (Butterflies) were only detected in the two Nurek samples. Overall, Nurek showed significantly lower species richness than any of the other sites.

Figure 9-31 - Species Richness (non-fish) as detected through eDNA analysis



9.5 FUTURE BASELINE

9.5.1 The future baseline under a 'do nothing' scenario would most likely reflect conditions currently presented across habitats upstream of the impoundment. There is no reason to believe that the dominance of heavily modified habitats would not persist, with land use likely to remain at current levels into the foreseeable future.

9.5.2 The only slight exception to the above would be for woodland habitat, which is in decline across all of Tajikistan (USAID, 2012) and is significantly reduced within the Vakhsh valley. It is therefore reasonable to assume that the remnant woodland identified during surveys would decrease in extent further, as human pressures continue in these areas (e.g., low levels of firewood collection, grazing pressures, etc.). The same logic for this consideration applies to notable flora, especially those currently collected for firewood, foodplants, pharmaceutical use, etc.

10 ECOSYSTEM SERVICES

10.1 SOURCES OF BASELINE DATA

10.1.1 The following sections describe the information relevant to the baseline for ecosystem services in respect of the Project. The baseline data collected to inform this assessment has comprised a review of:

- Previous ESIA documentation;
- Information from other technical workstreams, specifically the Biodiversity and Social Technical Annexes (including the primary data they have collected such as field surveys and stakeholder engagement – no additional primary data collection was held for the completion of this technical annex). Further details regarding the baseline data collection exercise are provided within the Biodiversity and Social Technical Annexes.
- Academic literature and other relevant documentation available online.

10.1.2 A summary of baseline conditions for ecosystem services are presented in Volume I, Chapter 7. Please note the following limitations of the Ecosystem Services assessment:

- This is a high-level assessment that complements the Biodiversity and Social assessment. Its aim is to provide a general overview of ecosystem services that are likely to be impacted by the project and demonstrate the link between biodiversity and social impacts.
- This assessment was applied retrospectively. The analysis is based on pre-existing data; primary data was not collected for the sole purposes of the ecosystem services assessment.
- In light of these characteristics:
  - The assessment comprehensively investigates a large breadth of provisioning, regulating, cultural and supporting ecosystem services, and extracts those that are key to consider for the Project.
  - However, the assessment is qualitative. Furthermore, to manage uncertainty – which is a known limitation of a high-level and retrospective assessment – the precautionary approach has been applied to the extent that it was deemed appropriated based on professional opinion and experience. The precautionary approach is recommended by ESS6 and follows the principle of, where there is a lack of information, a cautious scenario is applied.

10.2 CURRENT BASELINE

Table 10-1 - Baseline Ecosystem Services within the scope of the ESIA assessment for Rogun HPP

N*	Receptor	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritization?	Reason for prioritization	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 products, like nuts).	Yes	Impacting affected communities	Social Technical Annex
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	Social Technical Annex
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 blood).	Yes	Impacting affected communities	Social Technical Annex
4	Protected areas (Kamar Ob	Between 10 and 50km of the project	Cultural	Physical and experiential interactions	3.1.1	Local economies, tourists	Some nature reserves (like Sarikhosor natural park) are used for ecotourism and recreation.	No	Nature reserves unlikely to be affected by the project, and	IBAT report and Biodiversity Technical Annex

N*	Receptor	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritization?	Reason for prioritization	Source of information
			General class	CICES group	CICES group code					
	Valley, Sarikhos or natural park, Nurek, Romit)			with natural environment			Foreign tourists contribute to the local economy.		therefore unlikely to affect the project or local communities	
5	Local healing and thermal waters	Freshwater systems near the Obigarm community (1km outside AoI)	Provisioning	Other aqueous outputs	4.2.X	Local communities	The Obigarm 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.	No	Outside AoI, very unlikely for there to be hydrological connectivity between the water sources.	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
6	Croplands and orchards	Exact location unknown	Provisioning	Cultivated terrestrial plants for nutrition, materials or energy	1.1.1	Local communities	A large proportion of the area has been converted for cultivation. Cultivated plants or agricultural products harvested by people for human or animal consumption as food.	Yes	Impacting affected communities	ESIA 2014, Biodiversity Technical Annex
7	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, Biodiversity Technical Annex
8	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, Biodiversity Technical Annex

N*	Receptor	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritization?	Reason for prioritization	Source of information
			General class	CICES group	CICES group code					
9	Remaining woody areas (Juniper woodland)	Land habitats within the AoI	Cultural	Spiritual, symbolic and other interactions with natural environment	3.2.1	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 have social and cultural benefits for local communities.	Yes	Impacting affected communities	ESIA 2014, Biodiversity Technical Annex
10	All habitats	All habitats within the AoI	Supporting	Other type of regulation and maintenance service by abiotic processes	5.3.1	Local communities	Providing habitats (terrestrial, floodplains, freshwater) for species and promoting biodiversity including important, IUCN red-listed and/or EU Habitat Directive Annex listed species.	Yes	Impacting affected communities (for specific species see the Biodiversity Technical Annex)	Biodiversity Technical Annex
11	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
12	Floodplains	70km long stretch of floodplains going through different altitudinal zones and including to particularly special floodplain habitats.	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*	Receptor	Location	Type			Beneficiaries	Short Description of the Benefit	Prioritization?	Reason for prioritization	Source of information
			General class	CICES group	CICES group code					
13	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
14	Freshwater streams	Vakhsk, Surhob rivers	Provisioning	Wild animals (terrestrial and aquatic) for nutrition, materials or energy	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)
15	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)
16	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)

10.3 GENDER CONSIDERATIONS

10.3.1 A key aspect of the assessment is to identify those services which are used particularly by females and vulnerable groups. Services identified for the Rogun HPP Project as being of particular importance to females are:

- **Access to water:** this is a significant consideration for women. In consultation, many stakeholders cite the limited access to water at their current locations as a big complaint. As the majority of home-based responsibilities are placed on women and they are often the main users of utilities at home, issues with access to water can disproportionately impact women.
- **Agriculture:** Many women are engaged in agriculture and tending to orchards on their home-based plots. Additionally, a significant proportion of (mainly) men are working overseas due to labor migration and sending remittances home, which leaves women all the more responsible for agriculture and tending to their home plots. Furthermore, women can rely on informal income generation activities such as the sale of agricultural products, a household survey that was undertaken shows over 4.5 percent of women highlighting arable agriculture as their primary source of income and a total of nearly 6.5 percent when including cattle breeding and subsistence farming.

11 SOCIAL BASELINE

11.1.1 This section sets out the baseline for the social aspects of the Project, including socio-economics, labor and working conditions, and community health, safety and security (CHSS).

11.2 DATA COLLECTION

11.2.1 Desktop research, secondary data resources and primary data collection tools were used for the social baseline and impact assessments. Secondary sources covered during desktop review included:

- Published literature on socioeconomic research conducted in Tajikistan;
- Government data resources (PMG, DFZ, local authorities, Tajikistan National Statistics-TajStat);
- International data resources such as the United Nations (UN) and World Bank;
- Satellite imagery, maps;
- Previous environmental and social studies for Rogun HPP;
- Reports published by other donor and international organizations; and
- Online media, newspaper, articles.

11.2.2 Primary data was collected through quantitative and qualitative research methods including:

- Labor audit interviews, conducted by WSP in March 2023;
- Key informant interviews with key stakeholders and service providers for the gender assessment, conducted by a WSP local gender specialist, July 2023;
- Focus Group Discussions (FGDs), conducted by M-Vector Tajikistan in July and August 2023 – 36 in total (18 women FGDs in resettled, to-be resettled, host communities and 18 men FGDs in resettled, to-be resettled and host communities) covering around 285 participants;
- Key informant interviews with Jamoat leaders, conducted by M-Vector in July 2023 – 12 Jamoats;
- Household surveys, conducted by M-Vector Tajikistan in August 2023 – 900 households; and
- Site visit observations.

11.2.3 Primary data has been used for the resettlement-related studies and labor, gender and stakeholder engagement plans that have been developed by WSP, as well as feeding into the social baseline presented here. All data was collected from respondents aged 18 years and above. Additionally, face-to-face interviews and meetings were conducted with various project stakeholders on resettlement, livelihoods, gender, labor and stakeholder engagement between December 2022 and September 2024:

- PMG;
- Rogun JSC;
- Contractors;
- DFZ;

- Ministry of Labor, Migration and Employment of Population (MLMEP);
- Committee for Women and Family Affairs (CoWFA);
- Department of Women and Family Affairs at Districts;
- State Investment Committee (SIC);
- State Unitary Enterprise for the Registry of Real Estate (SUERRE);
- Bureau on Technical Inventory (BTI);
- State Committee on Land Management and Geodesy;
- UN organizations (UN Women, UN Population Fund (UNFPA), International Labor Organization (ILO));
- Non-governmental organizations (NGOs) supporting women and livelihood generation in Tajikistan;
- Local jamoats, district governors and other local government representatives; and
- Community members.

11.2.4 The main limitations faced during primary data collection were related to lack of centralized data systems and reliance on manual data collection, which led to data inconsistency and errors.

11.2.5 Baseline information is provided at a national level for context, with more localized information provided where available. Project impacts are considered up until 2032 when all resettlement activity is anticipated to be complete. Full reservoir inundation level (i.e.1290m) is anticipated to be achieved in 2038. It is noted that many households continue to use their previous lands until inundation occurs, even once resettlement in terms of their lands, assets and house construction are complete.

11.3 SOCIO-ECONOMICS: POPULATION AND DEMOGRAPHICS

11.3.1 General social indicators about Tajikistan are presented in **Table 11-1**. The most up-to-date data available has been used, and where possible compared to the data used in the 2014 ESIA (dated 2010).

Table 11-1 - Social Indicators

Social Indicators	2010 (2014 ESIA)	2023
Population (millions)	7.1	10.1 (World Bank, 2024)
Average annual population growth (%)	1.9	1.9 (World Bank Group, 2024)
Urban population (% of total)	26.5	28.0 (World Bank Group, 2024)
Net migration (thousands)	-34	-20 (World Bank Group, 2024)
Life expectancy at birth	-	71.6 (World Bank, 2024)

11.3.2 This report has focused on the districts (Rayons) of Rogun, Nurobod and Rasht, which are situated in the Rasht Valley region in the Northeast of Tajikistan. These Districts form part of the Districts of Republican Subordination (DRS), an administrative region in Tajikistan that consists of 13 Districts and Cities which are under centralized rule.

11.3.3 Details about Rogun City, Nurobod District and Rasht District were gathered from the local authorities through DFZ. General population information about these areas is presented in **Table 11-2**.

Table 11-2 - District Populations (August 2022)

	Rogun City	Nurobod (2020)	Rasht
Population size	47,147	75,023	139,848
% Male	50.6%	51.2%	50.9%
Number of Households	6,901	9,663	19,151
Population density (per km^2)	73.1	80.5	27.8

11.3.4 Information about the population of the Jamoats affected by resettlement was provided through interviews with Jamoat leaders in 2023. Information from these interviews is presented throughout the baseline where it was available. **Table 11-3** provides initial information about the households and populations that constitute the affected Jamoats.

Table 11-3 - 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
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	---
	Nusratullo 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 Istikloliat (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.

EDUCATION

11.3.5 A selection of indicators is presented in Table 11-4 relating to education in Tajikistan. The most current indicators are presented alongside those provided in the 2014 ESIA where possible (dated 2010).

Table 11-4 - Education Indicators

Education Indicator	2010	Year varies (World Bank Group, 2024)
School enrolment, primary (% gross)[13]	101.5	100.9 (2017)
School enrolment, secondary (% gross)	84.7	87 (2013)[14]
School enrolment, tertiary (% gross)	22.9	32.3 (2017)
Literacy rate, adult total (% of people ages 15 and above)	99.7	99.8 (2014)
Educational attainment, at least completed lower secondary, population 25+, female (%) (cumulative)	91.9	93.4 (2017)
Educational attainment, at least completed lower secondary, population 25+, male (%) (cumulative)	95.4	95.7 (2017)
Government expenditure on education, total (% of govt expenditure)	15.3	20.4 (2021)

11.3.6 According to the household level-data obtained from the household surveys, on average the highest level of formal education among family members of households is secondary education, including vocational education degrees (more than 30%). Of the household members covered in the sample, 16.5% are pre-school aged children (**Table 11-5**).

Table 11-5 - 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

[13] 'Gross' school enrolment refers to the percentage of the total school-age population and can exceed 100% if overage and underage students are present. 'Net' enrolment excludes overage and underage students. Net enrolment was 97.9% in 2010, and 98% in 2017, the most recent year for which data is available.

[14] This data is over 10 years old at the time of writing, and, while some more recent sources suggest current figures may be significantly higher – for example, the Aga Khan Foundation's Schools2030 project states that both primary and secondary school enrolment is now 99.9% in Tajikistan **Invalid source specified.** – this is unverified.

Highest level of formal education among members	Total	Number of family members in survey sample
	%	Number
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

11.3.7 The population of young (15-24) people in the household survey sample reported to be not in employment, education or training (NEET) is high, at 41.3% (see Table 11-6). A higher proportion of women (57.8%) than men (27.5%) are NEET. This implies a potential social exclusion risk if the Project does not address the particular challenges for young people and especially young women in the job market, particularly in terms of livelihood restoration for resettled communities.

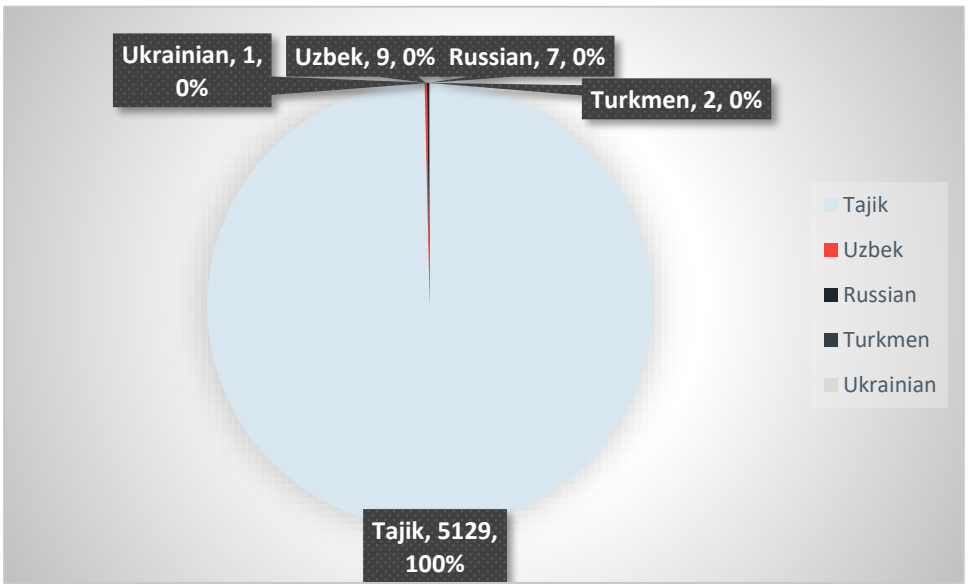
Table 11-6 - Youth in Sample Population (NEET)

	Gender		
	Male	Female	Total (N=989)
Neither in education nor in employment	27.5%	57.8%	41.3%

NATIONALITY/ETHNICITY

11.3.8 The household survey questionnaire included nationality/ethnicity in the household roster. 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, nine members as Uzbek, seven as Russian, two as Turkmen, and one as Ukrainian (see Figure 11-1).

Figure 11-1 - Sample Population Nationality Breakdown



RELIGION

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

11.4 SOCIO-ECONOMICS: LOCAL ECONOMY AND EMPLOYMENT

11.4.1 A selection of economic indicators for Tajikistan is presented in Table 11-7. The most current data is presented and compared where possible to the statistics presented in the 2014 ESIA (dated 2010).

Table 11-7 - Economic Indicators

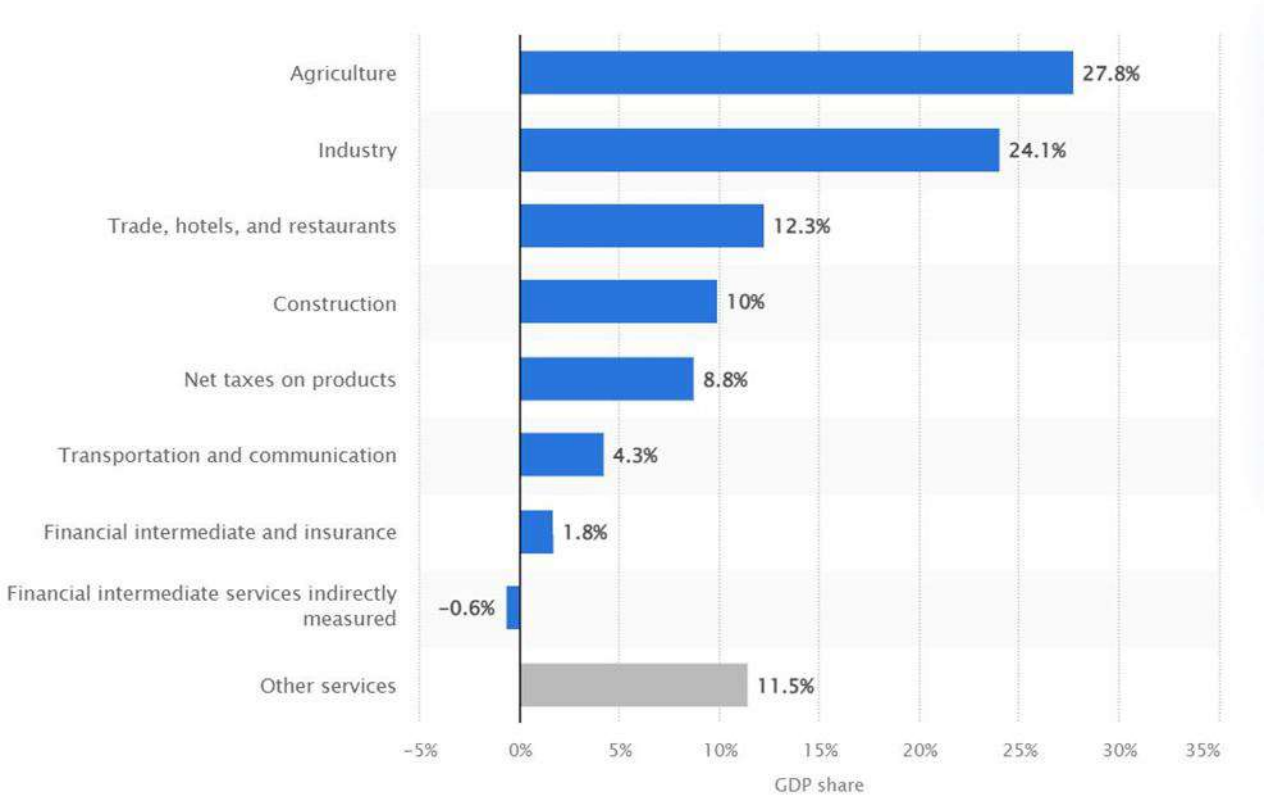
Economic Indicator	2010	2023 (World Bank Group, 2024)
Gross Domestic Product (GDP) (USD, billions)	5.64	12.06
GDP per capita (USD)	740.3	1,189.0
Gross National Income (GNI) per capita, Atlas method (current USD)	910	1.140
GNI per capita, purchasing power parity (PPP) (USD)	2,840	6,380
GDP growth (annual %)	6.5	8.3
Net Official Development Assistance (ODA) received (USD, millions)	388	611.8 (2022)
Foreign direct investment, net inflows (% of GDP)	9.4 (2008)	1.2
Personal remittances, received (% of GDP)	35.8	38.4

Economic Indicator	2010	2023 (World Bank Group, 2024)
Unemployment (% total labor force)	-	7.0
Population below national poverty line (%)	47.2	21.2 (UNICEF, 2024)

11.4.2 In 2023 it was estimated that 21.2% of the Tajikistan population was living below the national poverty line. This demonstrates a large improvement from the 2010 national poverty rate of 47.2%. Remittances, provided to households from members who are working as a migrant abroad, have played an important role in reducing poverty and providing an income to an estimated 30-50% Tajikistan households, comprising almost 40% of GDP in 2023 (World Bank, 2023). Incomes, particularly in rural areas such as the Rasht Valley region, tend to depend on unstable factors such as agriculture, livestock and remittances. Emigration out of Tajikistan is high, particularly amongst younger Tajiks, due to the limited availability of jobs and the higher incomes available abroad.

11.4.3 Agriculture makes up 27.8% of the country's GDP (2021 estimate (Statista, 2024)) and provides 44% of employment (2022 estimate (World Bank Group, 2024)), with the most important agricultural products from an economic perspective being cotton and wheat (Food and Agriculture Organization (FAO), n.d.). Extensive cultivation of fruit, nuts and vegetables, both for sale and personal consumption, also occurs (FAO, 2022).

Figure 11-2 - GDP share of different sectors in the economy of Tajikistan (Q4 2021) (Statista, 2024)



11.4.4 Tajikistan is included in the UNDP's global Multi-dimensional Poverty Index (MPI) measurement, which is done by measuring overlapping deprivation across ten indicators over three dimensions: health, education and standard of living. The most recent MPI for Tajikistan estimates that 7.4% of the population is multidimensionally poor, while an additional 20.1% is vulnerable to multi-dimensional poverty (UNDP, 2023). Full details of the ten MPI indicators for Tajikistan are presented in Table 11-8 (Oxford Poverty and Human Development Initiative (OPHI), 2023).

Table 11-8 - Multi-dimensional poverty indicators

Multi-dimensional Poverty	2012	2023
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	3.5
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	3.6
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	5.7
Population who are multi-dimensionally poor and deprived in assets (%)	1.7	0.3

11.4.5 According to the household survey data shown in Table 11-19, the main source of income is based on the remittances from labor migration (33.1%), followed by pensions (19.6%), public sector work (11.9%), agriculture (6.9%), self-employment (6.1%) and seasonal work (5.3%). Employment on 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 11-9 - 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 on the 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%
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%

11.4.6 Only 14 % of the women in the sample population reported having a source of income. Among those who have an income, 50% receive a pension, most likely from their husbands. Around 17% (339 out of 2478 women) of the women in the sample are engaged in public sector work (mainly as teachers, healthcare workers, and civil servants) earning regular income. Household farming is 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.

11.4.7 Interviews with the leaders of the affected Jamoats provided further detail of the existing income sources in the affected populations, as well as the planned economic activities following resettlement, detailed in **Table 11-10**.

Table 11-10 - Jamoat economic activity

District	Jamoat	Main economic activities	Planned economic activities once settled (where known)
Rogun	Sicharogh	1. Rogun HPP 2. Agriculture 3. Beekeeping 4. Road construction	School Trade Agriculture-horticulture, cattle breeding
Nurobod	Khakimi	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture (arable)	Farming Commercial activities
	I. Halimov	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture	Many are going to open their own small business
	Khumdon	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture 4. Trade	Unknown
	Mehrobod	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture 4. Beekeeping	Agriculture and business.
	Mujikharf	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture (arable)	Resettlers will take whatever employment opportunities are available in their new location
	Safedchashma	1. Labor migration abroad 2. Rogun HPP 3. Beekeeping 4. Trade	Tourism and hospitality, e.g. hotels, catering
Rasht	B. Rahimzoda	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture (arable)	Unknown
	N. Makhsum	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture	Mainly in education and health care. Some will develop their businesses.
	Obi Mehnat	1. Labor migration abroad 2. Rogun HPP 3. Beekeeping 4. Trade	Everyone be able to work according to their profession.
	Qal'ai Surkh	1. Labor migration abroad 2. Rogun HPP 3. Beekeeping 4. Trade	Resettlers will take whatever employment opportunities are available in their new location

District	Jamoat	Main economic activities	Planned economic activities once settled (where known)
	Navobod town	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture	This settlement has not been relocated yet.
Faizobod	Buston	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture 4. Beekeeping	Agriculture Construction work
Tursunzoda	10 Years of Independence	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture 4. Trade	Agriculture Gardening
	Toichi	1. Labor migration in Russia 2. Rogun HPP 3. Agriculture 4. Trade	Agriculture Gardening

11.4.8 Tajikistan is in the process of developing its nascent tourism industry. The Committee for Tourism Development was set up in 2017 and, in 2018, the Development Strategy for Tourism in Tajikistan for the Period to 2030 was published. Data provided by CEP states that Tajikistan welcomed more than 400,000 visitors in 2017, compared to just over 86,000 in 2016, and that there were ambitions to increase this figure to 1 million people per year by 2020. This goal was achieved ahead of schedule in 2018. However, out of approximately 1.035 million visitor arrivals, just 74,000 stated their purpose as 'holidays, leisure, and recreation,' while the vast majority (956,000) stated 'other personal purposes,' such as visiting friends and family (UN Tourism, 2022), which suggests that the majority of these visitors are not engaged in tourism per se.

11.4.9 A World Bank Group study of tour operators in 2019 found that the package-tour market in Tajikistan, which is the most significant tourist activity in Tajikistan in terms of revenue generation (Statista, 2024), was largely driven by adventure tourists from high-income countries in Europe, North America and Australia, and to a lesser extent China, who were mostly interested in nature and cultural activities. 80% of the surveyed tour operators reported increased interest in Tajikistan in recent years, and 89% stated that they believed Tajikistan had not reached its full potential regarding tourism (World Bank Group).

11.5 LAND ACQUISITION AND RESETTLEMENT

OVERVIEW OF RESETTLEMENT TO DATE

11.5.1 The Project will result in the involuntary resettlement of over 50,000 people from 69 settlements situated within the future footprint of the Project in Rogun City and Nurobod and Rasht Districts. Details about the resettlement are included in the Resettlement and Livelihood Restoration Framework (RLRF), which was disclosed in June 2024 (https://energyprojects.tj/index.php/en/rogun-hpp/eko-sots-instrument/1251-rlrf). RAP 2 also includes details on the second phase of resettlement. It is available at energyprojects.tj.

11.5.2 The reservoir will be filled over a period of several years, up until approximately 2038, with resettlement of the affected villages phased over this period. Physical resettlement is due to be completed by 2032.

11.5.3 Resettlement of the affected villages began in the early 1980s as construction of the Project commenced. In the early 1990s construction was paused after the breakup of the Soviet Union led 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. DFZ was set up to manage resettlement and other activities in 2011.

11.5.4 A summary of documents prepared to guide the implementation of resettlement activities is provided in **Table 11-11**.

Table 11-11 - Resettlement Documents

Document	Year	Purpose
Resettlement Policy Framework (RPF)	2014	Guides implementation of Phase 1 resettlement (2008-2017)
RAP 1 and LRP 1	2014 and 2015	Detailed implementation plan for Phase 1 resettlement and livelihood restoration
DFZ internal planning documents	2017-2021	Plans for resettlement activities taking place between full implementation of RAP 1 and the commencement of 2017-2025 RAP 2
Resettlement and Livelihood Restoration Framework (RLRF)	2024	Updates the 2014 Resettlement Policy Framework (RPF) and Resettlement Action Plan (RAP) and provides guidance for the preparation of RAP 2 and Livelihood Restoration Plan 2 (LRP 2) for the years 2017-2026 of the second phase of the resettlement and livelihood restoration, as well as describing when future RAPs and LRPs will be prepared for the remaining stages of the reservoir filling. The aims of the RLRF are to: ▪ Assess the ongoing resettlement process and provide recommendations for bringing RAP 2/LRP 2 in line with the lenders' requirements; ▪ Set out a strategic plan to effectively manage involuntary resettlement, ensuring living conditions for Project-affected communities (PACs) are equivalent to, if not better than, those which existed before the Project; ▪ Co-ordinate resettlement activities, including decision-making and providing sufficient resources; and ▪ Establish livelihood restoration principles. The objectives of the RLRF are therefore to: ▪ Detail resettlement objectives and principles, institutional arrangements, indicative number of affected people, summary of entitlements, indicative budget and timetables, and livelihood restoration modalities for upcoming resettlement activities for the period 2026 until the end of 2032, when resettlement will be completed before the inundation. The RLRF will guide the preparation of future RAPs and LRPs that will need to be prepared in synchronization with the stages of reservoir inundation after 2025. ▪ Summarize the Grievance Redress Mechanism (GRM) for resolving potential conflicts involving displaced persons; and ▪ Describe the arrangements for implementing and monitoring the resettlement process, including internal and external monitoring arrangements.

Document	Year	Purpose
RAP 2 and LRP 2 (2017-2026)	2025	RAP 2/LRP 2 assesses resettlement to date and includes measures to meet the lenders' requirements.
Future RAPs	2026 onwards	To be prepared to plan for resettlement taking place after 2025, guided by the 2024 RLRF.

11.5.5 Resettlement has been managed by DFZ since 2011. RAP 1 was completed in 2018 to manage resettlement of the first 8 villages, and a completion audit in 2018 confirmed that living standards for resettled communities had improved significantly, though livelihood restoration took some time. The processes set up during the RAP 1 period guided the initial RAP 2 program, which is now being updated as part of this TA package.

PHASE 1 RESETTLEMENT

11.5.6 Resettlement comprising eight villages in Rogun City and Nurobod District, 326 households, and 2,697 PAPs, was guided by RAP 1 developed in 2014, with an associated Livelihood Restoration Plan 1 (LRP 1) created in 2015. These villages were either situated within the construction footprint or were due to be flooded by early reservoir filling. According to audits on Phase 1 resettlement (Household-level Resettlement Audit (Intermediate) (2014), Dr. Eva Rossi and Lead Technical Consultant ; and Resettlement Audit of the Flooding Zone of Rogun Hydro Power Plant (2016), Baker Tilly), the resettlement program met the principles established in 2014 RPF, 2014 RAP 1, and LRP 1 and hence, was in line with the WB's previous requirements (WB OP 4.12).[15] However, the audits noted the time it took to restore livelihoods.

PHASE 2 RESETTLEMENT

11.5.7 In the 2014 E&S documentation for the Project, this phase referred to all resettlement activities after 2018 until 2032, covering the reservoir and the remaining area affected by dam construction. Phase 2 is currently divided into 2017-2026 (the RAP 2 period), and from 2026 until the end of 2032 (future RAPs).

11.6 LABOR AND WORKING CONDITIONS

WORKFORCE DATA

11.6.1 Indicators related to the labor force in Tajikistan are presented in **Table 11-12** and include the most current data available, compared to the indicators presented in the 2014 ESIA where possible (dated 2010).

Table 11-12 - Labor Indicators

Labor Indicator	2010	2023
Unemployment (% of total labor force)	10.9	7

[15] These have since been updated with new requirements under WB's ESF, specifically ESS 5 (refer to **Volume 1, Chapter 2: Administrative Framework**).

Labor force participation rate (%, female) (age 15 and older)	29.2	32
Labor force participation rate (%, male) (age 15 and older)	54.8	51

11.6.2 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.

11.6.3 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 were no Project-wide labor management plans or policies in place prior to the development of the 2024 Labor Management Plan (LMP) that formed part of this TA package, although some individual contractors had and continue to have their own Human Resources (HR) systems and policies.

11.6.4 In August 2023, a total of 14,746 people were identified as being engaged as workers on-site at the Project, which increased to 17,198 people by October 2024, and peak employment is likely to reach 20,000 people by the late 2020s. In 2023, women constituted around 5.1% of the total workforce. 18% of the total workforce is skilled workers (i.e., technical engineers), and the proportion of women in the skilled workforce is 5.8%. Current Project employees are primarily Tajik nationals (93.8%), of which 5.3% are women (as of August 2023).

11.6.5 In March 2023 it was understood that approximately 23% of the workforce was sourced from within 50 km of the Project. Employment fairs are regularly held in the local area to attract local workers, and a Job Centre in Rogun has been opened as part of an ADB-financed 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.

Table 11-13 - Project workforce statistics (August 2023)

	Total	Of whom are women (%)
Total workforce (no. workers)	14,746	5.1%
% skilled workers	18%	5.8%
% Tajik nationals	93.8%	5.3%
% locals (within 50km)	23%	[no data]

WORKING CONDITIONS IN TAJIKISTAN

Occupational health and safety (OHS)

11.6.6 Occupational health and safety (OHS) in Tajikistan is governed by the Labor Code, which includes requirements for employers to:

- Be responsible for ensuring safe working conditions and safety of work at every workplace (Article 331) and for informing workers of workplace conditions and the results of labor inspections (Article 332);

- Apply the means to protect workers individually and collectively (including protective clothing and equipment) (Article 335);
- Provide appropriate work and rest regimes;
- Training workers in their jobs and safe methods of work (Article 350);
- Provide instructions on labor protection (Article 336);
- Test and verify the knowledge of workers in working safely;
- Provide certifications of workplaces at least every five years;
- Investigate accidents (Article 342);
- Provide sanitation and medical services;
- Provide access to premises by state officials; and
- Providing social insurance for accidents and diseases.

11.6.7 Legislation also sets limits for exposure to harmful substances and noise, as well as requirements for adequate lighting, ventilation, hygiene, and fire and equipment safety. Personal protective equipment (PPE) must be provided as needed at no cost to workers. Emergency response plans, including regular drills, are required to be prepared and implemented. First aid arrangements must be in place. Recording and reporting of accidents by employers is required (Rivermate, 2024).

11.6.8 Workplace incident statistics from the National Information Agency of Tajikistan 'Khovar' and media organizations are presented in **Table 11-14**. The significant increase in deaths in 2023 relative to 2022 are attributed to a single accident at the Panjkent water treatment facility which killed 7 due to a gas leak (Ховар (Khovar), 2024). ILO-reported statistics from 2006 are also presented for comparative purposes. The number of injuries decreased dramatically between 2006 and 2023, although fatalities increased.

Table 11-14 - Workplace incident statistics

	2006 (ILO, 2008)	2022 (Aslanova, 2024)	2023 (Ховар (Khovar), 2024)
No. accidents	-	40	52
No. fatalities	23	25	36
No. injuries	105	46	34

Workers' rights

11.6.9 Tajik legislation (Article 208 and 174 of the Labor Code) prohibits employment of children under 15 years of age and bans workers under the age of 18 from participating in heavy, underground, harmful and hazardous works. The GoT conducted a survey of child labor in 2012 and found that 23.5% of children under the age of 17 were employed. This resulted in the adoption of the decree "On the National Program to Eliminate the Worst Forms of Child Labor in the Republic of Tajikistan for 2015-2020." However, no official updated statistics have been provided (Central Asian Bureau for Analytical Reporting (CABAR), 2021).

11.6.10 Forced labor remains a significant issue in Tajikistan, despite official efforts to eliminate it. The most significant risks are for vulnerable Tajik citizens being trafficked internationally, particularly to or within Russian, or for the cotton harvest, as well as sex trafficking of women and children. Within Tajikistan, vulnerabilities to trafficking exist for Afghan refugees and internally displaced people (U.S. Department of State, 2024).

11.6.11 Tajikistan scored 82.5 out of 100 in the 2024 Labor Rights Index. The right to form unions and participate in collective bargaining is recognized in Tajikistan, although there are some restrictions on the right to strike (Wage Indicator & Centre for Labour Research, 2024). Unions are active among the Project workforce and the majority of workers are covered by collective bargaining agreements.

11.7 COMMUNITY ASSETS AND INFRASTRUCTURE

HEALTHCARE FACILITIES

11.7.1 Tajikistan has a healthcare system which provides services to individuals who fulfil particular criteria. However, 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 (World Bank, 2021). However, a shift in focus in recent years to focus on primary healthcare has increased coverage and make steps towards universal healthcare (WHO, 2024).

Table 11-15 - Healthcare indicators (WHO, 2024) (World Bank, 2021)

	2018	2021
Health expenditure (% GDP)	7.2	8.01

UTILITIES

11.7.2 While the majority of the population in Tajikistan has access to electricity, many experience blackouts 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.

11.7.3 Access to clean drinking water continues to be a problem in Tajikistan, particularly in rural areas. Amongst rural populations, 18% do not have access to even basic drinking water services. Access to clean drinking water across Tajikistan has improved in the last decade. The proportion of the population with access to improved water sources increased from 75% to 84% between 2012 and 2020, although only 55% were using water supplies considered to be safely managed (World Bank Group, 2024). In the Project area, drinking water access is high but not universal. Data provided by I. Halimov, Qal'ai Surkh, Navobod town and Boqi Rahimzoda Jamoats have shown that at least some people within the jamoat do not have clean drinking water. Interviews with Jamoats and focus group discussions also indicated issues with water availability at resettlement sites, however it was also stated that many of these issues have been resolved and water availability has improved.

Table 11-16 - Utilities Indicators (World Bank Group, 2024)

Energy Indicator	Year varies	Year varies
Access to electricity (% of population)	98.8 (2010)	100 (2022)
Electric power consumption (kWh per capita)	2036.9 (2007)	1486.2 (2014)
Renewable energy consumption (% of total final energy consumption)	53.8 (2007)	34.9 (2022)
People using at least basic drinking water services (% of population)	69 (2010)	82 (2022)
People using at least basic drinking water services, rural (% of rural population)	61 (2010)	77 (2022)
People using safely managed drinking water services (% of population)	47 (2010)	55 (2022)

11.7.4 In Rogun City, water and power outages are relatively common. The Project and worker camps generate their own power from direct connection to the HPP and generators. Water is supplied to the Project site by tankering, and, in the case of one camp, a private borehole.

INFRASTRUCTURE IN THE PROJECT AREA

11.7.5 A breakdown of community assets and infrastructure in the affected Districts, specifically those associated with education and healthcare, are presented in **Figure 11-3,** based on Jamoat interviews in July 2023. The availability of community facilities, such as schools, religious meeting places, and healthcare services vary greatly across the affected Jamoats. This data covers both pre-resettlement communities and resettlement sites.

Figure 11-3 - Jamoat Community Infrastructure



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



11.7.6 Some specialized and regionally and nationally important infrastructure is present in the flooding zone. In Navobod, which will be totally resettled, there is an orphanage housing 110 children, which serves the whole of Rasht District, a college which is well respected for its teacher training courses. The Navobod psychiatric hospital, which has around 40 in-patients, accepts patients from throughout Tajikistan.

11.8 COMMUNITY HEALTH, SAFETY AND SECURITY

POPULATION STRUCTURE

11.8.1 Tajikistan is a relatively young country, with nearly 50% of the population under 25 years old. The population currently totals 10,389,799, and is projected to increase to 15,574,642 by 2050, due to a combination of high birth rate and increased life expectancy (WHO, 2024). A breakdown of the population is shown in **Figure 11-4**.

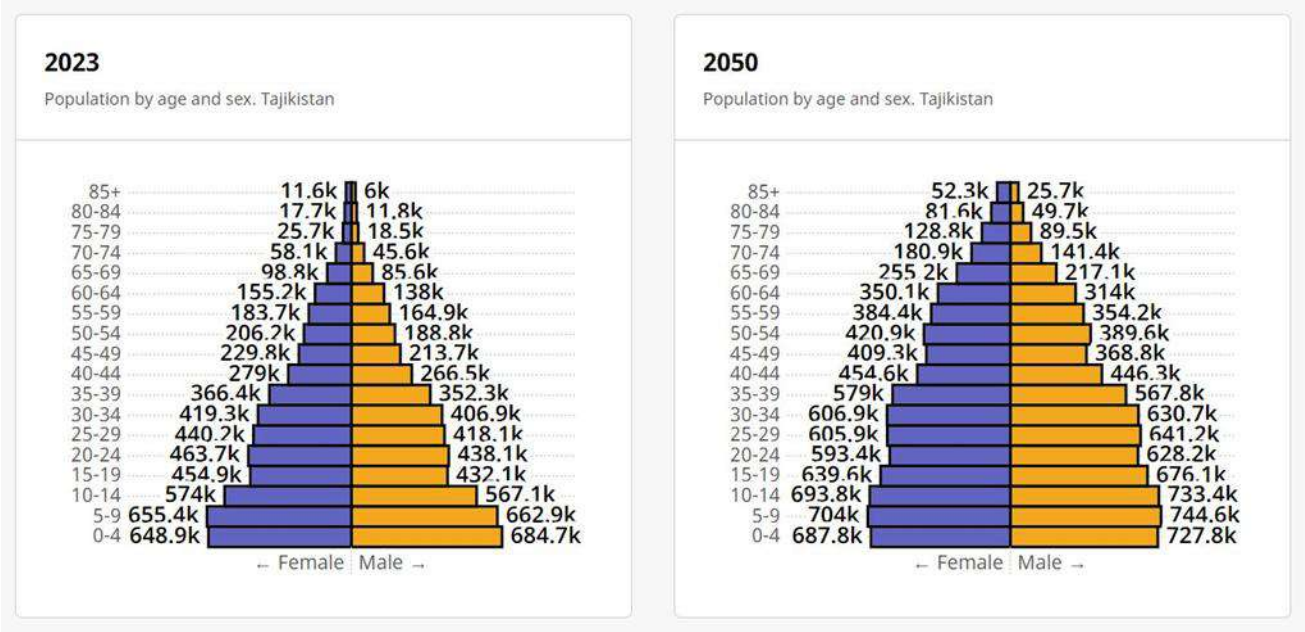
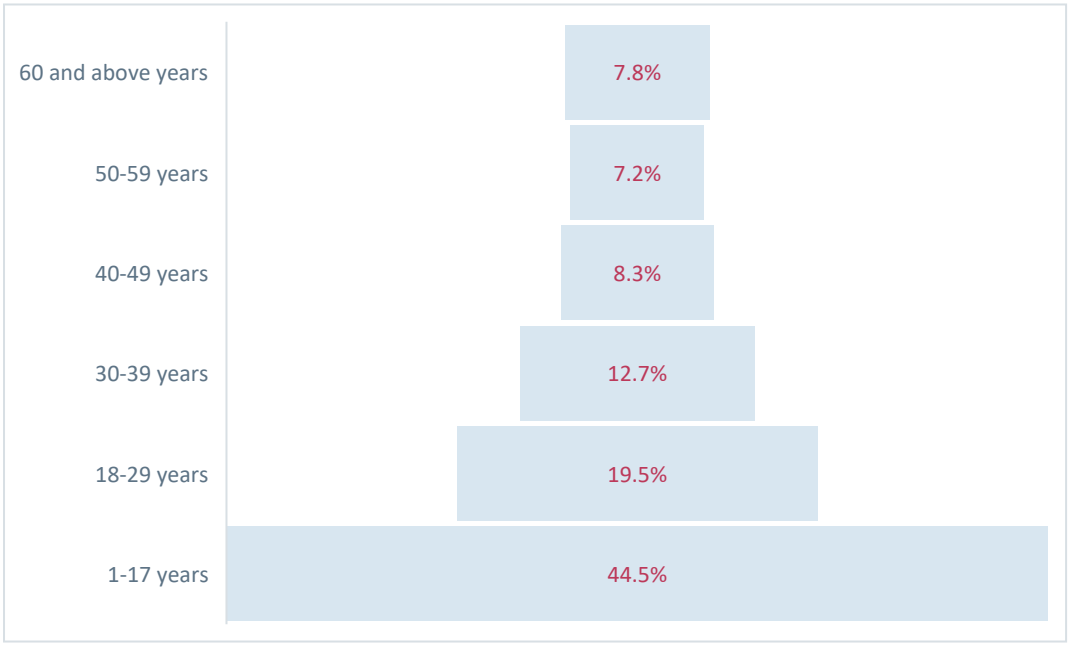


Figure 11-4 - Tajikstan population pyramid 2023, and projected change 2050 (WHO, 2024)

11.8.2 The age pyramid for the sample population in the household survey implemented for this TA package (**Figure 11-5**), also has 1-17 years as the highest proportion.

Figure 11-5 - Sample Population Age Breakdown (N=5,148)



11.8.3 Tajikistan has a relatively high fertility rate above 3 live births per woman, and annual population growth of 2% per year (WHO, 2024). This is significantly lower than during the Soviet era, when Tajikistan had the highest birth rate of all the Republics, peaking at 7 live births per woman in the 1960s (World Bank Group, 2024) (Henry & Juraqulova, 2020). Family planning services are available but limited. 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%. A 2020 study found that the total fertility rate exceeded the wanted fertility rate in all provinces of Tajikistan (Henry & Juraqulova, 2020).

PUBLIC HEALTH

General health of the population

11.8.4 Life expectancy in Tajikistan has increased significantly in recent years, from a low of just 53 years for the whole population and 46 for men during the civil war years of the 1990s, to over 70 years in the 2020s. This has been accompanied by an increase in healthy life expectancy, and a narrowing of the gap between males and females (**Table 11-17**). Public health has steadily improved, with decreasing infant and maternal mortality and under-nutrition, and increasing immunization. A selection of population health indicators is presented in **Table 10-18**. Where possible the most up to date indicator has been presented alongside the data provided in the 2014 ESIA (dated 2010).

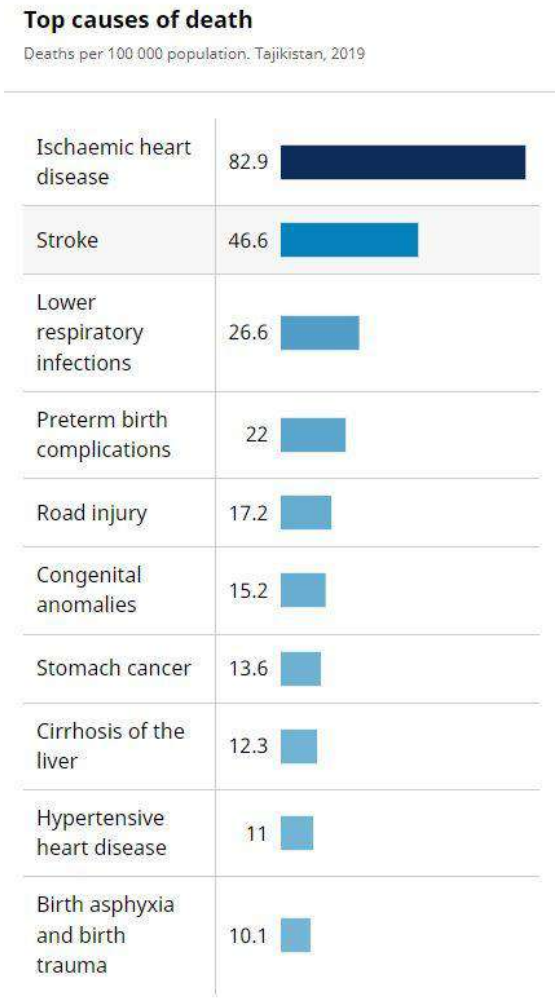
Table 11-17 - Health data for Tajikistan (World Bank Group, 2024)

	2010	2022
Life expectancy at birth, total (years)	68	71
Life expectancy at birth (male)	65	69
Life expectancy at birth (female)	70	74
Fertility rate (births per woman)	3.5	3.1
HIV prevalence (% population ages 15-49 yrs old)	0.1	0.2
Incidence of tuberculosis (per 100,000 people)	128	78
Mortality rate, under 5 (per 1,000 live births)	43	30
Maternal mortality rate (per 100,000 live births)	32.0	17 (2020)
Mortality rate, adult, female (per 1,000 female adults)	144.8	113
Mortality rate, adult, male (per 1,000 male adults)	227.0	175
Prevalence of underweight, weight for age (% of children under 5)	14.9 (2005)	7.6 (2017)
Prevalence of stunting, height for age (% of children under 5)	29.5	13.1
Immunization, measles (% of children ages 12-23 months)	94	98
Healthy life expectancy (total) (WHO, 2024)	60.9	63.1

	2010	2022
Healthy life expectancy (female) (WHO, 2024)	62.2	63.6
Healthy life expectancy (male) (WHO, 2024)	59.7	62.6

11.8.5 The leading cause of death in Tajikistan is non-communicable disease, which led to approximately 67% of deaths in 2019, the most recent year for which data is available (WHO, 2024). The most common of these are ischemic heart disease and stroke. Birth-related deaths and road accidents also led to large number of deaths. Violent deaths were rare, with injuries (including accidental injuries) leading to 0.1% of deaths.

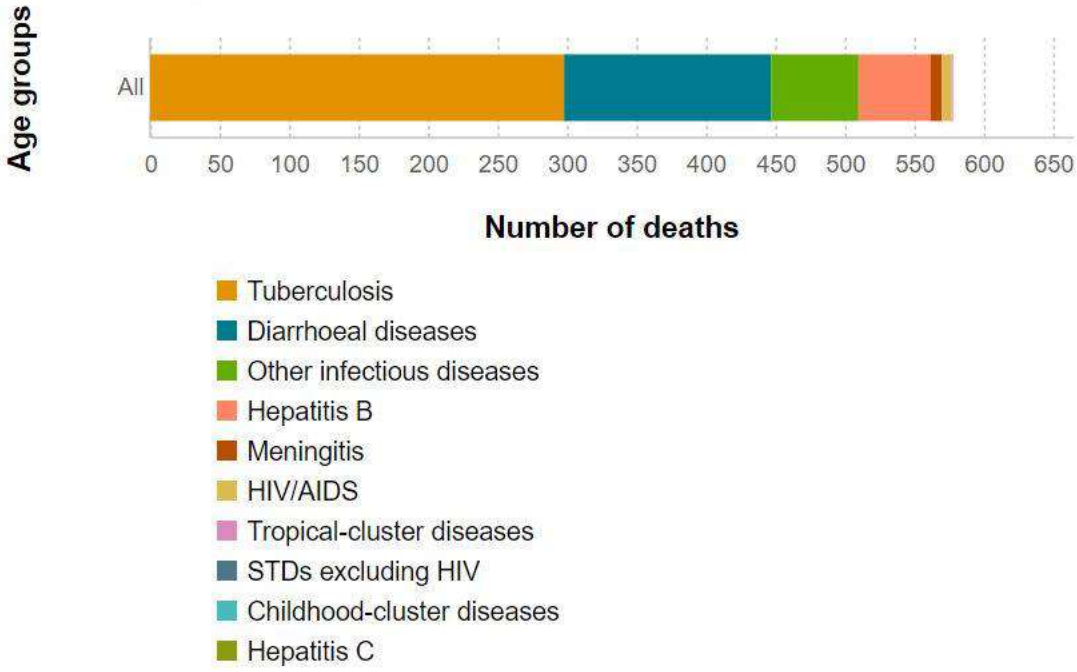
Figure 11-6 - Top causes of death in Tajikistan (2019)



Communicable disease

11.8.6 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).

Figure 11-7 - Deaths from infectious and parasitic disease in Tajikistan in 2017 (WHO, 2023)



Mental health

11.8.7 The Ministry of Health and Social Protection of Tajikistan stated that, in 2022, 44,725 people were known to be suffering from a mental illness, of whom 10,782 were children. Mental healthcare in Tajikistan is mostly focused on specialized institutions, both for in-patients and out-patients, however training in mental health by primary care providers is generally limited, inhibiting their ability to provide diagnoses and care. The National Healthcare Strategy 2021–2030 does not provide specialized measures or programs for mental health. Factors exacerbating poor mental health amongst the Tajik population included stressful conditions encountered during labor migration for men, and restrictive gender norms and high levels of family violence for women.

11.8.8 Mental healthcare workers and facilities are rather scarce. In 2020, there were just 454 registered mental health professionals in 2020, equivalent to 4.87 per 100,000 population. This comprises 187 psychiatrists (including 6 pediatric psychiatrists), 261 mental health nurses, and 6 psychologists. There were a total of 26 mental health facilities: 13 out-patient units attached to hospitals, and 13 inpatient facilities (11 psychiatric hospitals and 2 in-patient psychiatric units at general hospitals, including 1 pediatric facility). Mental health accounts of 0.7% of total government spending.

11.8.9 The suicide rate per 100,000 population was 5.32 in 2019, representing a slight increase since 2013 (5.04). This is significantly below the global average of 9.2 per 100,000. There were 375 recorded cases of psychosis in 2020.

11.8.10 Alcoholism is rare in Tajikistan, which has a low rate of alcohol consumption. The average Tajik adult consumed just 0.7 liters of alcohol in 2020, significantly lower than its CIS neighbors Uzbekistan (2.1 liters) and Kyrgyzstan (3.6 liters), and far lower than other CIS countries such as Russia (10.5 liters) and Ukraine (9.2 liters). Tajik women, on average, consume even less alcohol than do men (0.2 liters compared to 1.3 liters) (World Bank Group, 2024). In 2016, the WHO recorded that 53.8% of Tajiks aged 15 or older were lifetime abstainers from alcohol – 39.1% of men

and 68.6% of women – and that alcohol use disorders affected less than 1% of the adult population, compared to 8.8% across the WHO European region. Smoking rates are also relatively low and concentrated almost entirely within the male population – 17.0% of Tajik men were smokers in 2017, compared to 0.3% of women (WHO, Tajikistan).

11.8.11 Due to its border with Afghanistan, Tajikistan is a transit country for illicit drugs, particularly heroin and to a lesser extent cannabis. Heroin is one of the most widely used drugs in Tajikistan, although its use remains socially unacceptable and stigmatized (Global Organized Crime Index, 2023). It was estimated in 25,000 intravenous heroin users in Tajikistan in 2017 (Latypov, 2017). Drug use and addiction has become a steadily increasing public health concern, with treatment centers often poorly equipped and abstinence-focused (Peyrouse, 2018).

Table 11-18 - Mental health indicators

Indicator	Year	Total
No. mental health patients	2022	44,725
Of whom children		10,782
Number of mental health professionals	2020	454
Psychiatrists		187
Mental health nurses		261
Psychologists		6
Pediatric psychiatrists		6
In-patient mental health units	2020	13
Of which pediatric		1
Out-patient mental health units	2020	13
Of which pediatric		1
Suicide rate per 100,000	2019	5.32
Cases of psychosis	2020	375
Average annual alcohol consumption (l)	2020	0.7
Alcohol use disorder (% adult population)	2016	0.9
Smoking rate (% adult population)	2017	17% male 0.3% female
Intravenous drug use (estimate)	2017	25,000

SAFETY AND SECURITY

Crime and terrorism

11.8.12 The rate of violent crime in Tajikistan is low. In 2020, the most recent year for which data was available, there was just 1 intentional homicide per 100,000 population, similar to its CIS Central Asian neighbors Uzbekistan (1) and Kyrgyzstan (2). In 2023, Tajikistan was rated one of the safest countries in the world by the Gallup Safety Index, which surveyed self-reported feelings of safety – 92% of Tajik respondents stated that they feel safe walking alone at night where they live, which was equaled or exceeded by only Kuwait (99%), Singapore (94%), Saudi Arabia (92%) and Norway (92%).

11.8.13 The risk of terrorism in Tajikistan is largely associated with the Afghan border. Armed incursions by terrorist groups across the Afghan border are a regular but infrequent occurrence (Gov.uk, 2024). The main organizations of concern for the Tajik state are ISIS-K and Jamaat Ansarullah, which aim to overthrow the GoT and establish an Islamist regime, and stage attacks across the Tajikistan-Afghanistan border. The GoT actively participates in domestic and international counter-terrorism efforts and stated that 31 terrorist actions were prevented in 2022 (U.S. Department of State, 2023).

Road safety

11.8.14 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).

11.8.15 Locally, in the Rasht zone, both accident rates and fatality rates have remained relatively steady over the same period. The fewest accidents occurred in 2021 (3) and the fewest fatalities in 2019 (2). The most accidents occurred in 2022 (11) and the most deaths in 2020 (7). Although evidence lacks on the traffic accidents for the Project area specifically, both women and men FGDs highlight road safety concerns of communities and the poor road conditions due to ongoing construction and use of heavy trucks.

Figure 11-8 - Road accident rate (national and in Rasht)

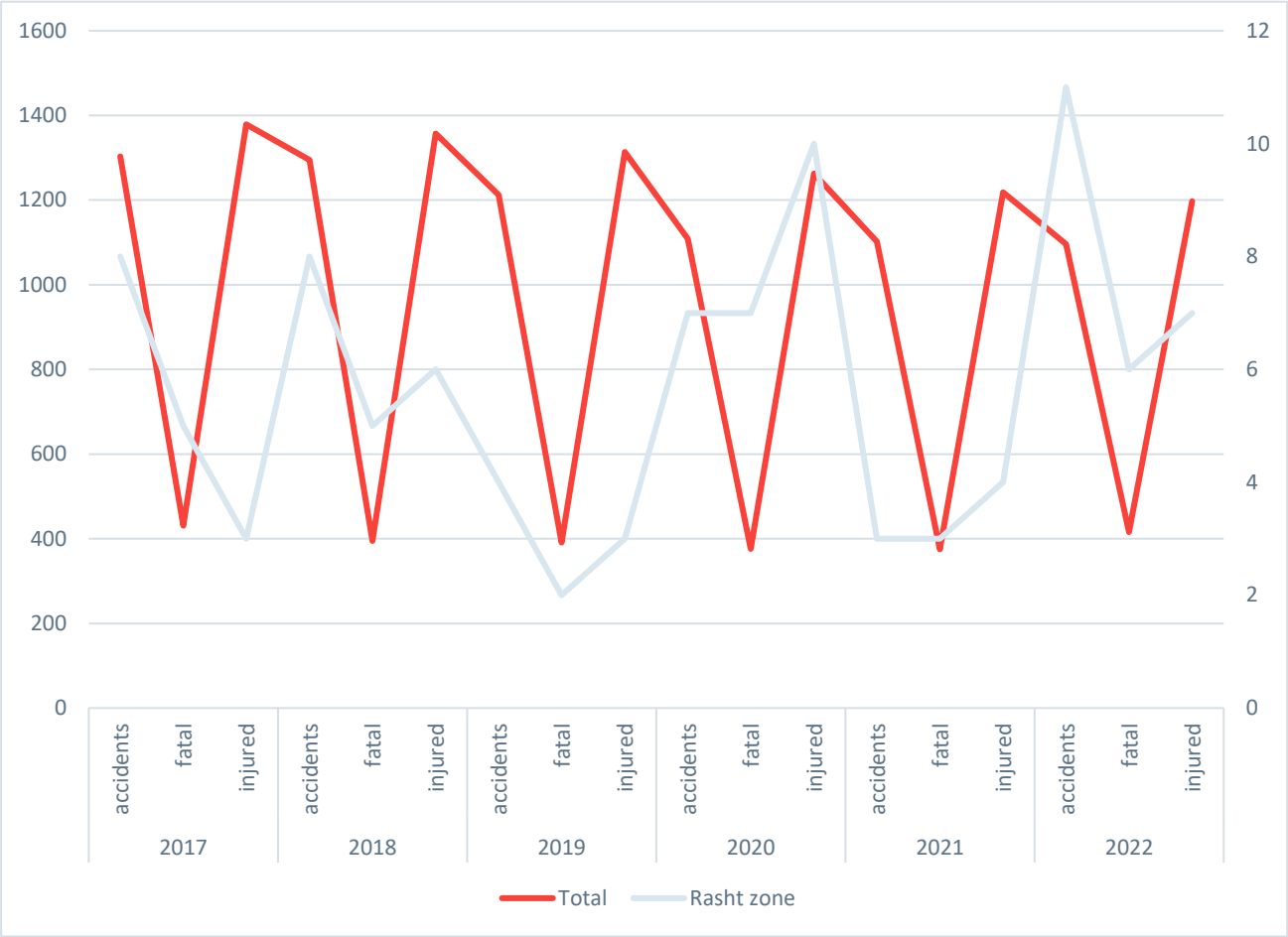


Figure 11-9 - Road accident fatality rate (national and in Rasht)



11.9 INCLUSION, VULNERABILITIES AND GENDER

11.9.1 In the last decade, Tajikistan has made significant progress in poverty reduction, and 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.

11.9.2 *ESS 1 of the WB ESF defines vulnerable people as 'disadvantaged or vulnerable [individuals or groups], who may be more likely to be adversely affected by the project impacts and/or more limited than others in their ability to take advantage of a project's benefits. Such an individual/group is also more likely to be excluded from/unable to participate fully in the mainstream consultation process and as such may require specific measures and/or assistance to do so. This will take into account considerations relating to age, including the elderly and minors, and including in circumstances where they may be separated from their family, the community or other individuals upon whom they depend.'*

VULNERABLE GROUPS IDENTIFIED FOR THE PROJECT

11.9.3 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, find it more difficult to enjoy Project benefits, or risk social exclusion. 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.

11.9.4 Based on the household level data, FGDs and secondary data sources, a vulnerability framework has been developed using different proxy indicators to identify project-specific vulnerable groups. Besides gathering average income data, household expenditure patterns and income sufficiency for food were also asked as a proxy indicator for assessing socio-economic strata.

Table 11-19 - Vulnerability Indicators

Vulnerability characteristic		Observations based on HH survey sample
Elderly	Households with members aged 60+ living in the resettlement areas that require additional care.	▪ Majority of the household population is at age 1-17 (44.5%). 28% households in the survey sample have members aged 60 and above. The health of some of them could be negatively affected due to the relocation and the caring burden on families could increase. ▪ 24% of the household heads in the sample population are 60 and above. Not all elderly above 60 maybe disadvantaged or vulnerable, but those who have other underlying vulnerabilities such as sicknesses, disabilities or dependent on low-income sources or living on their own would need additional measures in the resettlement plans. Few to name, help with moving assistance, reconstruction of houses, other social assistance (monetary or in-kind support) on payment for utilities etc.
	Households in which the HoH is elderly (aged 60+)	
Poorer households	Households stating insufficient money for food	▪ One in every five households indicated that they are struggling to buy food due to insufficient family income.

Vulnerability characteristic		Observations based on HH survey sample
	Households whose main income source social assistance/social aid	▪ Almost 20% of the households either rely on pension or social assistance as main source of income. These households are more vulnerable when they are exposed to economic shocks.
Households with less stable or insufficient income that might become more disadvantaged due to disruptions caused by physical displacement in income/livelihoods	Households whose pension is main source of income	▪ While remittances are the main source of income for the surveyed households, pension recipients are the second largest in the sample population. Although it can be seen as a regular source of income, pensioners are considered as vulnerable and the amount they receive depends on the vulnerable group they belong which is defined in the national legislation[16].
	Households with members who have fewer stable jobs (daily/seasonal worker) or informal jobs/businesses	▪ 5.3% of the sample population are engaged in daily or seasonal work, i.e., construction, agriculture. ▪ 11% of those with an income amongst the sample population are engaged in daily or seasonal work. Due to low social security coverage of the population and sample, it is likely that the majority of those engaged into informal jobs may lack decent work conditions.
Women-headed households and women with limited income sources	Women headed households who are temporarily abandoned due to labor migration in the household, or with low income or unreliable income sources	▪ Female-heads constituted 17.8% within the surveyed households. ▪ Only 12% of the women in the sample population have an income source, which is mainly depending on pension income, most probably from their husbands or other male relatives in the household. ▪ 7% of those have agriculture-based incomes.
Households affected by multiple projects	Households that faced resettlement previously (before Rogun) or Affected by another project	While the household sample state very few households that might be affected by other projects, FGDs report poor road conditions due to ongoing construction and the construction of the Obigarm-Nurobod road..
Persons with disabilities or sicknesses	Households with members who are disabled or with chronic illnesses that require care or social assistance.	19 % of households surveyed have at least one member with disabilities or suffers from chronic illnesses.

[16] Confirmed statement in ESIA 2014, pg 283

Vulnerability characteristic		Observations based on HH survey sample
Young people neither in work nor in education (NEET)	Young people at 15-24 age group who are neither in education nor in employment	41.3 % of the affected population at age 15-24 are NEET. They would be an important group to equally benefit from the project benefits and future employment and vocational training opportunities.
Illiterate HoH	HoH aged 18+ who are functionally unable to read and write	The project communication with communities have mostly relied on TV, visual media and verbal face to face communication. Specialized measures for engagement for these groups are detailed in the SEP. Although Tajikistan is reported to have close to 100% literacy, 15% of the survey sample aged 18 and above, and 6% of HoH, were reported to be illiterate.

11.9.5 Information on some categories of vulnerable people (including people with different disabilities, pensioners, widows, orphans, and people requiring social assistance, although specifics vary) is compiled by the Jamoats, who provide it to DFZ upon request.

Table 11-20 - Vulnerable Households Reported by Jamoats

District	Jamoat	Vulnerable Households receiving social protection	People with disabilities	Widows / Families of deceased breadwinner	Poor individuals	Elderly	Orphans	Military veterans
Rogun	Sicharogh	38	---	24 widows	103	42	---	---
Nurobod	Khakimi	223	---	---	---	---	---	---
	Halimov	241	---	---	60 poor people 181 poor families	---	---	---
	Khumdon	377	100	---	277	---	---	---
	Mehrobod	176	---	---	---	---	---	---
	Mujikharf	250	---	---	---	---	---	---
	Safedchashma	25	---	---	---	---	---	---
Rasht	B. Rahimzoda	222	98	---	124	---	---	---
	N. Makhsum	764	349	---	305	---	110 orphans	---
	Obi Mehnat	22	---	2 families	---	---	---	2
	Qal'ai Surkh	59	23	6 widows	30	---	---	---
	Navobod	143	110	---	33	---	---	---
Faizobod	Buston	16	6	---	---	16	2 orphans (both parents died)	---
Tursunzoda	10 Solangii Istikloliat (10	257	*Cat. 1 - 22* *Cat. 2 - 105*	---	---	---	---	---

District	Jamoat	Vulnerable Households receiving social protection	People with disabilities	Widows / Families of deceased breadwinner	Poor individuals	Elderly	Orphans	Military veterans
	Years of Independence)		*Cat. 3 - 46* Total - 173					
	J. Rahmonov	166	*Cat. 1 - 58* *Cat. 2 - 309* *Cat. 3 - 118* Total - 485	---	---	---	---	---

Orphans

11.9.6 The UN estimates that approximately 160 out of every 100,000 children in Tajikistan lose parental care each year, including those who are left with relatives while their parents undertake labor migration, those placed in institutions, and those whose parents are deceased. There are estimated to be 1500-3000 orphans due to AIDS aged 0 to 17 in Tajikistan. UNAID estimates that there are 15,000 – 16,000 people living with HIV in Tajikistan, giving an incidence rate of 0.01 per 100 people (1 in 10,000) across all age groups (UNICEF, 2021).

11.9.7 Data on orphans were provided by two Jamoats, including N. Makhsum in Rasht, which will be affected by reservoir impoundment and is home to 110 orphans residing at an orphanage in Navobod. It was reported by DFZ that orphanages are provided in all resettlement sites.

Gender

11.9.8 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 2023, women held 27% of the seats available in parliament, compared to 19% in 2010 (World Bank Group, 2024).

11.9.9 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 criminalize domestic violence or marital rape. It is estimated that around one-third of Tajik women are abused by their husbands, although reporting is low (United Nations, 2023).

11.9.10 The participation of women in the labor force in Tajikistan is low, with approximately 69% of working age females not in paid employment in 2016, and the proportion of females in the total number of employed declining. Tajikistan's Labor Force Participation Rate gender gap of 21.5% is much higher than in comparable low-income countries (average 15.3%). Gender equality is affected by Tajikistan's Labor Code, in which Article 216 prohibits women from working in certain occupations deemed to be dangerous, difficult or involving heavy and manual work (Sevimli & Rajabov, 2022).

11.9.11 Unemployment, particularly in rural areas, has led to a high proportion of Tajik migrant workers who seek employment and better opportunities elsewhere (particularly Russia). It is estimated that about 30% of the wives left behind by their migrant husbands have been abandoned, adding 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 (ADB, 2020).

11.9.12 Particular vulnerabilities exist for women with limited education. In some rural areas there are only primary schools and children must attend boarding schools for secondary education, returning to their parents at weekends. Many families do not want their daughters to leave the family for such a long period of time, so they do not continue their education and are left with only basic literacy skills. Therefore, women may be exposed to additional impacts, as without education their only livelihood options are to be housewives dependent financially on their husbands, to seek low-skilled work such as agricultural labor, or to be involved in informal businesses.

11.9.13 Only 14% of the women in the household survey sample stated that they had an income source. Household surveys showed that amongst women with an income, the most significant income source was from pensions (approximately 25%), and a significant proportion worked within the

public sector (approximately 14%). Women in the area often supplement their income with informal sale of agricultural surplus.

11.9.14 According to Tajikistan law, each household must have one registered HoH. Women and men have equal legal rights to be HoH, although in practice this role is typically occupied by men. However, labor migration by Tajik men has led to an increase in the numbers of female-headed households. Nationally, approximately 23% of households in Tajikistan have a female HoH. These households tend to be smaller households and have a higher risk of poverty than those headed by males. Within the Project AoI, 18% of HoH of surveyed households were female. Female HoH are often divorced or widowed women, and sometimes face additional difficulties in the resettlement processes, for example lacking suitable labor for house construction within their households or struggling with administrative processes that may previously been managed by their husbands.

11.9.15 Primary data on women in Project-affected communities was gathered via the household surveys and FGDs with women and men in 2023. The key findings from the women-only FGDs were as follows:

- The current socio-economic conditions of women participating in the FGDs varied greatly depending on the village they come from and available infrastructure; in the most underserved villages, women had limited education, and the majority did not work. Women in larger and more developed settlements had greater access to facilities and employment opportunities.
- Women with access to kindergartens stated that these were essential for their ability to work.
- Few women are employed on the Project, with participants citing the distance to the project and the 15-day shift pattern as barriers, as well as husbands not wanting their wives to work in a male-dominated environment.
- Where women are heads of household (HoH), they are free to make decisions regarding resettlement. Household members who are not HoH have a limited formal role in the resettlement process, and their decision-making power depends on their level of influence with the HoH. Some women reported a high level of influence, others had little to no involvement in the process.
- Participants were generally positive about the opportunities that they perceive come with resettlement, particularly for employment, education, and improved community infrastructure. Some women who had not previously worked expressed a desire to do so after resettlement, provided there were culturally suitable jobs available (e.g., pharmacy, food processing shop).

11.9.16 Concerns were raised around the following:

- The compensation process, with some worried about timing and others worried about the valuation.
- Availability of water in their new residences.
- Assurance that their conditions (jobs, property and availability facilities) would be provided for.
- Both male and female FGD participants were unsure whether adult women currently living with their parents could receive a land plot. All participants who raised this point were supportive of this idea.

- 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 of new residences).

11.9.17 Women also highlighted how they would prefer to be resettled alongside their existing neighbors and community.

12 CULTURAL HERITAGE

12.1 INTRODUCTION

12.1.1 This section presents the cultural heritage study compiled in relation to the Project. The general objective of the cultural heritage baseline study, as part of the overall ESIA process, is to collect robust baseline data to describe the cultural heritage conditions of the proposed Project area.

12.2 SOURCES OF BASELINE DATA

12.2.1 Baseline data has been collated from a combination of available secondary data sources and primarily data collection. A summary of the main sources informing the baseline is presented below:

- A. Donish Institute, 2013: Report on archaeological research in the flood zone of the Rogun hydroelectric power station: 1st Stage;
- Pöyry Energy Ltd., 2014: Vol I Rogun HPP ESIA: Environmental and Social Assessment for the Rogun Hydro Power Plant;
- A. Donish Institute, 2015: Nurobod and Rogun: Ethnographical Studies;
- A. Donish Institute, 2017: Anthropological study of the population of the village of Sicharogh (Cemetery Relocation Report);
- Information available at the National Museum of Tajikistan (March 2023);
- Household survey data for villages to be resettled gathered by M-Vector in 2023;
- Mineral and fossil data: recorded on Mindat.org, an online database operated by the Hudson Institute of Mineralogy and obtained during recent geological reconnaissance undertaken in support of the Project (2022);
- Geographical Information Systems (GIS) data provided by University College London (UCL) Institute of Archaeology Central Asian Archaeological Landscapes Project (CAAL); and
- Preliminary archaeology and ethnographic surveys undertaken by the team at the A. Donish Institute of History, Archaeology and Ethnography (hereafter, the A. Donish Institute) in June, August and September 2023.

12.2.2 These sources are supplemented with information collated during WSP's site visits in March and June 2023, during meetings with the team at the A. Donish Institute in Dushanbe (7th and 8th March and 9th June) and to the Rogun reservoir area undergoing active resettlement (10th March). Additional archaeological and cultural context has been provided through reviews of existing literature and academic studies (as listed in Section 12.5). Detailed information gathered from the field surveys undertaken on the site visit are available in **Volume 3: Annex 20.6: Cultural Heritage Field Reports, of this ESIA**.

12.3 BASELINE METHODOLOGY

BASELINE DATA COLLECTION METHOD

12.3.1 The preparation of a comprehensive cultural heritage baseline was completed in three stages: a rapid desktop review of existing data, two phases of targeted archaeological survey and two phases of community consultation specific to ethnographic cultural heritage. The detailed methodology of

these three stages is presented below. WSP's program of ESIA update has been supported by experts at the A. Donish Institute in Dushanbe, who are also legally mandated (Law of the Republic of Tajikistan on the Protection and Use of Objects of Historical and Cultural Heritage, Chapter 3, Article 23, 2017) to carry out all cultural heritage survey within the proposed Project zone.

12.3.2 The baseline study area was defined as the maximum inundation extent (1,290 *masl*), and all villages in the second phase of resettlement phase (RAP 2), plus a 20 km buffer. The buffer has been incorporated to adequately consider known cultural heritage within the wider area, to better understand the context of resources potentially impacted by the Project in particular, their rarity, historical associations and significance.

12.3.3 The baseline study area for cultural heritage is shown in **Drawing 20-1** (Annex 20.5).

Rapid Desktop Review

12.3.4 An initial rapid desktop review was undertaken to inform the specific requirements (and locations) of the rapid, targeted field surveys to follow.

12.3.5 The desktop study included:

- A legislative review (law of the Republic of Tajikistan);
- Local data acquisition and a literature review (within the archives of the A. Donish Institute) including an examination of existing studies undertaken to date (e.g., archaeological field survey and ethnography surveys completed in support of the 2014 ESIA);
- Reviews of recent aerial imagery to inform the locations of the targeted field surveys to follow, supported by a parallel phase of GIS data acquisition through the Institute of Archaeology Central Asian Archaeological Landscapes (CAAL) Project database; and
- Reviews of the current RAP 2 schedule to identify settlements within the inundation that have not been targeted for ethnographic study and related community consultations prior to 2023.

Targeted Field Surveys – Archaeology

12.3.6 The A. Donish Institute archaeology field team undertook a program of rapid, targeted reconnaissance in June 2023, and again in August and September 2023, to characterize the baseline environment in support of the 2023 ESIA update. The objective of these survey phases was to identify and record evidence of past human activity (e.g., archaeological remains) in selected "sample areas", to inform any requirement for further archaeological work and additional studies in support of the Project. The walkover surveys, which involved visual (non-intrusive) inspection, were targeted to upper terrace levels not previously surveyed (for the 2014 ESIA). Limited archaeological evaluation (one small scale test pit) was undertaken where it was considered necessary to help characterize a site.

12.3.7 A 'site record sheet' was completed for each archaeological or historical feature identified during the surveys, which included GPS coordinates, a brief description and detail of the feature's condition and level of disturbance. Each feature was photographed and associated features were recorded (e.g., the wider landscape setting and access paths).

12.3.8 For ease of mapping, each identified archaeological, historical and paleontological resource has been given an identification number prefixed "RHPP-AR", e.g., **RHPP-AR-01**.

Targeted Field Surveys – Ethnography

12.3.9 The A. Donish Institute ethnography field team undertook a rapid, targeted consultation program informed by the preceding desktop studies in June 2023, and again in August and September 2023. The objective of these survey phases was to identify and record local cultural resources and intangible heritage practice, in participation with a select number of settlements/communities to be resettled under the current (RAP 2) resettlement schedule. Formal ethnographic consultations were conducted in the following villages:

- June survey: Khakimi bolo, Khakimi poyon, Obiboriki bolo, Obiboriki poyon, Khumrogh (formerly Kumok or Qumoq) and Lughuri poyon.
- August-September survey: Mehrobod (formerly Komsomolobod), Roghuni poyon, Aligalaboni bolo, Khumrogh, Chanor and Bediho.

12.3.10 These community consultation phases were guided by the requirements of ESS8 (2016) to sensitively record intangible practices (ceremonies, traditional crafts, music etc.,) and the specific geographical locations of cultural receptors (cemeteries, memorials and natural sites of spiritual significance, e.g., medicinal plants, sacred watercourses) identified by Project Affected Peoples (PAPs).

12.3.11 Focus group discussions were held to identify key informants in each targeted settlement. Key Informant Interviews (KII) were subsequently undertaken with community / cultural leaders. The communities were asked to provide details of their knowledge of sites of cultural importance (e.g., religious places, cemeteries, burials, traditional practice areas, sacred watercourse or shrines) within their settlement (and near vicinity).

12.3.12 The survey team then sensitively recorded these resources with the assistance of the villagers/site guardians by completing a ‘site record sheet’ (including GPS coordinates, photographs and a description of the site) for each identified.

12.3.13 Where sites of cultural activity were identified, the field team sensitively recorded (with permission) any associated intangible cultural heritage practices, e.g., associated festivities, ceremonies, local taboos (e.g., sites which are restricted for the initiated only or exclusively men/women), which help to ascertain the relative significance of the site and any appropriate mitigation and management to follow. Where sensitive cultural sites and ‘secret’ areas were identified, one-to-one (private and confidential) interviews with a village elder or cultural leader were undertaken.

12.3.14 During their field surveys, the archaeology team also identified a small number of active cultural resources (e.g., cemeteries and shrines) in additional villages they passed through. These are incorporated where appropriate.

12.3.15 For ease of mapping, each identified cultural and sacred resource has been given an identification number prefixed “RHPP-CR”, e.g., **RHPP-CR-01**.

12.4 ASSUMPTIONS AND LIMITATIONS

12.4.1 The extent of the cultural heritage study area was defined in consideration of the Project footprint at the time the field surveys were completed (June, and August to September 2023). Any subsequent design changes and/or alterations may require new surveys to be conducted. Furthermore, these field surveys were rapidly targeted and subject to constraints imposed by restrictive ground visibility,

health and safety and inaccessibility. These constraints are typical of baseline field data collection and as a whole did not compromise the objectives of this survey.

12.4.2 There was no intention to undertake any significant below-ground investigations during this phase of work but limited archaeological evaluation (one small-scale test pit) and manual clearance of vegetation was necessary to clarify the nature and extent of particular sites. Equally, there was no scope to remove surface objects *en masse* from identified sites, as this will be undertaken, if necessary, during further stages of work.

12.4.3 The collection of archaeological baseline information provided a valuable baseline study of the visible cultural heritage resources within the study area. However, it does not discount the possibility that other (potentially more important) remains may survive undiscovered in below-ground deposits, or in areas that are inaccessible to survey (e.g. where a feature cannot be located and positioned accurately).

12.4.4 Typical of cultural heritage consultations, the ethnographic information presented is limited to that which the communities consulted were willing to share with the survey team. There remains a potential for unidentified features of local cultural sensitivity to exist throughout the study area. Not all of the cultural heritage resources identified in consultation with local communities could be visited by the survey team due to the aforementioned constraints, and the exact locations of these resources are yet to be determined. Recommendations for ongoing and future consultation programmes are presented in **Chapter 20** of the ESIA and the Cultural Heritage Management Plan (CHMP, **Volume 3**).

12.4.5 Due to seasonal constraints, the active nature of Project construction and health and safety considerations, the entirety of the cultural heritage AoI (defined in **Chapter 20** of the ESIA) has not yet been fully inspected for cultural heritage sensitivities. Visual (non-intrusive) cultural heritage survey and sensitivity mapping of the following parts of the AoI is ongoing and described in further detail in the CHMP (**Volume 3**):

- along the left bank of the Vakhsh River from the village of Sangdevor to the dam itself;
- on the right bank of the Vakhsh River, along its tributary, the Lugur Stream;
- on the right bank of the Obikhingou River; and
- along the left bank of the Obikhingou River, in the upper part of the flood zone.

12.4.6 Only villages and settlements that are currently undergoing resettlement (i.e., under RAP 2) were visited by ethnography team during the June and August-September 2023 surveys. Those villages to be resettled under future RAPs were not visited.

12.4.7 Community consultation in all villages, in relation to the documentation of cultural and sacred resources and any related intangible heritage, is also ongoing, as described in the CHMP (**Volume 3**).

12.4.8 Preconstruction survey will be required for any elements of the evolving Project design situated outside the current AoI, such as the proposed new resettlement sites, the left bank roads and bridges and overhead transmission lines. The cultural heritage Pre-construction Survey Process is described in **Volume 3**, **Chapter 1** (and **Volume 3: Annex A1: Environmental Social Management Plan** of this ESIA).

12.4.9 Potential impacts on cultural heritage receptors downstream of the study area in the event of dam failure, including those in the riparian countries of Afghanistan, Uzbekistan, Kazakhstan, Kyrgyz Republic and Turkmenistan, are considered to be beyond the scope of this assessment.

12.5 EXISTING CONDITIONS

12.5.1 This section summarizes the relevant desktop studies and fieldwork phases previously undertaken within the baseline study area.

SUMMARY OF EXISTING STUDIES UNDERTAKEN FOR THE PROJECT: ARCHAEOLOGICAL

12.5.2 A summary of previous archaeological investigations completed in support of the Rogun HPP project is outlined to follow. This includes phases of field survey undertaken by the A. Donish Institute between 2013 and 2017.

Table 12-1 - Summary of Previous Archaeological Surveys (prior to 2023)

Study / survey	Timing	Purpose
Archaeological Survey	2013	Archaeological desk-based assessment, visual reconnaissance and targeted intrusive evaluation in support of the baseline of the 2014 ESIA.
Archaeological Survey	2014	Reconnaissance mission informed by desktop study to identify archaeological resources for the 2014 ESIA.
Sicharogh Cemetery Excavation	2016 – 2017	Archaeological excavation of a cemetery dated to the 18th – 19th Centuries CE near to the (resettled) village of Sicharogh. The cemetery was excavated as part of the planned relocation of burials in advance of village resettlement.

2013 Archaeological Survey

12.5.3 In 2013, archaeological desk-based assessment, visual reconnaissance and targeted intrusive evaluation was undertaken by experts at the A. Donish Institute, in support of the baseline of the 2014 ESIA. These were targeted to the “first stage of flooding” (below 1,110 *masl*). At this lower level, within the floodplain, the archaeological potential was concluded to be limited, with no evidence of ancient settlement or land use observed.

12.5.4 Just above this first inundation level, prehistoric burial mounds (approximately six, in a radial pattern) were identified in proximity to *Sicharogh* village, at a height of 1,100 *masl*, tentatively dated to the Kushan Period (1st Century BCE – 4th Century CE). Two mounds were excavated by the 2013 field team and concluded to be ‘false burials’ (possibly to deter grave robbers) and the remainder were unevaluated due to time constraints. This area has since been cleared and levelled during Project preparation works. Burials (identified as Late Bronze Age) and ceramics were also recorded near the village of *Yurst*, with human remains visible on the exposed (and unstable) river terraces, at a height of approximately 1,400 *masl*.

12.5.5 The remains of two fortresses (over 1,100 *masl*) were also identified, noted to be in poor condition and damaged by construction (‘*Jamkhur’* fortress at *Kalai Dahoni Obigarm*) and by the encroachment of modern settlement (unnamed fortress at *Komsomolobod*). Pottery, including painted sherds, and iron arrowheads were identified at these locations. Though limited further

details were reported, a tentative date between the 12th and 18th centuries for the fortress at *Komsomolobod* was suggested.

12.5.6 The 2013 baseline study concluded that the upper terraces of the Vakhsh River (above 1,100 *masl*) have greater archaeological potential, observed during the field survey at locations near the villages of *Pandovchii* and *Yurst*. These observations were supported by studies undertaken by research teams (Mandlestam et al) in the late 1950s, recording approximately 60 archaeological sites in the vicinity of Rogun and the Vakhsh River. This research verified the proximity of the Karategin sub-section of the ancient Silk Road Route and associated small fortresses or outposts to deter raiders, and the locations of trading settlements (Tatyana Filimonova, Pers. Comm. 9th March 2023). The 2013 study made a recommendation for ongoing archaeological reconnaissance, targeted to the river terraces between 1,100 – 1,300 *masl* which would be potentially impacted by the Project as the valley is inundated and the upper terraces as subject to under-cutting and landslip.

2014 Environmental and Social Impact Assessment

12.5.7 The 2014 ESIA describes 14 archaeological resources identified during a reconnaissance mission informed by desktop study. 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). They are dispersed throughout the valley, with the fortresses generally located in proximity to a confluence. All fourteen resources, with the exception of the ancient fortresses at *Navdonak* village, were found to be in poor condition / damaged by road construction or other development. An archaeological investigation was recommended at *Navdonak* prior to development. This site is located at the eastern extent of the reservoir, on the southern bank of the Vakhsh River. The recommended phase of evaluation, prior to inundation was confirmed as incomplete (Tatyana Filimonova, Pers. Comm. 9th March 2023).

12.5.8 The ESIA does not discuss the heightened archaeological potential of the upper terrace levels of the valley though the archaeological potential of the Project area in relation to its proximity to the Silk Road is also noted. The potential for (surviving) subsurface remains associated with partially damaged sites is not discussed and direct impacts are described in the ESIA to include submersion and damage during construction. Indirect impacts, to environmental setting / tourist access, or through (secondary) landslip, outside the direct inundation area are not evaluated, however, the *Navdonak* fortress is noted as vulnerable to shoreline erosion.

2017 Sicharogh Cemetery Relocation Report

12.5.9 Between 2016 and 2017, the A. Donish Institute carried out an archaeological excavation of a cemetery near to the (resettled) village of Sicharogh. The cemetery was excavated as part of the planned relocation of burials in advance of proposed flooding. Some of the earliest burials excavated show a burial position characteristic of a transition period between the ancient Persian faith of Zoroastrianism to Islam, within single-chambered, stone-lined graves, orientated around the central shrine (*mazar*). 18th to 19th Century CE burials were also recorded.

12.5.10 Anthropological research was completed in parallel with the archaeological excavation process by a team from a Moscow-based research institute, with aims to characterize the local population according to their ethnicity, from study of the human remains. These studies have employed an outdated and controversial, technique known as craniology, which involves the measuring of skulls to identify genetic traits to indicate ethnicity or race. In the provided documentation, craniological systematics are used to define parameters aligned with race classification (or crainotypes) through

measurement of the skull, forehead nasal index etc. These parameters are then linked to ethnic groups (e.g., Tajik, Kyrgz and Turkmen). The purpose and dissemination of data from this work is unclear.

SUMMARY OF EXISTING STUDIES UNDERTAKEN FOR THE PROJECT: ETHNOGRAPHIC

12.5.11 A number of ethnographic studies have been undertaken for the Project. General summaries of each study are provided below. Detailed summaries of the findings in each of the targeted villages are included in **Annex 20.2** and **Annex 20.3**.

Table 12-2 - Summary of Previous Ethnographic Surveys (prior to 2023)

Study / survey	Timing	Purpose
Focus group discussions	2011	Focus group discussions were held within villages to be resettled in support of the baseline of the 2014 ESIA.
Ethnographic study	2014 – 2015	An Ethnographic Study of Nurobod and Rogun report (2015) was compiled following a period of survey in 2014. Two survey phases were completed with the aim of collecting information on the local traditions of the regions' inhabitants.

2014 Environmental and Social Impact Assessment

12.5.12 During fieldwork for the 2014 ESIA (completed in 2011) focus group discussions were held within the villages to be resettled (including Aligalaboni bolo, Khakimi poyon, and Mehrobod). 'Holy places' were identified within the proposed flooding zone, including monumental assets associated with spirituality as well as sacred (and ancient) trees linked to the 'luck' of the village (associated with harvest and health) and frequented by local pilgrims to ensure good fortune (ESIA Annex, 13.4.3, p.116 - 117). The ESIA Annex also notes that the villages "*have not heard anything about the relocation of these holy places*" (ibid).

2015 Ethnographic Study

12.5.13 The subsequent Ethnographic Study of Nurobod and Rogun report (2015) was compiled by the A. Donish Institute following a period of survey in 2014. Two survey phases were completed with the aim of collecting information on the local traditions of the regions' inhabitants. The study targeted six villages within Nurobod district (Mehrobod (partly), Chorsada, Aligalaboni bolo, Furudgoh, Sari pul and Mahallai poyon) and six villages within Rogun city (Mirogh, Tagi Agba, Tagi Kamar, Talhakchasma, Sicharogh and Sich). The following high-level observations are highlighted:

- Data was collated through a visual inspection of objects, the collection and purchase of local handicrafts and through interviews with residents.
- The following traditional craft activities were observed within the villages surveyed: wool carpet weaving; carpentry painted with regional motifs; needlework and embroidery; iron-mongering; musicians making their own instruments and playing traditional music.
- Tangible sacred and / or cultural sites were observed (though not located and recorded) including natural monuments and memorials, including ancient trees and shrines, attracting pilgrims e.g., for healing properties of the adjacent land, containing ritual / fetish objects. The cultural importance of springs was highlighted, as their presence is a key factor in determining

the suitability of a location for settlement. Traditional architectural styles were also identified, including clay hearths dug into the ground (made by local craftswomen) and central 'magical greeting' pillars within traditional house plans.

- Oral histories of early 20th Century CE pottery production were noted and legends around the naming of a village and its origin were commonplace. Legends and taboos associated with specific villages or notable residents and related to specific locations and / or tree species (mulberry, pear) were also recorded.
- The practice of traditional medicine was observed, with plants and herbs gathered from the mountains (e.g., wild rose, sea buckthorn) and traditional ceremonial practices (associated with seasonal festivities, birth, circumcision, marriage and death) were noted and widespread.
- The influence of both the ongoing Project and outside influence / globalization as concurrent drivers for societal and economic change (and loss of traditional lifestyles and skills) was observed in the Project area.
- The relocation of cemetery sites was inferred, however, the detailed recording and/or management of other identified resources (prior to clearance and inundation) was not discussed and their permanent loss through resettlement is suggested, potentially as an inevitable outcome e.g., "*none of the inhabitants identified are sure they will install a magical greeting pillar in their new house…*"
- Two regional museums were noted (in Rogun City and Mehrobod) and a selection of ethnographic artefacts, mainly ceramics, were purchased from residents, by the researchers, for the National Museum of Ethnography in Dushanbe.

ENVIRONMENTAL AND SOCIAL PANEL OF EXPERTS SITE VISIT

12.5.14 The Environmental and Social Panel of Experts (ESPoE) visited resettlement sites in 2023. The Panel visited a small museum in a community school which contains artefacts found in the Project area, some of which date back to the 17th Century CE. Some of the resettled population also donated items of past use from the abandoned areas.

12.5.15 The Panel considered this to be an '*excellent example of how cultural heritage should be conserved and shared with communities*' and encouraged this approach to be undertaken in other resettlement areas, such as Nurobod (Republic of Tajikistan ESPoE, 2023). This museum (in Tursunzoda) was visited by WSP in March 2023, and is discussed in **Chapter 20** of the ESIA.

12.6 PALEONTOLOGICAL BACKGROUND

12.6.1 Fossils of prehistoric animals, including dinosaurs, have been found across Tajikistan. Bones of a *Kansajsuchus extensus* (a paralligator) have been found in the Sughd Province in the north of the country. This neosuchian crocodile inhabited much of Central Asia in the Late Cretaceous Period (60–100 million years ago). In Shirkent National Park in the west of Tajikistan, over 400 dinosaur footprints from the Jurassic (164.7–155.7 million years ago) and Late Cretaceous periods survive. Fossils of the *Cleoniceras* species of ammonite, a group of extinct marine mollusc, survive in the Pamir Mountains in eastern Tajikistan. They lived in the ancient seas which covered this part of the country approximately 120 million years ago.

12.6.2 Bones of a southern mammoth have been discovered on the shore of the Kayarakkum Reservoir in northern Tajikistan, estimated to be approximately 1.5 million years old. Late Pleistocene to middle

Holocene waterbird bones were identified in a cave over 4,000 *masl* in the Pamir Mountains, representing the first and only known high altitude avian fauna in Asia (Zelenkov, Sayfulloev and Shnaider, 2021).

12.6.3 Fossilized dinosaur footprints were identified in close proximity to the Project inundation zone during recent geological investigations. The multiple sets of footprints (**RHPP-AR-36**) from different species were recorded on a steeply dipping sandstone slab approximately 500m to the west of the existing dam, immediately adjacent to an existing construction road (see **Figure 12-1**). It is noted that the slab in places shows evidence of ripples that are consistent with a shallow inter-tidal beach environment. Based on the available geological data, these date to the Cretaceous period (~145 – 65 million years ago). During the September 2024 site visit by the WSP team it was noted that the condition of the footprints had deteriorated due to dust caused by nearby construction work. There was no demarcation or protection of the footprints in place. Another set of footprints was identified approximately 1.5 km to the south of the current crest of dam.

Figure 12-1 - Fossilised dinosaur footprints identified adjacent to an existing construction road (RHPP-AR-36) (Seller, 2023)



12.6.4 Several additional fossils are recorded within and around the proposed Project inundation zone on Mindat.org, an online database of minerals and fossils operated by the Hudson Institute of Mineralogy. It should be noted, however, that the co-ordinates of sites provided are estimates and have not been verified by an expert in the field. The fossil of a Jurassic dinosaur is recorded within the maximum inundation zone near the village of Sari pul (or Surkhob most) which will require field verification (see **Volume 1, Chapter 20: Cultural Heritage** of the ESIA). A *Gissarites iljini* fossil (a species of marine mollusc) dating to the Late/Upper Cretaceous (83.5–70.6 million years ago) is located a short distance outside the maximum inundation zone near the village of Sari Kosh.

12.6.5 A further four fossils are recorded within the 20 km study area. Additional Jurassic dinosaur fossils are recorded 2.5 km to the east and 5 km to the north of the maximum inundation zone. In the northern part of the study area, a Middle Jurassic *Pternopteron mirabile* fossil (a flying insect

species) is recorded. A *Praeneothyris darvasensis* fossil (a brachiopod species) dating to the Late/Upper Cretaceous is recorded in the southern part of the study area.

12.7 CULTURAL HERITAGE BACKGROUND AND CONTEXT

12.7.1 The earliest evidence of human activity within the area which now comprises Tajikistan dates to the Lower Paleolithic period (1,000,000 BCE to 200,000 BCE). The oldest of the country's major archaeological sites of this period, Kuldara, is situated approximately 46km to the south of the Rogun Dam. Archaeological material found at Kuldara has been dated to 0.85 million years ago, forming evidence of early human occupation of Central Asia. This dating is supported by stratigraphic, pedological and palynological data, shedding new light on the antiquity of stone tool making in this region and in Asia as a whole (Ranov, et al., 1995). Pebble and flake tool industries have been found in well-stratified loess deposits at Kuldara (Davis & Ranov, 1999). Small stone tools used for scraping, chopping and grinding have been recorded here along with the bones of rhinoceroses, camels, panthers and hyenas.

12.7.2 Among the other known Lower Paleolithic sites within the region is Kuhi-Pioz (or Kukhi-Piyez) in the Vakhsh River basin, assigned to the early Middle Pleistocene in accordance with geological evidence (Ranov, et al., 1995).

12.7.3 Evidence of pebble-tool industrial sites, likely in the age range of 400,000 to 600,000 years, were identified during excavations in the 1970s in Karatau and Lakhuti in southern Tajikistan. These finds established the presence of Middle Pleistocene populations in the semi-arid interglacial environment of inner Asia (Dodonov and Baiguzina, 1995).

12.7.4 Nearly 8,000 stone tools were recorded during excavations at a Middle Paleolithic (200,000 BCE to 35,000 BCE) site at Kara Bura (or Karaburo) on the banks of the Vakhsh River in the Dustri District of south-western Tajikistan. This stone tool production site is believed to be 40,000-50,000 years old. Excavations in the late 1950s at Kara Bura revealed a large number of pebble tools and Mousterian scrapers (Davis & Ranov, 1999). Evidence suggests that the people living in this region during the Middle Paleolithic were Neanderthals.

12.7.5 The Upper Paleolithic (35,000 BCE to 12,000 BCE) saw the introduction of *Homo Sapiens* in the region, although the onset of ice age in this period forced people elsewhere, resulting in a smaller number of archaeological sites.

12.7.6 Spears with stone tips, polished axes, knives, chisels and bone drills were produced and used from the Neolithic period (6,000 BCE to 4,000 BCE). Animal skins were also used to sew shoes and boots. Several Neolithic settlement sites have been recorded across the country, mainly comprising small stone-paved huts. One such site is located in Tutkavul in Nurek, 55km to the south-west of the Rogun Dam. Neolithic culture in Tajikistan is also referred to as the 'Hissar culture', with the first find dating to this period discovered in the Hissar Valley in 1948. Numerous Neolithic finds of Hissar tradition were discovered in Holocene soils on the surface of watersheds, comparable with Paleolithic sites in buried soils (Dodonov and Baiguzina, 1995).

12.7.7 In the mountain settlements of southern Tajikistan, many of which were investigated in the late 1970s, implements of the local Neolithic Hissar culture were encountered. A Hissar Neolithic layer was discovered under the floor of one of the buildings of the Late Bronze Age settlement of Kangurt-Tut. It is believed that the Hissar culture in these mountain regions continued right up until the arrival of the Late Bronze Age Bactrian population. It is possible that the appearance of the steppe tribes

brought about an intensification of livestock herding in the region. Long-distance livestock herding likely played a leading role in the development of the herding economy in the area (P'iankova, 2014).

12.7.8 The Neolithic also saw the first pottery production in the region. Pottery vessels seem to have served a purely functional purpose initially, but the creation of decorated pottery became common from around the 6th millennium BCE. Ceramic pots remained important domestic items into the 19th and 20th centuries, and the local production of decorated pottery continues to this day across Tajikistan. A society centered around cattle breeding emerged in the 2nd millennium BCE in the lower reaches of the Vakhsh and Qizilsu (Kyzylsu) rivers and is known as 'Vakhsh culture'. It is thought that Vakhsh culture was brought to this region by ancient tribes who arrived from elsewhere in Central Asia. Pastoralism was the basis of the economy of the Vakhsh culture. The people probably lived in temporary camps that might have been situated on the banks of the Vakhsh River, the traces of which have been washed away (P'Iankova, 2016).

12.7.9 Vakhsh culture graves lie in the upper foothill terraces of the river valleys adjacent to the mountain ridge watersheds (P'Iankova, 2016). There are various types of burial associated with Vakhsh culture, including round, triangular, T- and U-shaped and curved burials. Pair burials of men and women have been recorded, with the men typically facing north in a crouched position on the right-hand side and the women on the left. The majority of these mounds (or kurgans) have a ring of stones at their base. The burial grounds are characterized by uniformity of the burial structures and identical material culture (LT., 2016). Grave goods can include ceramic, metallic, stone and bone artefacts. Simple grave pits were also used, usually for children. Zoroastrianism is potentially reflected the beliefs of the ancient inhabitants of the lower reaches of the Vakhsh and Qizilsu. Its traces may be identifiable in the form of charcoal in graves, fires under the barrow fill and soot-covered vessels on small hearths in the burial chambers (P'Iankova, 2016).

12.7.10 In the settlements of Kangurt-Tut and Teguzak-ha near the Nurek Reservoir, there have been found both vessels made in the traditions of the settled farming milieu (of the Molali type), and pottery of the Bronze Age steppe tribes. In both settlements, two periods of construction have been identified, marked by extensive use of stone in their architecture (a distinguishing feature of Late Bronze Age settlements in southern Tajikistan). The influence of the pottery designs of the steppe tribes has been traced in vessels from the graves of the Vakhsh Culture (P'Iankova, 2016).

12.7.11 The ethnocultural composition of the population of southern Tajikistan during the Late Bronze Age was complex, with no unilinear development and traces of movement of various populations, representative of large tribal migrations characteristic of Central Asia in the second millennium B.C. All Bronze Age sites in southern Tajikistan have been dated to the last quarter of the second millennium B.C (P'Iankova, 2016). During the Hellenistic period (4th – 1st Century BCE), the southern extent of modern-day Tajikistan was within the Greco-Bactrian kingdom, a Greek state enduring throughout Central Asia. The region was effectively lost to Iranian nomadic tribes by c. 145 BCE, with the onset of the Kushan Period (Guerra et al, 2009).

12.7.12 Evidence of prehistoric copper craftmanship includes arrowheads, spears, horse armor and axes. The ancient Greek historian Herodotus noted in the 6th century BCE that the inhabitants of Central Asia were skilled in the production of copper. Copper production increased significantly during the Samanid dynasty's rule (819-999 CE), with high quality copper pots and goblets mostly made in Samarkand, the capital of the dynasty. Copper vessel manufacture reached its peak in the 19th Century CE.

12.7.13 The territory of present-day Tajikistan was a crossroads for the many different ethnic groups that have controlled Central Asia over the past 3,000 years. Three main Silk Road routes pass through Tajikistan, with the Karategin route, linking China with Uzbekistan, primarily used throughout the 5th to 12th Centuries (UNESCO, 2013). The Silk Roads: Zarafshan-Karakum Corridor is one of two 'cultural' (rather than 'natural') UNESCO World Heritage Sites in Tajikistan. The site, which was inscribed in 2023, spans three countries (Turkmenistan, Uzbekistan and Tajikistan) and at its closest is approximately 65 km to the north of the Project area (UNESCO, 2023). The Tugay forests of the Tigrovaya Balka Nature Reserve 'natural' World Heritage Site is discussed in Section 12.8. Until the Arab invasions, beginning in the 7th Century CE, most of Central Asia was under Persian influence. This remained strong, and new Islamic Persian dynasties sprang up, the most important of which was that of the Samanids (875 to 999). The Samanid period made a major contribution to the development of the cultural identity of the peoples that were subsequently to call themselves Tajiks. The collapse of the Samanid Empire left a battleground for successive waves of invaders, primarily from the northeast and evident in the medieval-period fortress sites located in the study area, as discussed in Section 12.8.

12.7.14 The defeat of the Samanids by the Turkic Ghaznavid dynasty in 999 marked the beginning of the decline of Persian influence in Central Asia. Largely due to the protection provided by the mountainous terrain, the people of present-day Tajikistan were able to preserve their Persian culture. Tajikistan is the only former Soviet Republic with an Iranian language; and music, dance and poetry in the Persian tradition play a major role in Tajik society.

12.7.15 Until the Soviet period, the territory of what is now Tajikistan belonged to the Emirate of Bukhara. It was ruled by the Turkish governors of the Amir of Bukhara. In 1920, the Red Army ousted the Amir, who fled to Afghanistan. His people, the Tajiks, were assigned a new rulership chosen from among the leaders of the newly formed republic of Uzbekistan. In 1924, recognized as a people, the Tajiks were given their own republic with the capital at Stalinabad (the Soviet name for Dushanbe). In 1929, the republic was awarded Union status. When the Soviet Union broke up in 1991, Tajikistan became an independent state.

12.8 CURRENT CONDITIONS

ARCHAEOLOGICAL AND HISTORICAL RESOURCES

12.8.1 Targeted field surveys (visual reconnaissance) were completed by the archaeology team at the A. Donish Institute from 14 to 23 June and 15 August to 12 September 2023. The areas targeted in June, and August to September were informed by the preceding desktop study of available literature including the list of Registered Monuments (2017) and previous survey phases, particularly to understand the current condition of resources previously identified. The primary aim of the surveys was to rapidly record archaeological resources falling with the upper terraces (over 1,200 *masl*).

12.8.2 The data collected during the targeted field surveys is supplemented by the GIS data acquired through the CAAL Project database, which is based on analysis of remote sensing imagery. Features identified within 20 km of the maximum inundation zone are discussed in this section.

12.8.3 A gazetteer of all cultural heritage baseline resources identified within 20 km of the maximum inundation zone is provided in **Annex 20.1**. **Drawing 20-2** (**Annex 20.5**) shows the distribution of these resources.

Geology and Topography

12.8.4 A series of river terraces line the course of the Vakhsh through the study area. Along much of the west bank of the river, the lower terraces have been washed away, with only high terraces (often over 100m higher than river level) remaining. Much of the west bank therefore comprises steep cliffs. On the eastern bank of the river, more of the expansive and flat lower terraces survive.

12.8.5 Between the dam and the confluence of the Vakhsh and the Khingob rivers (i.e., the south-western half of the study area), the Vakhsh River valley comprises six terraces: the current floodplain and five terraces of Mid-to-Upper-Pleistocene and Holocene age. Only small sections of the first and second lower terraces have been preserved (**Figure 12-2**). The third and fourth terraces (located at approximately 40m and 50-60m above river level respectively) were the focus of the 2023 archaeological surveys.

Figure 12-2 - Terraces 1 - 3 between the villages of Tagi Agba and Tagi Kamar, with the first and second terraces preserved only in narrow sections (Filimonova, 2023)



12.8.6 The bases of the terraces are composed of channel alluvium and pebbles. In the third terrace, the pebbles are covered with a layer of loess-like loam, mixed with mudflow sediments. Although the topography of the terraces is relatively level, the lack of fertile soil makes farming difficult. The soils are rocky and dry and there is a risk of dangerous mudflows. The fourth terrace is generally much narrower than the third. The pebbles here are covered by 1 – 3m of loess with less mudflow rubble, and dry soils. As a result of these challenging conditions, few rural settlements are situated on the third and fourth terraces, with most modern villages located on the fifth terrace. Here, the layer of loess is ~10m in thickness and the soil contains fewer stones. The presence of springs and streams also means that the soil is also less dry, with conditions more favorable for settlement historically.

12.8.7 The Tugay forests of the Tigrovaya Balka Nature Reserve, which is located approximately 180 km downstream of the Project area to its south-west, was inscribed on the UNESCO World Heritage List in 2023. This is a ‘natural’ World Heritage Site, inscribed as an outstanding example “*representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals*” (UNESCO, 2023). Potential impacts on this World Heritage Site as a result of the construction of the

dam and suggested offset measures are set out in the No Net Loss Framework of the Biodiversity Management Plan.

Nurobod District

The June survey was targeted to two areas of heightened potential, between the villages on Pandovchi and Gharm on the western side of the reservoir area, and between Nurobod and Qal'ai Surkh on the eastern side. On the outskirts of Pandovchii Agba, on the edge of the upper river terrace, the team inspected the site of a 16th-Century fortress, Qal'ai Kofir (RHPP-AR-01), a nationally registered monument at 1,250 masl. No upstanding remains of the historical fortress were observed. The location has been in regular agricultural use (**Figure 12-3**).

Figure 12-3 - Location of Qal'ai Kofir Fortress (RHPP-AR-01; Filimonova, 2023)



12.8.8 On the western outskirts of the Magzori Sir settlement, the fortress of Qal'ai Mir or Qal'ai Shokhon (**RHPP-AR-02**) was recorded. The site, dated to the 18th Century CE, was first identified by Soviet archaeologists in the 1950s and is listed on the National Register. During the June 2023 inspection of the site, the team observed a raised mound and stone-lined square pit to the west of the fortress, known locally as the Zindan Hill (**Figure 12-4** and **Figure 12-5**), and a drainage culvert, which potentially supplied water to the fortress from the nearby stream. According to a local resident, a local Bek (chief or commander) lived in the fortress and people from the nearby village of Gulomon (meaning 'slaves') worked for him, cultivating the fields surrounding the fortress and on the lower floodplain terrace.

12.8.9 The fortress of Qal'ai Mir is close to the settlement of Darband and the fortress of Qal'ai Imlok (**RHPP-AR-13**), which dates to the 10th to 12th centuries. According to archaeologist A. M. Mandelstam, Qal'ai Imlok was the political and economic center of Karategin in the ancient and medieval periods, strategically located near the confluence of the Vakhsh and Khingob Rivers (Mandelstam and Rosenfeld, 1960).

Figure 12-4 - View to the west of Qal'ai Mir / Qal'ai Shokhon Fortress (RHPP-AR-02) (Filimonova, 2023)



Figure 12-5 - View to the west of Zindan Hill at Magzori Sir village (Filimonova, 2023)



12.8.10 At Zarda village, the Kalai Chungi Zubaid fortress (**RHPP-AR-46**) was observed. It is situated above the maximum inundation zone, although its exact elevation is not known. The villages of Dehai Gulomon, Sari dasht, Sari kosh and Bulbuldara were also inspected during the reconnaissance survey, although no archaeological monuments were observed in the vicinity of these settlements.

12.8.11 During the August-September 2023 archaeological survey, poorly preserved structural ruins were recorded between two tributaries of the Vakhsh River, close to Khakimii poyon (**RHPP-AR-37**). The stone foundations of two buildings, which are situated within the maximum inundation zone, measure 7x3m and 4x3m. Small ceramic fragments found here date to the 19th Century CE.

12.8.12 The remains of a fortress were recorded within the maximum inundation zone near Mehrobod (formerly Komsomolobod; **RHPP-AR-38**). The fortress is situated on a narrow rectangular terrace below Mehrobod at the mouth of a tributary of the Vakhsh River, and two stepped platforms, separated by an earthen rampart, survive (**Figure 12-6**). The masonry of the outer wall of the fortress is visible from the southern edge of the upper platform. The team excavated a 1.5m wide test pit through the earthen rampart in an attempt to determine its structure. Several large stones

from the destroyed masonry of the wall were encountered at a depth of 1m, and the remains of a beam from the ceiling were found at 1.4m. Small fragments of 18th and 19th century CE molded pottery were also found in the rubble (**Figure 12-7**). An oil depot was located at this site in the 1960s and 70s.

Figure 12-6 - The terrace on which the fortress at Mehrobod (RHPP-AR-38) was located (Filimonova, 2023)



Figure 12-7 - Pottery fragments from the fortress at Mehrobod (RHPP-AR-38; Filimonova, 2023)



12.8.13 The remains of a 9th – 12th century CE settlement was discovered during an earlier reburial of a Christian cemetery at Mehrobod, although this site has since been significantly disturbed by modern burials. A cave above the terraces to the east of Mehrobod was examined for possible rock art, although during the August-September 2023 survey nothing was identified.

12.8.14 Whilst examining the fourth terrace (50 – 60m above river level) to the west of the village of Yakhch, several stone objects were identified, mostly comprising flakes (**RHPP-AR-45**). They could not be dated due to their small number and lack of markings. It is possible that the objects have been redistributed from higher levels. No archaeological evidence was identified during the inspection of terraces between the villages of Yakhch and Sari Ju. Stone objects, comprising flakes and a pointed tool, were found in the upper ploughed layer of a terrace 1.5 km to the east of Sari Ju (**RHPP-AR-44**).

12.8.15 The poorly preserved remains of a small fortress, called Kalankok by locals (**RHPP-AR-39**), were recorded to the northeast of Sari Ju on the edge of the terrace, within the maximum inundation zone (**Figure 12-8**). The remains have been disturbed by ploughing. Fragments of ceramics were collected from the surface which date the fortress to the 18th – 19th centuries (**Figure 12-9**).

Figure 12-8 - The site of the Kalankok Fortress (RHPP-AR-39; Filimonova, 2023)



Figure 12-9 - Pottery fragments recovered from the surface at Kalankok Fortress (RHPP-AR-39), Sari Ju village (Filimonova, 2023)



12.8.16 No archaeological evidence was identified during the examination of terraces between Sari Ju and Sangdevor. The ruins of a fortress were recorded to the northeast of the village of Roghuni poyon (**RHPP-AR-40**) on a hill at the edge of a 50 – 60m high terrace, within the maximum inundation zone. The stone foundations of the walls are well preserved and the contours of partially buried buildings can be seen at the foot of the hill (**Figure 12-10**). Based on the ceramic material recovered from the site, it likely dates to the 18th – 19th centuries.

Figure 12-10 - Remains of fortress near Roghuni poyon (RHPP-AR-40; Filimonova, 2023)



Figure 12-11 - Ceramic fragments recovered from the surface at the fortress near Roghuni poyon (RHPP-AR-40; Filimonova, 2023)



12.8.17 The archaeology team also inspected the terraces along the Khingob River during the August-September 2023 survey. No archaeological or historical sites were identified on the terraces surveyed, between the village of Yakhak and the bridge over the Khingob.

12.8.18 Several possible archaeological and historical sites have been identified with Nurobod District as part of the CAAL Project. The potential remains of structures have been identified via remote sensing, some of which may comprise parts of abandoned settlements. One such settlement site has been identified on a platform above the Vakhsh River to the west of the village of Kavlokho

(**RHPP-AR-24**). Another is recorded in mountainous terrain near the village of Labi Jar (**RHPP-AR-25**). The possible remains of abandoned structures have been recorded near Darband City (**RHPP-AR-29**, **RHPP-AR-30**, **RHPP-AR-32**) and Roghuni poyon (**RHPP-AR-31**). The location of the historical settlement of Komsomolobad (now Mehrobod) is also recorded (**RHPP-AR-14**).

Rasht District

12.8.19 In the vicinity of Navdonak settlement, the fortresses previously identified and investigated by the A. Donish Institute in 2017 were noted by the field team. Qal'ai Bacha (**RHPP-AR-05**) and Qal'ai Dukhtarak (**RHPP-AR-06**) are located on the upper terraces, over 1,300 *masl*. The latter site houses a modern cemetery. Surface artefacts were noted in proximity, potentially associated with another possible fort location on the lower terrace (**RHPP-AR-07**). These sites have been tentatively dated, pending further analysis, to the 17th – 19th centuries.

Figure 12-12 - Qal'ai Bacha Fortress (RHPP-AR-05), Navdonak village (Filimonova, 2023)



Figure 12-13 - Qal'ai Dukhtarak Fortress (RHPP-AR-06), Navdonak village (Filimonova, 2023)



Within the village of Shule, a fortress, Qal'ai Shul (**RHPP-AR-08**) was noted. Two other potential fortresses were recorded at Shahrisabz (**RHPP-AR-09**) and Shohindara (**RHPP-AR-10**), which require further investigation. A heavily destroyed monument to Tepai Shul was identified in the southern part of the village.

Figure 11-14 - Qal'ai Shul Fortress (RHPP-AR-08), Navdonak village (Filimonova, 2023)



12.8.20 Within the Obi Mehnat Jamoat, the settlement of Dakhana was noted to have higher archaeological potential. A fortress (**RHPP-AR-03**) is recorded from the 18th Century CE. Although no above ground remains survive, there is some potential for subsurface material. In proximity, a cone-shaped mound was observed, possibly the site of an associated watchtower.

12.8.21 Near the village of Dakhana, a raised earthen mound (**RHPP-AR-04**) was identified in proximity to the Dakhana Fortress (**RHPP-AR-03**). The mound (and others yet to be identified in the near

vicinity) may be associated with the arrival of nomadic tribes (e.g., Saks / Scythian) into the Karategin territory between the 4th – 6th centuries (Filimonova, 2023).

12.8.22 The location of a possible watchtower was also recorded within the maximum inundation zone between the villages of Dakhana and Obi Mehnat (**RHPP-AR-11**). A mazar, named the mausoleum of Khodja Abdullohi Vali, is currently situated atop this cone-shaped hill (**Figure 12-16**). Fragments of ceramics dating to the 19th and early 20th centuries were identified on the surface of a terrace opposite the mausoleum during the August-September 2023 survey. The outlines of structures were also identified here, suggesting it may be the site of an abandoned village.

Figure 12-14 - Dakhana Fortress (RHPP-AR-03; Filimonova, 2023)



Figure 12-15 - Mound near Dakhana Fortress (Filimonova, 2023)



Figure 12-16 - Possible site of a watchtower between the villages of Obi Mehnat and Dakhana (RHPP-AR-11; Filimonova, 2023)



12.8.23 According to archaeological data from the 1950s, a small fortress was located in the village of Sangi maliki. However, no trace of the fortress was found during the survey.

12.8.24 The terraces between the villages of Navobod and Dakhana on the western bank of the Vakhsh River were examined in greater detail during the August-September 2023 survey. The well preserved Gumushkala fortress (**RHPP-AR-41**), which is located above the maximum inundation zone close to the village of Dakhani gumush, was examined. The fortress likely dates to the 18th – 19th centuries and was first examined by A. M. Mandelstam in 1954. It was located in a strategically advantageous position, overlooking the road on the western bank of the river.

12.8.25 A collection of stone tools was found during examination of the terraces around the village of Vahdat (**RHPP-AR-43**). The tools were found on the surface of the soil in the upper part of the fourth terrace to the east of the village. It is likely that the tools were originally deposited on the surface of the fifth terrace but have been redeposited as a result of erosion. The handaxe found in the collection is thought to be Late Stone Age (50,000 BP). The lithic scatters identified throughout the study area are considered to be resources of medium sensitivity due to their rarity and individual research value, although the sub-surface archaeological potential of these locations is likely to be very limited.

Figure 11-18 - Stone tools identified on a terrace near Vahdat (RHPP-AR-43; Filimonova, 2023)



12.8.26 The Yapoloki Fortress (**RHPP-AR-42**), located close to the village of the same name, was examined. The fortress is well preserved, and the remains of the outer rampart and small mounds from its rooms are still visible. Ceramic vessels previously recovered from the site, which are currently stored in the regional museum of Gharm, suggest that the fortress was originally erected in the early Middle Ages and was still in use in the 18th and 19th centuries. The fortress is located above the maximum inundation zone.

12.8.27 The potential remains of structures located on low ground have been recorded near Dehai Amirbek as part of the CAAL Project (**RHPP-AR-28**).

Rogun District

12.8.28 An inspection of the terraces on the western bank of the Vakhsh River between the villages of Lughuri poyon and Chorsada was undertaken during the August-September 2023 archaeological survey. No traces of ancient buildings were identified during inspection at the village of Aligalaboni, and local residents claimed that the village was founded in the 1970s. Locals in Obi boriki poyon were not aware of any fortresses or other ancient buildings around their village.

12.8.29 In the village of Khumrog (formerly Qumoq), locals reported finding fragments of ceramics whilst digging in their gardens, and sherds from molded ceramic vessels dating between the late 18th and early 20th centuries were collected from vegetable gardens here during the survey. The chairman of the Jamoat told the team that, according to local legend, a watchtower was previously located on a hill near the village. However, most of the hill collapsed into the river when the base of the terrace was washed away. The existence of a watchtower here is disputed; the legend may simply be based on the fact that the shape of the hill would have made it an ideal location.

12.8.30 During the ethnographic studies undertaken in June 2023, a mill was identified in the village of Lughuri poyon (**RHPP-AR-12**). The owner of a mill believes that it is over 100 years old. It was inherited from the man's father and has been used by at least three generations of the same family. The exact co-ordinates for the mill's location within the village are unknown, although the informant suggested that it is likely to be situated within or adjacent to the maximum inundation zone. As

stated in **Volume 1: Chapter 20: Cultural Heritage** of the ESIA, where the exact location of cultural heritage resource is currently not known, this will be determined through further community consultation, where possible.

12.8.31 The CAAL Project dataset includes three archaeological sites in Rogun City which are situated within the study area. These are the potential remains of abandoned settlements in the southern part of the study area, downstream of the proposed Project footprint (**RHPP-AR-21**, **RHPP-AR-26**, **RHPP-AR-27**).

12.8.32 A fortress was located at the confluence of the Obigarm and Vakhsh rivers in the Rogun District, although this was destroyed in the 1980s during the construction of structures associated with the Rogun hydroelectric power station.

12.8.33 Several archaeological and historical sites have been recorded in the southern part of the study area in the Baljuvon District as part of the CAAL Project. Archaeological finds recorded near the village of Mulokoni include a flint splinter, believed to date to the 6th to 4th millennia BCE (**RHPP-AR-20**). An abandoned settlement at Tagov Detai (**RHPP-AR-23**) is believed to date to the 1st to 4th centuries CE. A square stone with pitted sides recorded here may be associated with the abandoned settlement (**RHPP-AR-22**). The fortresses of Ruiob (**RHPP-AR-16**), Shohindara (**RHPP-AR-17**), Guldara (**RHPP-AR-18**) and Mulokoni (**RHPP-AR-19**) likely date to the 18th and 19th centuries. The Sarihisor Watchtower (**RHPP-AR-15**) dates to the 18th to 20th centuries.

Summary of Archaeological and Historical Resources

12.8.34 In summary, 45 archaeological and historical resources have been recorded within the baseline study area, including 20 fortress sites, mostly dating to the 16th – 19th centuries and commonly situated on the outskirts of currently populated (ancient) villages. The conditions in the study area were not favorable for settlement historically, particularly on the lower terraces, although there was an upturn in human activity in the 18th and 19th centuries. It was during this period that the economic position of the Karategin territory, which was independent at the time, strengthened, as Tajiks returned to their ancestral lands and pushed the nomadic Kyrgyz to the upper reaches of the Qizilsu River, with most of the monuments in the area date to this period (Mandelstam, 1956). The majority comprise small fortresses and settlements along the road connecting Karategin with the plains. It is likely that many of the modern villages in the study area originated in this period. Larger fortified estates were also constructed in this period, belonging to local Beks who ruled the districts. The small fortresses and estates were mostly abandoned by the Beks in the 1920s and 1930s as Soviet power was established. Most of these sites have since been damaged as a result of ploughing and natural erosion.

12.8.35 The historical 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 Khakimii bolo, Khumrog and Lughuri poyon have burial sites dating from the 16th to 18th centuries.

12.8.36 Several earlier period resources were also identified, such as the prehistoric lithic scatter sites and the 4th – 6th century CE mounds in proximity to a fortress at Dakhana village. Remains of relic agricultural features were identified as part of the CAAL Project, concentrated on the north-eastern slopes of the Vakhsh Valley, including possible remains of field systems (**RHPP-AR-33**), such as terraces (**RHPP-AR-35**) and lynchets (**RHPP-AR-34**; terraces formed on slopes as a result of ploughing).

12.8.37 With the exception of the fortress near Mehrobod (**RHPP-AR-38**), none of the archaeological and historical resources within the study area have yet been subject to intrusive 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 route of the Silk Road and the Surkhob-Vakhsh river valley. All fortresses located during the June survey have been previously listed on the official register of National Monuments of Tajikistan (2017).

CULTURAL AND SACRED RESOURCES

12.8.38 Targeted ethnographic surveys were undertaken by the ethnography team at the A. Donish Institute from 14 to 21 June and 25 August to 7 September 2023. In the June survey, consultations were carried out in the villages of Khakimii bolo, Khakimii poyon, Khumrog, Obiboriki bolo, Obiboriki poyon and Lughuri poyon. In the August-September survey, consultations were carried out in Mehrobod (Komsomolobod), Roghuni poyon, Aligalaboni bolo, Kumrog, Chanor and Bedikho.

12.8.39 A series of targeted interviews at household level were also conducted by M-Vector in August 2023. Data concerning general demographic and socio-economic background, gender, education level, employment status, vulnerable populations, resettlement status, access to services, expectations and knowledge of cultural heritage was collected from across five regions: Rogun, Nurobod, Faizobod, Tursunzoda, and Danghara. A total of 900 participants were asked about their awareness of cultural heritage sites, whether they were consulted about them and their feelings regarding management and recording of cultural heritage in the Project area.

12.8.40 Of the 900 respondents, 35% (38% of male-headed households and 20% of female-headed households) stated that they were aware of cultural heritage sites in their village of origin. Of those who were aware of these sites, 81% of these 332 respondents (81% of male- and 74% of female-headed households) had been consulted regarding cultural heritage site relocation, primarily in relation to mosques and cemeteries. 79% of these 332 households stated that they were satisfied with the management of cultural heritage in their village, while 5% were generally satisfied but thought more could have been done, 8% had no or insufficient information and 8% stated that they did not know. Households undergoing resettlement in RAP 2 were more likely to have been aware of cultural heritage sites (46%), more likely to have been consulted (83%) and more likely to be satisfied (88%) than other households (20%, 72% and 52% respectively).

12.8.41 A gazetteer of all cultural heritage baseline resources identified within 20 km of the maximum inundation zone is provided in **Volume 2, Annex 20.1** – **Cultural Heritage Gazetteer - Drawing 20-2** (**Annex 20.5**) which shows the distribution of these resources. A gazetteer of villages studied in the current and previous ethnography surveys, which includes details of cultural and sacred resources within in each, is provided in **Volume 2, Annex 20.2** - **Drawing 20-3** (**Annex 20.5**) shows the location of all villages being resettled under RAP 2 of the resettlement program.

Nurobod District

12.8.42 Within the Nurobod District, the heads of 568 households were consulted as part of the M-Vector survey regarding cultural and sacred heritage sites within their villages and their feelings regarding the recording and management of those sites. Just over one fifth of respondents (21%) answered that they were aware of cultural sites, including religious sites, local shrines, traditionally sacred places and historical and/or archaeological sites. This was the lowest level of awareness recorded across the five districts.

12.8.43 Of those respondents who were aware of cultural heritage sites, it was found that 78% were directly consulted by the Project team regarding the cultural heritage prior to their relocation. Subsequently, 58% of respondents who were aware of cultural heritage sites agreed that the cultural and sacred places were appropriately, and permissibly recorded and appropriate mitigation strategies were proposed, including maintenance of access. 12% of households responded that the cultural sites were recorded, but they were not consulted regarding the relocation or management of the sites.

12.8.44 Overall, 63% of respondents stated that they were satisfied with the management of cultural heritage sites in their villages of origin, with only 16% of respondents responding with uncertainty ("*I don't know*").

12.8.45 Two of the villages in which consultations were undertaken during the June 2023 ethnography survey are located within the Khakimi Jamoat in the Nurobod district:

- In Khakimii bolo, the chairman of the village and ten other locals were interviewed. When asked about holy places in the village, one local referred to the village cemetery (**RHPP-CR-01**) and the village mosque (**RHPP-CR-05**), both of which are modern.
- In Khakimii poyon, thirteen locals were interviewed, including the village chairman. The 'holy places' identified in the village were a modern mosque (**RHPP-CR-07**), a modern cemetery (**RHPP-CR-06**) and a small burial place of 18th and 19th century date (**RHPP-CR-20**).

12.8.46 The ethnography team consulted the register of monuments for the district and identified the following tombs and graves of religious scholars located in the villages visited in Nurobod, many of which are visited regularly by locals:

- The 17th to 18th century CE tomb of Oftobhuga (**RHPP-CR-02**), who, according to legend, was a herbal healer and religious scholar who came from the southern regions and founded the village of Khakimii bolo (*khakim* meant '*healing*').
- Another 17th to 18th century CE tomb (**RHPP-CR-03**) in Khakimi bolo.
- The 19th Century CE tomb of theologian, Dumullo Olim, in Khakimii bolo which is visited by pilgrims from all over Tajikistan (**RHPP-CR-04**).

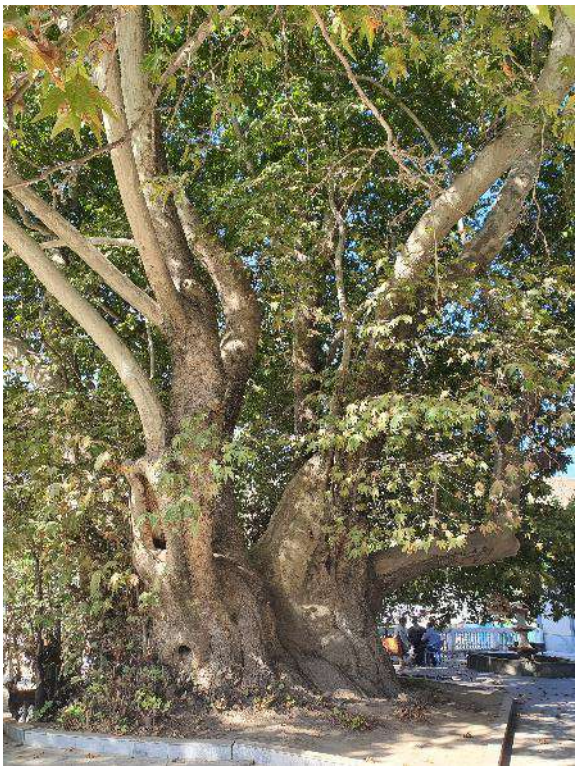
12.8.47 Several cultural and sacred resources were also identified within the Nurobod district during the archaeological field survey undertaken in June 2023:

- In the village of Pandovchii agba, which is situated at 1,242 *masl*, an old cemetery was identified (**RHPP-CR-21**). The cemetery is believed to be 200-300 years old and contains over 100 graves. A modern stone mausoleum in the village, called '*Xazrati Khujai Paron*' by the locals, has been built on the site of an older one (**RHPP-CR-22**). The locals spoken to said that they do not know who is buried in the mausoleum, but he is said to have been a holy man. The archaeology team considered the mausoleum and the village's late 20th Century CE Mosque to have '*no historical value*'.
- A mosque (**RHPP-CR-23**) built in the 1980s was identified in the village of Bulbuldara (1,252 *masl*). The mosque, which is named after Shokh T.G. Filimonov, is no longer in use.
- An old mazar named after *Vakhobiddin* (**RHPP-CR-24**) was identified in the village of Zarda at an altitude of 1,400 *masl*.
- In the village of Magzori Sir, a cemetery (**RHPP-CR-25**) was identified in which, according to locals, a great priest is buried. The village is situated at 1,306 *masl*.
- An old cemetery (**RHPP-CR-26**), named after *Oromgoh*, was also identified in Sari Kosh (1,286 *masl*), although no other cultural or sacred resources were identified in the village.

12.8.48 During the August-September 2023 survey, the ethnography team visited the village of Mehrobod, which was formerly the center of the district and known as Komsomolobod. Villagers refer to the settlement as “Old District”. The grave of a *Bibi Otun*, an influential female religious figure, is located within the village (**RHPP-CR-32**). *Bibi Otun* are female informal spiritual leaders who perform rituals and prayers, teach religion to women and children, and help women with social and domestic matters. They have a high social status as religious authorities in Tajikistan (Cieślewska, 2015). According to locals, people visit this grave and rub dirt from it on wounded parts of their body to heal them.

12.8.49 A sycamore tree (or *Chanor*), believed by locals to be over 1,000 years old, is located in the village (**RHPP-CR-33**). According to a local legend, a large dragon once lived where the tree now stands and forbade anyone to pass through the area. The sycamore then slowly grew around the dragon, preventing it from harming anyone. It is said that, if you look closely, you can still see the shape of the dragon’s head in the tree.

Figure 12-17 - Sycamore tree (*Chanor*), Mehrobod



Rogun District

12.8.50 Within the Rogun District, awareness of cultural heritage sites was higher than Nurobod, at 39% of respondents. Of those who were aware, just over half (54%) were directly consulted regarding cultural heritage prior to relocation.

12.8.51 51% of respondents who were aware of cultural heritage sites answered that they were satisfied that the sites had been recorded with their permission and that appropriate compensation, relocation or management strategies had been proposed. Nearly a fifth (18%) responded that the places had been recorded, but that no consultation on further management or relocation had occurred to date.

Overall, 61% of respondents who were aware of cultural heritage sites stated that they were satisfied with the organization and management of the sites within their district.

12.8.52 The following sites were recorded in Rogun District during the June 2023 ethnographic survey:

- A modern mosque (**RHPP-CR-08**) and cemetery (**RHPP-CR-09**) in Khumrog.
- The 16th to 17th century CE tomb of the great theologian Mir Sayyid Aliya Hamadoni (**RHPP-CR-11**) and another 16th to 17th century CE tomb (**RHPP-CR-10**) in Khumrog.
- A modern mosque (**RHPP-CR-14**) and cemetery (**RHPP-CR-12**) in Obiboriki bolo. A spring (**RHPP-CR-13**) was also identified in the village.
- A modern mosque (**RHPP-CR-15**) and a spring (**RHPP-CR-19**) in Obiboriki boyon.
- A modern mosque (**RHPP-CR-16**) and cemetery (**RHPP-CR-17**) in Lughuri poyon along with an 18th Century CE tomb (**RHPP-CR-18**).

12.8.53 During the August-September 2023 survey, the ethnography team visited the village of Aligalaboni bolo, previously named Lake Ararakon. The shrine of Aligalabon, who was a scholar of Islam, is located here, and it is believed that his descendants still live in the village. There are three tombs located in the village: two of them are of unknown scholars of Islam who were supposedly martyred (**RHPP-CR-35**, **RHPP-CR-36**) and the third is the tomb of Eshan Asrari (**RHPP-CR-34**). Eshan Asrari's tomb is visited more often than the other two.

12.8.54 There are several burial sites in the village of Bedikho. One is the mausoleum of a young scientist who, during the establishment of Soviet power, supposedly tried to escape the rulers and took refuge in the village (**RHPP-CR-27**). However, he was caught by the authorities and killed. A further four burial sites were recorded in the village (**RHPP-CR-28**, **RHPP-CR-29**, **RHPP-CR-30**, **RHPP-CR-31**).

Rasht District

12.8.55 A mazar, named the mausoleum of Khodja Abdullohi Vali, is situated atop a cone-shaped hill located between the villages of Dakhana and Obi Mehnat (**Figure 12-16**). It was identified during the August-September 2023 archaeology survey. This may also have been the site of a watchtower historically (**RHPP-AR-11**).

12.8.56 A museum to the Tajik-Soviet writer, Boqi Rahimzoda (**RHPP-CR-37**), is located in Sangi Maliki village, within the inundation zone. It may be possible to move the museum up the valley to Boqi Rahimzoda's birthplace, Sorbog, which will not be inundated.

Faizobod District

12.8.57 The highest level of awareness of local cultural heritage was recorded in the Faizobod District (86%), although only 30 households were interviewed (compared with 568 in Nurobod and 84 in Rogun). Of those aware, all but one household was directly consulted about cultural heritage sites (97%).

12.8.58 Regarding permissible recording, further consultation and proposed mitigation strategies, 94% of respondents who were aware of cultural heritage sites answered that they felt cultural places were adequately recorded with their permission, and appropriate compensation, relocation and/or management strategies of those places was proposed. Consequently, 97% of respondents with awareness of cultural heritage sites agreed that the management of the cultural heritage in their villages of origin were well organized.

Tursunzoda District

12.8.59 In the Tursunzoda District, awareness of cultural heritage sites stood at 83% of respondents. Of those respondents who were aware, 97% responded that they were directly consulted regarding cultural heritage in their villages of origin, such as religious sites, local shrines and traditionally sacred places, prior to being relocated. The same percentage responded that these sites had been recorded with their permission, and that appropriate mitigation strategies had been proposed. Overall, 98% of respondents who were aware of cultural heritage sites were satisfied with their management. This was the highest rate of satisfaction recorded in the five districts.

Danghara District

12.8.60 In Danghara District, 66% of respondents were aware of cultural heritage sites, and of these, 45% were directly consulted about them. Only 28% of respondents (the lowest across the five districts) who were aware of cultural heritage sites said that these sites were recorded with their permission, and that appropriate mitigation was proposed. The overall level satisfaction with how cultural heritage sites were being managed was, however, high (94%).

Cultural Landscape

12.8.61 Community / cultural leaders in the targeted settlements expressed how the landscape is important to them during the Key Informant Interviews (KII). Specifically, they were asked to identify important landscapes and key viewpoints which may be impacted by the inundation. Generally, connections with the natural landscape were not noted as significant, though this viewpoint is very subjective and likely to vary between individuals, and potentially according to age and local family history.

12.8.62 In general terms, the cultural value of the landscape is heightened by the archaeological potential and the long-standing continued occupation of the land, particularly in the older settlements (e.g., Mehrobod). The spiritual associations of specific topographic and natural features, and between wider elements of the landscape (i.e., views from individual receptors towards the mountains), are potentially multi-faceted and entrenched in local belief systems and oral history (stories around local landmarks including trees, spring sites and shrines, etc.).

12.8.63 It is considered that these cultural connections are important to the local sense of place, potentially helping to establishing the distinctiveness of a unique ethnographic landscape, with isolation fostering unique aspects of local culture and intangible heritage, which may vary between villages. These belief systems form the basis of local relationships with, and understanding of, the physical and spiritual world upon which a shared cultural identity has been built and how the local society is organized.

12.8.64 Viewsheds from the mountains towards the settlements / reservoir area are considered less significant than the connections to and between the villages, since general access to the tops of the mountains is limited.

INTANGIBLE CULTURAL HERITAGE

12.8.65 Evidence of intangible cultural heritage was also recorded during the 2023 ethnographic surveys. The field reports (**Volume 2**, **Annex 20.6**) concluded that, 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.

12.8.66 A gazetteer of villages studied in the current and previous ethnography surveys, which includes examples of intangible cultural heritage, is provided in **Volume 2, Annex 20.2** - **Drawing 20-3** shows the location of all villages being resettled under RAP 2 of the resettlement program.

12.8.67 A number of common themes emerged over the course of the June 2023 ethnographic survey which are summarized in this section. Specific examples of intangible cultural heritage in different villages are outlined in **Volume 2, Annex 20.3**.

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.

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

7.1.1. 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. Further detail on traditional medicine is provided in **Volume 1: Chapter 06: Ecosystem Services** of this ESIA.

Traditional Food

7.1.2. 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.

7.1.3. During the September 2024 site visit, the WSP team spoke with women from Chorsada who had been resettled to Tursunzoda. The women told the team that when they lived in Chorsada, they would prepare food to leave in the mosque for travelers who got stranded in severe weather. They no longer do this in Tursunzoda because the climate is milder, and because the government have limited mosque opening hours for national security reasons.

Traditional Clothing

7.1.4. There is a mixture of styles from different regions and countries in the clothing of the inhabitants of the villages. Women mostly wear modern 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

7.1.5. 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,* centered around a first-born's cradle.

12.8.68 Marital relations in the villages were traditionally often intrafamilial, with cross-cousin marriages being preferred, in part to keep wedding expenses low and to prevent a family's inheritance from falling into the hands of a stranger.

12.8.69 A law on the regulation of traditions, celebrations and ceremonies in Tajikistan now restricts wedding celebrations to one day. The aim of this law is to protect values of national culture and respect traditional customs whilst ensuring that families do not feel the need to spend more than they can afford on wedding celebrations. One common theme that emerged was the sharing of produce and resources with fellow villagers, with 'collective attachment' to the landscape a necessity of sustainable, remote rural lifestyles. Several informants said they thought of their neighbors as relatives who they would provide resources to and undertake work for free of charge.

12.9 PREDICTED FUTURE BASELINE CONDITIONS

ARCHAEOLOGICAL, HISTORICAL AND PALEONTOLOGICAL RESOURCES

12.9.1 In the absence of the Project, it is likely that the archaeological, historical and paleontological resources within the AoI would continue in their existing condition, though potentially subject to pressures through localized settlement growth, agriculture, and environmental degradation (erosion, flooding etc.).

12.9.2 As a result of continued Project progress, the Rogun dam will be fully constructed, and the reservoir fully inundated by 2038. The entirety of the flooding zone will be cleared, inundated and therefore, effectively archaeologically sterilized as a result of Project.

12.9.3 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

12.9.4 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 localized settlement growth, agriculture and environmental degradation (erosion, flooding etc.).

12.9.5 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 flooding zone (i.e., in the indirect area of impact) may experience loss of access, change in setting, changing demographics, and tourist influx.

12.9.6 In the absence of the Project, it is likely that any cultural landscape features would continue in their existing condition. As a result of the Project, by 2038 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 change will be gradual rather than sudden. 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 effect on the sense of place.

INTANGIBLE CULTURAL HERITAGE

12.9.7 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 recognized that some adjustments in cultural behaviors and social organization are inevitable over time.

12.9.8 All villages within the inundation zone are due to be resettled by 2032. Given that intangible heritage 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 directly within the flooding zone may be affected by a loss of access, change in setting, demographics and tourist influx.

13 MATERIALS AND WASTE

13.1 INTRODUCTION

13.1.1 This section on existing waste management infrastructure in Tajikistan has been drawn from a range of secondary baseline data sources.

13.1.2 Information on current Project waste management practices has been collated through review of existing Project reports, data provided by Project HSE personnel and WSP site visits undertaken during 2023-2024.

13.2 MATERIALS

13.2.1 The current land use in the AoI comprises predominantly mountainous, low-productivity grazing pasture. A small minority of land is floodplain, forest and scrub. On the Project site, existing assets comprise a reservoir, an underground substation, a network of dirt roads, various plant and monitoring and control equipment, borrow pits, tunnels and spillways. The construction, operation and maintenance of these assets will require the consumption of a number of specialist components and equipment, as well as some bulk products for repairs.

13.2.2 A preliminary overview indicates that there is high regional and national availability of construction materials from quarries on site and around in Tajikistan. The construction industry of the country has a significant mineral resource base for the production of bricks, inert materials, expanded clay, aggloporite, gypsum, cladding, sawing and quarry stone, lime, cement and other construction materials. It is noteworthy that in recent years, Tajikistan has become a net exporter of cement to markets such as Russia, China, Kazakhstan, Turkey and European countries (Embassy of the Republic of Tajikistan in the Federal Republic of Germany, 2021).

13.2.3 **Table 13-1** sets out the gross volumes of the production of industrial mineral production between 2015 and 2019.

Table 13-1 - Construction material production in Tajikistan, 2015-2021 (Metric tons, gross weight, unless otherwise specified) (USGS, 2024)

Mineral	Year						
	2015	2016	2017	2018	2019	2020	2021
Cement, hydraulic (thousand metric tons)	1,418	1,361	3,117	3,844	4,202	4,243	4,000
Gypsum, mine	8,500	9,000	8,648	9,639	10,031	8,183	7,800
Salt	35,704	35,516	23,676	36,964	35,496	37,023	39,000[e]
Sand and gravel, construction	666,000[e]	730,700[e]	1,670,000	3,410,000	2,470,000	2,330,000	2,400,000

13.2.4 [e] Estimated.

BORROW PITS AND QUARRIES

13.2.5 There are a number of borrow pits and quarries on Site which provide materials for the construction of the Project. These are set out in **Table 3-10** of **Chapter 3: Project Description** of this ESIA.

13.3 WASTE

EXISTING WASTE MANAGEMENT INFRASTRUCTURE IN TAJIKISTAN

13.3.1 According to the United Nations Environment Program (UNEP), waste management (including waste from mining, industry, medicine, households and other municipal sources) is one of Tajikistan's biggest environmental challenges (UNEP, 2019). The current waste management system in Tajikistan relies heavily on landfilling and faces several challenges, such as insufficient landfill capacity and the lack of any centralized method for separating or composting for recycling in the country. According to the World Bank, access to improved drinking water sources and to sanitation connected to a functioning sewage system, are among the most severely limited and unequally distributed services in the country. Tajikistan has abundant freshwater resources, however outside Dushanbe, the availability and quality of water supply, sanitation and hygiene (WASH) services remain poor (World Bank Group, 2017).

13.3.2 The average waste generation per capita is 0.89 kg per day which equates to around 2.6 million tons annually across the country. There are approximately 70 official municipal solid waste landfills in Tajikistan, which hold about 12 million tons of waste and cover 296 ha (Boboeva, 2015). The average current deposition in these landfills is estimated to be 4 tons of solid waste per m2 (United Nations Economic Commission for Europe (UNECE), 2017). The per capita generation of municipal solid waste varies from city to city. Waste generation rates are higher in urban areas. Rural areas have lower waste generation rates, on average, as rural area residents are typically less affluent, have higher levels of recycling, reuse and composting, and purchase fewer items from stores. In Dushanbe approximately 1,200,000 m^3 of municipal waste is generated every year, which is about 218,000 tons and only about 50% of that is dumped at official, regulated landfills. The rest of the waste goes to illegal landfills (Boboeva, 2015).

13.3.3 Municipal solid waste in Tajikistan typically consists of food waste, leather, resins, plastics, metals, paper and cardboard, glass, ceramics, leaves and ash. Municipal waste is neither sorted nor treated in the country. Due to a shortage of trucks, the collection of municipal waste is poor even in urban areas. Waste is often disposed of illegally in the countryside and in parts of the cities (Boboeva, 2015). National data on collected municipal solid waste are typically in m^3, but individual operators tend to collect waste data in tons. Rural populations often dispose of waste by dumping or burying it in gardens (confirmed by site visit discussions).

13.3.4 According to research undertaken by UNECE in 2016, collection was only provided to 38.25 % of Tajikistan's population. Modernization of waste services is required to increase the share of the serviced population and develop adequate disposal capacity. Municipal waste is collected from designated places, which may be equipped with containers. In some cases, waste is dumped on the ground or in large containers (skips) located at the entrances to houses, and a front loader is used to transfer the waste to a collection truck. Existing disposal sites at regional centers are overfilled and there is an urgent need to start developing a national network of landfills (UNECE, 2017).

13.3.5 According to Boboeva (2015), none of the landfills in Tajikistan meet current international standards. At the time of writing this information could be out of date as the Kurugsoy landfill at Tursonzoda

(135km west of the Project Site) was observed by WSP colleagues to meet international standards. This 2015 study identified that waste separation had not yet commenced, although some progress had been made, as the collection of fluorescent lamps had started at this time. The 2015 research also revealed that Tajikistan generally lacks recycling infrastructure, except for recycling of scrap metals and paper. According to the UNECE's Environmental Performance Review of Tajikistan (UNECE, 2017), Tajikistan does not have a national waste management strategy or action plan for waste management, however such a strategy is currently under preparation. The country also lacks waste management plans for regions, municipalities and individual waste generators.

13.3.6 The Vahdat landfill, which services Dushanbe and the surrounding area, was visited by WSP during a September 2024 site visit. The site has been in use since the Soviet era and was found to be in a very poor condition. Unsorted waste was dumped on bare ground (no lining was visible), where it was observed to be contaminating soils, and leachate was flowing into a nearby watercourse. The waste was affected by extensive fires generating large volumes of fumes, creating a respiratory hazard for workers, who were not observed to be wearing PPE and residents of local communities' houses were around 100m away from the landfill boundary.

13.3.7 The Rogun landfill was observed to be in a similarly poor condition. It is located on a steep hillside approximately 4km outside of Rogun city. Waste was observed to be dumped on the ground on the hill side and uncontained. There were no signs of containment in the form of bunds or lining. Waste was seen to be loosely deposited and partially cascading down the hillside into the valley below where a stream flowed through during wet periods.

13.3.8 **Table 13-2** sets out design measures from the IFC guidance and whether they were observed as part of the design of the Rogun and Vahdat landfills by WSP staff during their site visits in September 2024. This table is inclusive of the list of design measures which WSP were able to ascertain during the site visits. It is not an exhaustive list of all in the IFC guidance.

Table 13-2 - IFC landfill design measure and landfill design in the AoI

Design measure	Observed at Rogun	Rogun Comment	Observed at Vahdat	Vahdat comment
Residential development should be typically further than 250 m from the perimeter of the proposed landfill cell development.	✓	The landfill is located off a main road around 3km out of Rogun city. No houses were observed within 250m of the landfill site. The closest residential receptor is approximately 450m to the east.	✗	A cluster of residential receptors were observed to the east across the road from the Vahdat landfill site, with the closest being approximately 130m.
Visual impacts should be minimized.	✓	The landfill is screened from the road by a 3m high solid metal gate and so is not visible from the road. No other receptors were identified in the vicinity of the landfill.	✗	The landfill is located on a gently sloping hill above residential receptors who live in houses east of the landfill who currently incur a visual impact from the site.
Siting should be further than 3 km of a turbojet airport and 1.6 km of a piston-type airport.	✓	There are no airports within 3 km of the landfill.	✓	The landfill is greater than 3km away from an airport.
Perennial fluvial watercourse(s) should not be located within 300 meters downgradient of the landfill cell development, unless diversion, culverting or channelling is feasible.	✗	A river runs along the valley floor within 300m (approximately 235m) south of the edge of the landfill.	✓	The landfill is greater than 300m from a river, however there are three ponds to the southwest of the site where there are visible signs of contamination from the landfill. However, these ponds are

Design measure	Observed at Rogun	Rogun Comment	Observed at Vahdat	Vahdat comment
				isolated and are not part of a river system.
Landfills should be located in gently sloped topography (about 2%).	✗	A 2% gradient is defined as 'little to no slope'. The landfill is located on a steep slope in a valley and so it is estimated that the gradient is greater than 16% which would denote a 'moderate slope'.	✓	The landfill is located on a hill with a gentle slope of around 2% gradient.
Suitable soil cover material should be available on-site to meet the needs for intermediate (minimum of 30 cm depth) and final cover (minimum of 60 cm depth), as well as bund construction. Preferably, the site would have adequate soil to also meet required cover needs (a minimum of 15 cm depth of soil).	✗	Suitable soil is not available at the location due to the topography of the land. Any soil on site is inaccessible to machinery that could cover dumped refuse.	✗	Suitable soil cover is potentially available at the location; however, the current condition of the landfill does not lend itself to being used for covering the waste. Any potential remaining soil that could be used for this purpose is of insufficient volume and is inaccessible.
Landfills should be sited outside of a floodplain subject to 10-year floods.	✓	The landfill is approximately 235m above a river so is outside of the 10-year flood plain.	✓	The landfill is a sufficient distance from any river and is not at risk of being flooded.

Design measure	Observed at Rogun	Rogun Comment	Observed at Vahdat	Vahdat comment
Design and operate the landfill in accordance with applicable national requirements and internationally recognized standards to minimize leachate generation, including the use of low-permeability landfill liners to prevent migration of leachate as well as landfill gas, a leachate drainage and collection system, and landfill cover (daily, intermediate, and final) to minimize infiltration.	✗	No evidence of the use of materials to limit leachate generation or transportation were observed.	✗	No evidence of the use of materials to limit leachate generation or transportation were observed.
Treat leachate onsite and/or discharge to municipal wastewater system.	✗	No leachate treatment operations were observed on site.	✗	No leachate treatment operations were observed on site.
Use perimeter drains and landfill cell compaction, slopes and daily cover materials to reduce infiltration of rainfall into the deposited waste.	✗	No perimeter drains, compaction or covering was observed on site.	✗	No compaction or covering was observed on site.
Prevent run-off of precipitation into the active area of the landfill (e.g., by use of berms or other diversions); systems should be designed to handle the peak discharge from a 25-year storm.	✗	Dumped refuse was open to the elements and located on a moderate to steeply sloping hill. No mechanism to prevent run-off from the landfill was observed. As such the site is particularly	✗	Dumped refuse was open to the elements and located on a gently sloping hill. No mechanism to prevent run-off from the landfill was observed. As such the site is particularly prone to leachate running off into the river below.

Design measure	Observed at Rogun	Rogun Comment	Observed at Vahdat	Vahdat comment
		prone to leachate running off into the river below.		
Collect and control run-off from the active area of the landfill; the system should be designed to handle the discharge from a 24-hour, 25-year storm.	✗	No system for collecting and controlling run-off was observed on site.	✗	A small drainage ditch was observed outside the boundary of the landfill between it and the road. It was unclear whether this was designed to collect and safely transport leachate from the landfill specifically. Markings from run-off from the landfill site were visible on the road, which suggested that the drainage facility was an insufficient intervention for this purpose.
Use gas blowers (boosters) of sufficient capacity for the predicted gas yield and constructed of materials appropriate for landfill gas duty.	✗	No system for collecting gas was observed on site.	✗	No system for collecting gas was observed on site.
Install and regularly sample boreholes surrounding the landfill to monitor for migration of landfill gas.	✗	No boreholes for sampling were observed on site.	✗	No boreholes for sampling were observed on site.
Compact and cover waste promptly after discharge from the vehicle delivering the waste.	✗	No evidence of compaction observed on site. Compaction is not possible using heavy	✗	No evidence of compaction observed on site. Compaction is not possible using

Design measure	Observed at Rogun	Rogun Comment	Observed at Vahdat	Vahdat comment
		machinery due to the moderate to steep relief on site.		heavy machinery due to the moderate to steep relief on site.
Dispose of odorous sludge in covered trenches.	✗	No evidence of odorous sludge collection or disposal was observed on site.	✗	No evidence of odorous sludge collection or disposal was observed on site.
Aerate leachate storage areas.	✗	No leachate storage areas were observed on site.	✗	No leachate storage areas were observed on site.

Figure 13-1 - Landfill site at Vadhat and litter in roadside draining gutter



13.3.9 In general, waste management remains an issue at the site. Although there have been some improvements by some Contractors waste management in some locations as a result of the increased attention to environmental matters, waste management has not changed materially. Site waste framework has been prepared, and contractors will subsequently prepare and implement strict waste management practices upon World Bank effectiveness

HAZARDOUS AND MEDICAL WASTE

13.3.10 According to the UNECE (2017), there is little information on industrial/hazardous waste, because regular reporting is not carried out. Industrial enterprises and organizations, based on agreement with the road maintenance units, transport their waste to the municipal disposal sites, where it is disposed of together with municipal waste. CEP has begun to make an inventory of disposal sites used for industrial waste.

13.3.11 Inadequate regulation and management in the country mean that hazardous chemicals pose a considerable threat to the environment and public health. According to UNEP, there is little data available on chemical incidents or the number of chemical-induced poisonings. Obsolete and banned pesticide stockpiles also represent an increasing environmental hazard.

13.3.12 Understanding of hazardous waste is mostly limited to radioactive waste and pesticides. These types of waste are a priority at present and, once their situation has been improved, it is expected that progress will be achieved by defining an approach to waste with other hazardous properties. Medical waste management is improving under the influence of donor funded projects. However old management practices continue. Experience gained in pilot projects is not evaluated and good practice is not extended to all hospitals. No healthcare waste management strategy has been developed to manage this type of waste. According to the IHPA, there is a lack of adequate waste disposal facilities in the country. Rules and regulations for the construction and operation of landfills are not in place.

13.3.13 There is a lot of uncontrolled waste dumping, even along riverbanks, which directly affects water quality. There is no legislation regarding waste incineration and there are no special facilities for disposal of toxic and hazardous waste (IHPA, 2017). In 2016, Tajikistan acceded to the 1989 Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal. Participation in

this treaty will increase the protection of the country from unregistered import of hazardous waste and will improve access to facilities for disposal of hazardous waste abroad. The country is not yet a party to the 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the 2013 Minamata Convention on Mercury (UNECE, 2017).

13.3.14 Over the coming years Tajikistan will establish an inter-ministerial chemicals management committee to strengthen the coordination of activities between governmental agencies responsible for chemicals and waste management at the national, regional and local levels, and improve the involvement of private and non-profit sectors working on chemicals and waste. Tajikistan will also establish a technical and legal working group to identify the gaps in national legislation that have prevented the country from accessing the Rotterdam and Minamata conventions. This group will then draft the necessary legal instruments and documents to become a party to these international treaties. To improve the implementation of the Stockholm and Basel conventions, Tajikistan will also create a national tool for information exchange on sound chemicals and waste management. This will further improve interagency cooperation among relevant government ministries, as well as increased cooperation with the private and non-profit sectors.

13.3.15 Tajikistan will also launch an awareness-raising program to strengthen knowledge and skills within government ministries and agencies, to help embed these issues into national development plans and policies. Training and roundtable discussions will also take place with private sector representatives and civil society groups (UN Environment Programme (UNEP), 2019).

CURRENT PROJECT WASTE MANAGEMENT PRACTICES

CONSTRUCTION WORKS

13.3.16 The construction works are being undertaken according to four main work packages. These are set out in **Table 3-3** in **Volume 1, Chapter 3: Project Description** of this ESIA. The Project does not hold a site-wide waste inventory. This section provides summaries of the types and typical quantities of waste generated by the main Project contractors, as provided to WSP by the contractor HSE leads. Photographs and descriptions of on-site waste storage areas were provided to WSP, with further information and photographs obtained during WSP site visits during August – September 2023.

13.3.17 At the time of compiling this report, WSP had been informed that disposal sites being used for general/domestic waste include Rogun municipal landfill as well as Vahdat municipal waste facility. It is WSP's understanding that waste removal contractors used for general waste include Rogun Municipal Services and PE Asoev.

13.3.18 With respect to hazardous waste, this is mostly being collected from site by waste contractor Yokubjon 2016 LLC. It has been confirmed that Lot 2 (WeBuild) hazardous waste is being disposed of at a waste facility in Dushanbe; it is not universally understood whether all other hazardous waste from site is also being disposed of at this same facility. Details of facilities being used for recycling of materials (such as metals) have not been confirmed – it has not been established if any wastes are being exported for recycling.

13.3.19 During site interviews with Project contractor HSE leads in August 2023, it was confirmed that waste contractors and disposal/recycling facilities currently being used have not been audited by Project

personnel to ensure that they are operating to acceptable standards and that the various waste streams are being disposed of appropriately.

13.3.20 It has also not been confirmed if all necessary waste-related permits and licenses are in place.

Lot 1 Construction – Voith Hydro GmbH & Co. Contractor

13.3.21 Voith Hydro are scheduled to mobilize to site during 2024 to start work on construction of the new turbines and refurbish the existing ones.

13.3.22 A Voith Hydro HSE policy and draft HSE Plan (both dated April 2019) have been provided to WSP for review. The table of contents in the HSE plan indicates a Waste Management Plan should be attached as an Annex – this was not included in the version of the document reviewed by WSP.

Lot 2 Construction – WeBuild Contractor

13.3.23 Facilities managed by the contractor WeBuild include a tank farm, maintenance yard and garage, warehouses, crushed-ore storage, and small-scale wastewater treatment plant (WWTP). The WWTP is further discussed in the Wastewater section of this Annex.

13.3.24 The Lot 2 contractor has a Waste Management Plan (WMP) (2022) (for hazardous and non-hazardous wastes) and a Water and Wastewater Monitoring and Management Plan (WWMMP) (2022) in place.

13.3.25 Waste streams generated by WeBuild include domestic/general waste (food, plastics, metal etc.), hazardous wastes (chemicals, used oil, batteries, etc.) and medical waste.

13.3.26 Information on types of waste generated, quantities, disposal methods and waste disposal companies used, has been provided to WSP (**Table 13-3**) by the Lot 2 Contractor.

13.3.27 According to the information provided, WeBuild has commissioned waste company PE Asoev to collect domestic waste to be disposed of at a landfill site in Vahdat.

13.3.28 Waste contractor Yokubjon 2016 LLC has been commissioned for the removal of hazardous waste, to be disposed of at a facility in Dushanbe. information about the Dushanbe waste site, including whether it is licensed or is suitable for receiving hazardous wastes is not universally understood. WSP has been informed that batteries collected from site are transported to Dushanbe for recycling of metals, however details of the location have not been confirmed. According to information initially provided to WSP, medical waste is transported to Obigarm Hospital for incineration. This information may, however, be outdated, as WSP has subsequently been informed that medical waste generated elsewhere on site (i.e. at the HPP central clinic) is currently being taken to a new incineration facility at Rogun Hospital, which has been redeveloped to international standards.

13.3.29 This is further discussed in the Medical Waste section. Some of the information provided and presented in **Table 13-3** (in particular with respect to waste disposal locations and waste service providers being used) does not align with information in WeBuild's Waste Management Plan (for example, the WMP states that domestic waste is uplifted by Rogun municipal service for disposal at Rogun landfill).

Table 13-3 - Types and Quantities of Wastes Generated by WeBuild during Q2 2023

Waste Category	Main Components	Quantities	Storage Location	Disposal (location, service provider)
Domestic waste	Food waste & other organics	72.7 tons	Designated storage area constructed from concrete	Disposed of at landfill in Vahdat by waste contractor PE Asoev
	Paper	-	Designated storage area constructed from concrete	Disposed of at landfill in Vahdat by waste contractor PE Asoev
	Plastic	0.73 tons	Designated storage area constructed from concrete	Disposed of at landfill in Vahdat by waste contractor PE Asoev
	Metal	4.35 tons	Designated storage area constructed from concrete	Disposed of at landfill in Vahdat by waste contractor PE Asoev
Hazardous waste	Acetone	1.57 kg	Temporary storage in the construction workshop area	Final disposal at a waste site in Dushanbe as per agreement with contractor Yokubjon 2016 LLC (Batteries being recycled in Dushanbe to extract metals – details not confirmed)
	Batteries	0.036 tons		
	Filters	0.06 tons		
	Oil	9.4 tons		
	Lubricants	0.03 tons		
	Mercury lamps	0.065 tons		
	Laser printer used cartridges	0.1635 tons – total quantity in 2011		
	Laser printer used toner containers	0.011 tons – total quantity in 2021		
Construction waste	Excavated materials sent to spoils area	974 tons	Spoils area downstream	Spoils area downstream

Waste Category	Main Components	Quantities	Storage Location	Disposal (location, service provider)
Medical waste	Contaminated infectious material	9 kg	Temporary storage in 'WeBuild medical point'	Reportedly sent to Obigarm Hospital – however potentially being sent to Rogun Hospital for incineration.
Wastewater	Sewage	23m^3 of sewage sludge generated quarterly in 2021	Septic tanks	WWTPs
	Industrial wastewater (from batching plant, washing stations etc.)	TBC	Sedimentation ponds with oil-water separators	Effluent from the sedimentation ponds is discharged to the environment. (according to the WeBuild WWMMP). Final disposal of removed sediment/sludge TBC.

*TBC – to be confirmed

13.3.30 Photographs of WeBuild waste collection and storage facilities are presented in **Figure 13-2** to **Figure 13-7**.

13.3.31 The domestic waste storage area shown in **Figure 13-4** is constructed of concrete brick, fitted with concrete flooring, however there is no roofing, and hence no protection from rain, wind or snow. The waste requires containment so that it does not get dispersed across the site. Recyclable materials were observed in this area.

13.3.32 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, which is noted to have appropriate controlled access.

Figure 13-2 - WeBuild Office waste bins



Figure 13-3 - WeBuild Camp domestic waste skips



Figure 13-4 - WeBuild Domestic Waste storage area



Figure 13-5 - WeBuild Hazardous Waste storage area





13.3.33 During the September 2023 WSP site visit, numerous drums of waste bitumen were observed in an area adjacent to the WeBuild asphalt plant (**Figure 13-6**). The drums are stored in an area covered in concrete hard standing. WSP were informed during the site visit that WeBuild are in the process of making arrangements for off-site disposal of this waste. The Project is to ensure that the material is disposed of at an appropriate and licensed waste facility which is operating to acceptable standards. Chain of custody documentation is to be completed and kept on file.

Figure 13-6 - Waste bitumen





Lot 3 Construction – TajikGidroElectroMontazh (TGEM) Contractor

13.3.34 Types of waste produced by the contractor TGEM include domestic/general waste, packaging, hazardous and construction waste, sewage and batching plant wastewater. Typical quantities of waste produced on a monthly basis are presented in **Table 13-4**. (At the time of compiling this report, it had not been confirmed when the data presented in **Table 13-4** was generated, and if it represents current waste outputs).

13.3.35 According to information provided by TGEM, septic tanks are installed on site for the collection of sewage waste. Sewage waste is removed from site by Rogun municipal services. Wastewater from the Batching Plant at the TGEM facility is initially placed in settling tanks and after settling, 'is removed and placed in internal dumps'. At the time of compiling this report, it had not been confirmed if there is yet another step in the wastewater disposal process. The majority of the domestic waste and packaging waste is collected by Rogun municipal services to be disposed of at Rogun landfill site. Metals are removed from site by LLC Yokubjon 2016, to be recycled, however the locations and means of removing wastes from storage areas are not universally understood.

13.3.36 Information provided indicates that hazardous wastes such as batteries, used oil and oil filters are collected by waste contractor LLC Yokubjon 2016 for reuse (recycling of metals, in the case of the batteries) or disposal, at a waste facility in Dushanbe. Information on the location of this facility or its capability in managing such waste to international standards are not universally known. The Oil-contaminated rags (which should be classified as hazardous) are being collected by Rogun municipal services for disposal at the Rogun municipal landfill site. All oil-contaminated waste must be disposed of at an approved hazardous waste facility. Construction wastes such as concrete, metal and wood are recycled or re-used; other components such as sand and excavated rock are stockpiled on the Project site.

Table 13-4 - Types and Typical (Monthly) Quantities of Wastes Generated by TGEM

Waste Category	Main Components	Quantities (Monthly)	Storage Location	Disposal (location, service provider)
Domestic waste	Food waste and other organics	15.22 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Paper	7.16 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Plastic	1.79 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Metal	1.49 tons	Metal skips on site	Collected by Yokubjon 2016 LLC for recycling

Waste Category	Main Components	Quantities (Monthly)	Storage Location	Disposal (location, service provider)
				– at an unspecified facility
	Other	4.18 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
Packaging waste	Paper	7.68 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Plastic	2.47 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Metal	0.30 tons	Metal skips on site	Collected by Yokubjon 2016 LLC for recycling – at an unspecified facility
	Wood	TBC	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Other	2.44 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
Hazardous waste	Batteries	15 items	Temporarily stored in designated location in warehouse	Collected by Yokubjon 2016 LLC for recycling or disposal at an unspecified facility in Dushanbe.
	Used oil	7.5 tons	Metal containers	Collected by Yokubjon 2016 LLC for recycling or disposal at an unspecified facility in Dushanbe

Waste Category	Main Components	Quantities (Monthly)	Storage Location	Disposal (location, service provider)
	Oil-contaminated rags	63 kg	Metal containers	Collected by Rogun Municipal Services for disposal at Rogun municipal landfill site
	Oil filters	250	Metal containers	Collected by Yokubjon 2016 LLC for recycling or disposal at an unspecified facility in Dushanbe
Construction waste	Concrete	135 m^3	Stockpile on site	Recycled material (road repair)
	Sand	72.5 tons	Stockpile on site	Rogun HPP
	Metal	Data not provided	Stockpile on site	Recycled (removed from site by TGEM) at an unspecified facility.
	Wood	Data not provided	Stockpile on site	Recycled
	Excavated rocks	54340 m^3	-	Rogun HPP
Electronic waste	-	-	-	-
Wastewater	Sewage	1749.8 m^3 annually	Septic tanks	Collected by Rogun municipal services
	Batching plant wastewater	TBC	Settling tanks on site	From the settling tanks, it is 'removed and placed in internal dumps'.

*TBC – to be confirmed

13.3.37 Photographs of the domestic waste and un-contaminated construction waste storage areas used by TGEM are presented in **Figure 13-7** and **Figure 13-8**, respectively.

13.3.38 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.

13.3.39 According to information provided to WSP, the storage area shown in **Figure 13-8** is for un-contaminated construction waste, however the photograph indicates that there may be hydrocarbon staining within the concrete cubicles. The storage area is not fitted with containment, as such

contamination of the surrounding environment could occur, particularly during rain events. Hazardous wastes should be stored in suitable UN-rated drums (or equivalents) in bunded areas.

13.3.40 According to TGEM, hazardous waste is stored in metal barrels fitted with lids, which in turn are kept inside larger containers. Photographs of Rogun municipal landfill site are presented in **Figure 13-7.** Based on anecdotal descriptions provided as well as the photographic evidence, this facility does not appear to be an engineered landfill. WSP has been informed, anecdotally, that it was initially constructed simply as a deep excavation which is now full of waste, and as such waste material is not contained but is spreading around the site, and potentially beyond. A lack of appropriate design and construction means that there is potential for leachate generation and contamination of groundwater. There is also potential for fire risks due to possible production of methane. Anecdotal descriptions of some of the materials being disposed of at this site include plastic wastes and piles of 20L buckets, potentially disused paint containers. Any empty containers contaminated with chemicals, such as paint, would constitute hazardous waste, and must be disposed of as such at an appropriate hazardous waste facility.

Figure 13-7 - TGEM Domestic Waste storage area



Figure 13-8 - TGEM Construction Waste storage area



Lot 4 'Early Works' – Ariana and EMZ

13.3.41 Types of waste produced by Ariana include domestic/general, packaging, hazardous and construction waste. Septic tanks are installed on site for the collection of sewage waste. Typical quantities of waste produced on a monthly basis are presented in

13.3.42 **Table** 13-5. (At the time of compiling this report, it had not been confirmed when the data presented in

13.3.43 **Table** 13-5 was generated, and if it represents current waste outputs).

13.3.44 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, however the facility used has not been specified.

13.3.45 WSP has been provided with a copy of a contract (dated January 2023) between Ariana and waste company Yokubjon 2016 LLC for the collection, transport and disposal of hazardous waste (including used batteries, used oil and filters, used tires) from the Ariana workshop and warehouse. The contract does not specify the disposal location. Concrete construction waste is recycled and other components such as sand and excavated rock are stockpiled at the Project. The Ariana Waste Management Plan provided for review is high level and not project specific. This is discussed further in this section.

13.3.46 According to information provided by Ariana, septic tanks are installed at the Lot 4 Early Works facility and wastewater is disposed of into the Project WWTP.

Table 13-5 - Types and Typical (Monthly) Quantities of Wastes Generated by Ariana

Waste Category	Main Components	Quantities (Monthly)	Storage Location	Disposal (location, service provider)
Domestic waste	Food waste and other organics	10.35 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Paper	4.8 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Plastic	1.17 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Metal	0.89 tons	Metal skips on site	Recycled at an unspecified facility
	Other	2.47 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
Packaging waste	Paper	5 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Plastic	1.73 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
	Metal	0.2 tons	Metal skips on site	Recycled at an unspecified facility
	Wood	-	-	-
	Other	1.6 tons	Metal skips on site	Disposed of at Rogun municipal landfill by Rogun municipal services
Hazardous waste	Batteries	8 units	Metal skips on site	Collected by waste contractor Yokubjon 2016 LLC for transportation to a 'certified disposal site' (location not confirmed – possibly being recycled at a facility in Dushanbe)

Waste Category	Main Components	Quantities (Monthly)	Storage Location	Disposal (location, service provider)
	Used oil	5 tons	Metal skips on site	Collected by waste contractor Yokubjon 2016 LLC for transportation to a 'certified disposal site' (location not confirmed)
	Oil filters	155 units	Metal skips on site	Collected by waste contractor Yokubjon 2016 LLC for transportation to a 'certified disposal site' (location not confirmed)
Construction waste	Concrete	80 m^3	Stockpile on site	Recycled
	Sand	45 tons	Stockpile on site	Rogun HPP dump site
	Excavated rocks	33935 m^3	Stockpile on site	Rogun HPP dump site
Electronic waste	-	-	-	-
Wastewater	Sewage	TBC	Septic tanks	Disposed of into site WWTP

*TBC – to be confirmed

Summary Overview of Contractor Facilities and Workshops

13.3.47 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 (**Figure 13-9**). 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.

13.3.48 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, this contradicted discussions held with the Rogun HPP team.

Figure 13-9 - Waste Storage - Contractors' Compounds



MEDICAL WASTE

13.3.49 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.

13.3.50 According to information provided, a new medical waste incineration facility has recently been installed at Rogun Hospital. WSP has been informed it has 40 years' capacity with 1m^3 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'.

13.3.51 WSP was informed anecdotally that medical waste stockpiled at the Rogun hospital facility, awaiting incineration, is not stored securely but is potentially accessible to unauthorized personnel. A 'city truck' with a load of medical waste for incineration has been observed adjacent to the facility, in an area which is not secure, with waste (including syringes) visible through clear waste bags.

PROJECT DUMP SITES

13.3.52 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. Individuals responsible for administering the ‘dump’ sites are not universally known.

13.3.53 The ‘dump’ site located north of Construction Area 1 on the west bank of the dam (**Figure 13-11** and 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.

13.3.54 The ‘dump’ site located north of Construction Area 1 on the west bank of the dam (**Figure 13-10** and **Figure 13-11**), 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, tires, 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.

Figure 13-10 - 'Dump' Site - Construction Area 1 (Photo 1)



Figure 13-11 - 'Dump' Site - Construction Area 1 (Photo 2)



13.3.55 The ‘dump’ site south of Construction Area 5 (downstream) (**Figure 13-12**) was anecdotally built up from geotechnically out-of-specification materials. Whilst the majority of the materials observed were aggregates, there was the occasional load of general waste within the dump.

Figure 13-12 - 'Dump' Site - Construction Area 5



13.3.56 The ‘dump’ site located on the east bank of the dam (**Figure 13-13**) was anecdotally built up from geotechnically out-of-specification materials, although it was not clear to the site visit team, exactly where the material had come from. Anthropogenic inclusions (including old tires, pieces of metal etc.) were noted within the lower levels. When raised with the contractors working in the area, the tires and metal were removed – it was not confirmed where they were being removed to for disposal.

Figure 13-13 - 'Dump' Site on east bank



13.3.57 WSP noted during the September 2023 site visit that a workshop has been built upon foundation material that appears to contain waste (**Figure 13-14**). Beyond the visual examination, no further discussions or examinations were undertaken during the site visit.

Figure 13-14 - Potential Construction upon Waste Materials



13.3.58 Recommendations regarding investigations at on-site dumps to confirm extent and nature of the non-aggregate deposits, are presented in **Volume 2, Annex A06A – Contaminated Land**.

SUBSTATIONS AND TRANSFORMERS

13.3.59 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 utilized historically onsite and may still be present within some of the legacy equipment.

13.3.60 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.

13.3.61 A Hazardous Waste Management Framework was prepared as part of the ESMP. Each Contractor employed at Rogun HPP will prepare and implement a Hazardous Materials Management Plan (HMMP) that is consistent with this Framework, including PCB and other similar hazardous chemicals.

ASBESTOS

13.3.62 During the September 2023 site visit, possible Asbestos Containing Materials (ACMs) in the form of corrugated asbestos sheeting were noted on several buildings within Construction Area 1.

13.3.63 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.

Figure 13-15 - Possible Asbestos Containing Materials



WASTEWATER MANAGEMENT

13.3.64 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.

Information provided by Site

According to information provided by site HSE representatives, the following wastewater facilities (refer to photographs **Figure 13-16** to **Figure 13-23** are being used on site:

- WeBuild Accommodation Camp - sewage waste from the camp (approximately 300 personnel) is held in a septic tank (capacity 6 m^3 /day). The effluent passes through a screen at an inlet station and then undergoes chlorination treatment. The waste liquid is then pumped to the site WWTP.

Sewage sludge from the septic tank is removed twice a year by a licensed waste contractor. Bacteriological testing of the liquid is carried out on an ad hoc basis. Individuals responsible for treating effluent from the WWTP are not known.

- WeBuild Main Office - sewage waste from the office (approximately 250 people) is held in a septic tank (capacity 5m^3/day). According to information provided by site, the liquid component is discharged to an area of open ground just outside the perimeter fence (see **Figure 13-18** and **Figure 13-19**). Sewage sludge from the tank is removed twice a year by the same waste contractor used to dispose of sludge from the WeBuild Accommodation Camp septic 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 Accommodation Camp, effluent passes through a screen at an inlet station and then undergoes chlorination treatment. The liquid is pumped to the site WWTP. Sewage sludge from the septic tank is removed twice a year by a waste contractor. Bacteriological testing of the liquid is reportedly carried out on an ad hoc basis.
- Rogun Permanent Camp – a portable facility (Fraccaroli & Balzan automatic double filtering treatment unit using quartzite and activated carbon) is in operation. Confirmation of the types of wastewater this facility is used to treat and where the water is ultimately discharged to, was not obtained.
- 'Septic tanks' are reportedly installed in other areas of the Project site including at the Lot 3 and Lot 4 early works construction areas. WSP was informed that sewage waste from Lot 3 is collected by Rogun municipal services and Lot 4 early works sewage waste is disposed of into the site WWTP. WSP has been informed that wastewater from the Batching Plant at the TGEM facility is initially placed in settling tanks and after settling, 'is removed and placed in internal dumps'. It has not been confirmed what happens with the wastewater following transfer to the 'internal dumps'.

Figure 13-16 - WeBuild Accommodation Camp WWTP



Figure 13-17 - WeBuild Office septic tank



Figure 13-18 - WeBuild Office perimeter fence area (1)



Figure 13-19 - WeBuild Office perimeter fence area (2)



Information obtained during September 2023 Site Visit

13.3.65 During the WSP September 2023 site visit, a walkover of wastewater management facilities was undertaken with site representatives. A summary description of observations made by the site visit team is provided in this section.

Sewage

Construction Site 1

13.3.66 The sewage effluent arrangements in place are not universally known, with contradictory information seemingly provided by Rogun HPP and the contractors on site.

Construction Site 1

13.3.67 A sewage WWTP is located in Construction Site 1 **Figure 13-20**. The works currently 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'. WSP did not enter the building, however from the outside it appeared to be derelict.

13.3.68 Unknown effluent appeared 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. 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.

Figure 13-20 - Construction Site 1 Sewage WWTP











Remote Contractors' Compounds and Workshops

13.3.69 Across the wider site away from Construction Area 1, different contractors anecdotally utilized 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). This arrangement would be consistent with arrangements witnessed for water runoff at a number of compounds (see section, Workshop Effluent & Runoff).

Workshop Effluent & Runoff

13.3.70 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.

Figure 13-21 - 'Septic Tanks' used for the collection of water runoff



Washout Areas

13.3.71 During the September 2023 site visit, the majority of the contractors spoken to 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).

13.3.72 During the September 2023 site visit, WSP witnessed across the site, 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 water treatment, to washout areas with no control, capture or treatment of the washout water. The latter was the more common practice witnessed across the site.

13.3.73 A number of areas appeared to drain directly into the dam or river, with visible build-up of cement down gradient of the washdown areas (**Figure 13-23**). When discussed with the contractors / operators, they referred to surface water monitoring undertaken by another party and that if there was a significant environmental impact, Rogun HPP would have halted their practices.

Figure 13-22 - Washout Areas (1)



Figure 13-23 - Washout Areas (2)



Contractors Tanks and Tank Farms

13.3.74 In addition to the 'main' diesel tank farm operated by Rogun HPP, a number of contractors operate their own diesel storage installations, ranging from tank farms consisting of multiple fixed tanks or parked fuel tanker trailers to individual tanks of varying builds and sizes. The installations appear to have been installed to numerous different standards and similarly operated under different standards and or procedures.

13.3.75 Through on-site discussions with a number of contractors, WSP was informed that their tanks (including tank farms) had been relocated either within the Rogun HPP project or from other projects, with a number of tanks seemingly decades old.

Figure 13-24 - Contractor Tank Farms



Figure 13-25 - Contractor (Single) Diesel Tanks



Figure 13-26 - Visual Evidence of Spills / Leaks



13.3.76 Detailed findings of the September 2023 site visit carried out by the WSP Contaminated Land team are presented in **Volume 2, Annex A06A – Contaminated Land**, which presents recommendations for assessing, managing and disposal of contaminated soils as well as disused/abandoned fuel storage tanks. The Contaminated Land Annex outlines WSP's general recommended approach for management of diesel contaminated soils in the tank farm areas, which would potentially involve an on-site 'low tech' bioremediation system.

13.3.77 The contractor management plans related to fuel storage and contaminated land will provide details on fire safety and spill prevention measures in the fuel storage areas; plans for presence of appropriate signage; the level of staff awareness and experience regarding spill or fire incident procedures; and the availability of trained staff on site.

13.3.78 Regarding contaminated land, and as required by the Project's Environmental and Social Commitment Plan (ESCP) , PMG has appointed a consultant to undertake a survey of the land that will be inundated, which will be remedied prior to inundation.

13.3.79 Management of all contaminated material on site will be undertaken in line with national regulations and IFC EHS Guidelines.

RESETTLED COMMUNITIES

13.3.80 As discussed in **Chapter 3: Project Description**, resettlement is managed and funded by the Directorate of the Rogun HPP Flooding Zone (DFZ), it is understood resettlement will be partly funded by the Lenders and as such is considered a core Project component.

13.3.81 Resettlement is planned in phases in line with the inundation levels of the reservoir. According to data from DFZ as of March 2023, resettlement planning for the Project is due for completion by 2032. It covers 69 villages from the Rogun, Nurobod, and Rasht districts affecting more than 50,000 Project Affected People (PAPs).

13.3.82 The Resolution of the Government of Tajikistan of January 20, 2009, No. 47, "On the Resettlement from the Flood Zone of Rogun HPP of the Population of Rogun City and Nurobod District" (amended in 2011 and 2015), governs the resettlement of the population of Rogun Town and Nurobod Rayon (District) within the Rogun HPP flooding zones. In 2024, Resolution No. 47 was updated to include the areas of the flooding zone within Rasht.

13.3.83 DFZ are responsible for managing resettlement and provision of community infrastructure, including connecting newly built houses to electricity, water, sewage systems, etc. A summary of waste services provided in Darband and a series of photographs (**Figure 13-27** to **Figure 13-33**) have been provided by the DFZ. An overview of waste management facilities available in all the resettled villages is not yet available.

13.3.84 According to the DFZ, there are currently no general (domestic) waste removal contractors in the Nurobod District. General waste collection points have been established in five micro districts within the city of Darband (Nurobod District) by the DFZ. The collection points are equipped with metal skips for collecting household waste from local communities. Employees of the Housing and Communal Services of the Nurobod Region collect the waste from these points on a daily basis and transport it by truck to a designated location approximately 6km away, at an elevation of approximately 1400 a msl. According to the DFZ, this is in line with the "General Plan for the Placement of Household Land Plots in the City of Darband".

13.3.85 The photographs of the waste collection points indicate that the waste skips are not equipped with lids/covers to protect the contents from wind, rain or snow. At some of the points, waste is noted on the surrounding ground, and at one of the collection points there is only one skip provided – plastic bags of rubbish on the ground beside the skip suggest that additional skips are needed at this collection point. Photographs of the trucks being used to remove waste from the collection points indicate that the vehicles are not fitted with tailgates or covers/sheeting, suggesting that they are inadequately equipped to contain the waste during transportation and offer no protection from wind and rain. The photographs provided also suggest that the general waste is not being disposed of at a licensed landfill site but is being deposited at an informal landfill / open ground. DFZ have confirmed that a sewage wastewater treatment plant (WWTP) has been installed in Darband. It is

WSP's understanding that in other areas of resettlement which are more rural, septic tanks or cesspits have been constructed.

Figure 13-27 - Community waste collection point (1)



Figure 13-28 - Community waste collection point (2)



Figure 13-29 - Community waste collection point (3)



Figure 13-30 - Community waste collection point (4)



Figure 13-31 - Community waste collection point (5)



Figure 13-32 - Vehicles used for waste removal



Figure 13-33 - Waste deposition location



14 TRAFFIC AND TRANSPORT

14.1 INTRODUCTION

14.1.1 This section presents the baseline data for the Traffic and Transport Assessment for the Project. The information presented here is to be read in conjunction with **Volume 1, Chapter 22: Traffic and Transport**.

14.1.2 No primary transport baseline data collection was undertaken for the 2014 ESIA. The baseline conditions at the site reflect existing operations plus the construction work that is ongoing.

14.1.3 Secondary baseline data sources have been utilized through desk-based studies to identify key issues based on existing maps, previous studies, satellite imagery and other relevant material.

14.2 TAJIKISTAN TRANSPORT NETWORK

BACKGROUND

14.2.1 Tajikistan is a landlocked and mountainous country, surrounded by Afghanistan, the People's Republic of China (PRC), Kyrgyzstan, and Uzbekistan. Approximately 93% of Tajikistan's terrain is mountainous, complicating transport and transit. Most of the transport infrastructure was built during the Soviet period and was designed to optimize the Soviet system of inter-republic linkages between other Soviet republics. After Tajikistan became independent in 1991, relationships between Tajikistan and the neighboring countries changed and the Tajik Civil War began, affecting the transport networks and reducing inter-country traffic volumes and trade.

14.2.2 As a result, passenger transport reduced by three quarters, freight transport by two thirds, and freight turnover by three quarters during 1990–1996. As such, government funding for the transport sector was significantly reduced which has since resulted in the deterioration of the nation's transport infrastructure due to lack of maintenance (ADB, 2021).

NATIONAL ROAD NETWORK

14.2.3 The dominant form of transport infrastructure in Tajikistan is roads, which play a key role in facilitating domestic and international connectivity. Road connectivity is oriented mainly toward Uzbekistan, accounting for more than half of the main road border crossing points (BCPs), as well as towards Kyrgyzstan through several BCPs. The nearest seaport to Tajikistan is Bandar Abbas, Iran (approximately 2,500km from Dushanbe, a 35-hour drive) which can be accessed through Afghanistan, but the available transport modes to reach the port are limited, and recent political stability and violence in Afghanistan makes transit through the country difficult.

14.2.4 The ADB 2021 transport sector assessment indicates that around 56% of Tajikistan's roads are in poor condition, particularly smaller local roads (ADB, 2021).

PUBLIC TRANSPORT

14.2.5 Public transport exists in cities in Tajikistan. In Dushanbe, buses and white vans (marshrutkas) with line numbers run to most destinations within Dushanbe. A refurbished Grand Bus Station opened in Dushanbe in 2013 which serves passengers who are travelling to suburban areas, other Tajik cities such as Bokhtar, Khujand and Khorog, and international destinations such as Termez (Uzbekistan), Osh (Kyrgyzstan) and Moscow (Russia).

14.2.6 However, aside from this, rural Tajikistan does not benefit from an extensive public transportation network. No buses or trains connect rural suburbs with urban centers. The main form of transport is by car. Rural residents travel either in their own private vehicles or participate in a taxi-sharing system with their neighbors in order to travel to local and regional centers. Some marshrutkas are also available.

14.3 ROADS IN PROXIMITY TO THE PROJECT

PAMIR HIGHWAY - (M41 / E60 / AH65)

14.3.1 The M41, more commonly referred to as the Pamir Highway, is an international road traversing the Pamir Mountains through Afghanistan, Uzbekistan, Tajikistan, and Kyrgyzstan. In Tajikistan, the Pamir Highway is divided into sections IB02, RB04, RB07. The RB07 section of the Pamir Highway (M41) runs from border of Kyrgyzstan – Jirgital – Obigarm – Vahdat adjoining with RB04 to Dushanbe, passing the Rogun HPP project site at Obigarm.

14.3.2 WSP visited this section of the M41 highway in September 2024 to assess its condition. The road is a single carriageway highway with a single lane in either direction with bridges and tunnels to traverse the mountainous terrain in which it sits. The asphalt used was of good quality, is wide and clear, and had no obvious defects such as potholes in the approximately 50km stretch assessed by WSP. Construction of the road was almost complete at the time of the visit and the program was due to finish at the end of 2024. Final works being completed included adding bridge expansion joints to the bridges crossing ravines along its length, adding in road markings, and fixing safety barriers. WSP met with the Deputy Director of the Project Management Group for M41 (Obigarm-Nurobod) who stated that the road will undergo a period of stress testing to ensure any defects are identified and rectified before it is opened to the public in early 2025, as is currently planned.

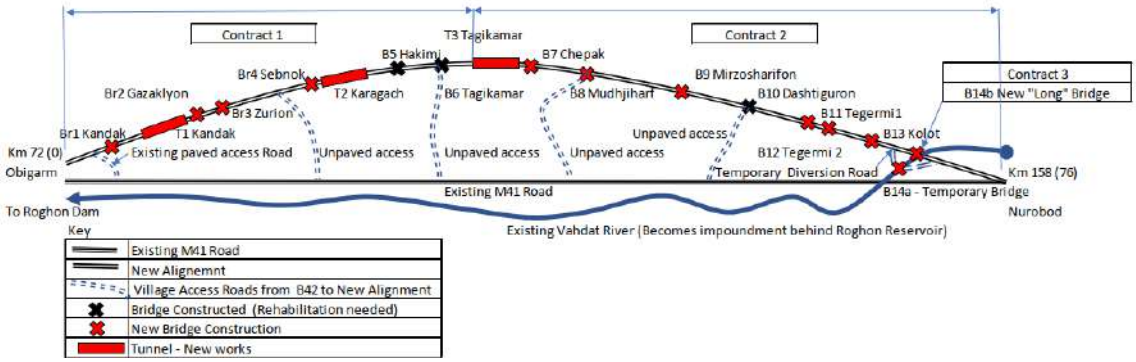
M41 Obigarm-Nurobod Road Realignment Project

14.3.3 The Obigarm-Nurobod road section of the existing Pamir Highway (M41) will be inundated once the HPP reservoir has filled to operating levels. The Obigarm-Nurobod Road Realignment Project will provide a 75 km bypass road. The overall project was divided into 3 sections:

- The Obigarm–Tagi kamar section is about 30km long financed by ADB and OFID;
- The Tagi kamar–Nurobod section is about 44km long financed by the EBRD; and
- The 920-meter-long bridge and its approaches will be financed by AIIB.

14.3.4 These are referred to under “Section 1” and “Section 2” in **Paragraph 14.3.8**.

14.3.5 In 2019, an Environmental and Social Impact Assessment (ESIA) was prepared for the Obigarm-Nurobod Road Realignment Project by the Ministry of Transport of the Republic of Tajikistan. The Project includes 13 new bridge constructions, rehabilitation of three existing bridges, three new tunnel constructions and six village access roads.



Source: Central Asia Regional Economic Cooperation Corridors 2, 3 and 5 (Obigarm-Nurobod) Road Project ESIA 2019

Figure 14-1 - Schematic of Pamir Highway (M41) Obigarm-Nurobod Road Realignment (Ministry of Transport of the Republic of Tajikistan, 2019)

14.3.6 Due to the international and national importance of the highway, in providing the only major continuous road connection across the Pamir Mountains, it is understood the realignment needs to be completed by November 2025 as the existing highway section will be inundated by the reservoir (Tajik Ministry of Transport, 2019).

14.3.7 Two major new roads are planned for the area surrounding the reservoir:

- One 55km road along the left bank of the lower part of the reservoir, from the dam to the main bridge which will cross the reservoir;
- One on the right bank, upper part of the reservoir, between the bridge and the town of Gharm, located approximately 50 km to the north-east.

14.3.8 As shown in **Figure 14-2**, the following roads will be affected by the Project:

- Section 1: Main road (M41) 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. Recently, the Research and Design Institute in Dushanbe, the state agency responsible for planning and construction of roads, planned to finalize construction of the 76 km new road alignment, which also includes rehabilitation of the damaged sections.
- Section 2: Main bridge over the reservoir: the relocation of the international road also includes a major bridge with a span of 786 m.
- Section 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.
- Section 4: New access road on the right bank in the upper part of the reservoir: an access road needs to be built because of the rugged terrain.
- Section 5: New access road on the left bank in the lower part of the reservoir: an access road is required because of the reservoir.

14.3.9 Sections 1, 2 and 3 are part of the national and international road Dushanbe - Vahdat - Jirgital - (Kyrgyzstan) and are considered associated facilities within this ESIA. An EIA was undertaken as part of the project to rehabilitate the international highway Vahdat – Jirgital.

14.3.10 Sections 4 and 5 are at the pre-feasibility stage of planning and will only be built as a result of the Project. They are included within the Project's assessment.

THE KAMAROB VALLEY ROAD

14.3.11 The Kamarob Valley (also known as Kamarov) is a tributary valley on the right bank of the reservoir, located partly within the flooding zone in Rasht District. Currently there are 21 settlements within the valley and its tributary valleys, 9 of which are scheduled for resettlement and 12 of which will remain. The whole valley is covered by the Boqi Rahimzoda jamoat, so named for the Tajik-Soviet writer who was born in the valley. There is one road that goes into and out of the valley. The road continues beyond the uppermost village, but is impassable by vehicle, and the next settlement (Gorif) is a 48-hour walk away.[17] This road passes through the mouth of the valley and will be flooded. It is currently unknown if, how and when the right bank road will be connected to the villages remaining within the valley. The total population of the valley (including Gorif) is approximately 12,000, including approximately 2,000 in the non-resettled villages.

14.3.12 On-site discussions with residents in the upper valley confirmed heavy reliance on travel to settlements outside of the valley to meet basic necessities, particularly Gharm and Rasht City. All interviewed residents in September 2024 reported travelling to these settlements at least monthly, usually utilizing taxi-sharing arrangements with their neighbors.

[17] Reported on site by the head of B. Rahimzoda jamoat, September 2024.

Figure 14-2 – Roads around the Rogun HPP Project area

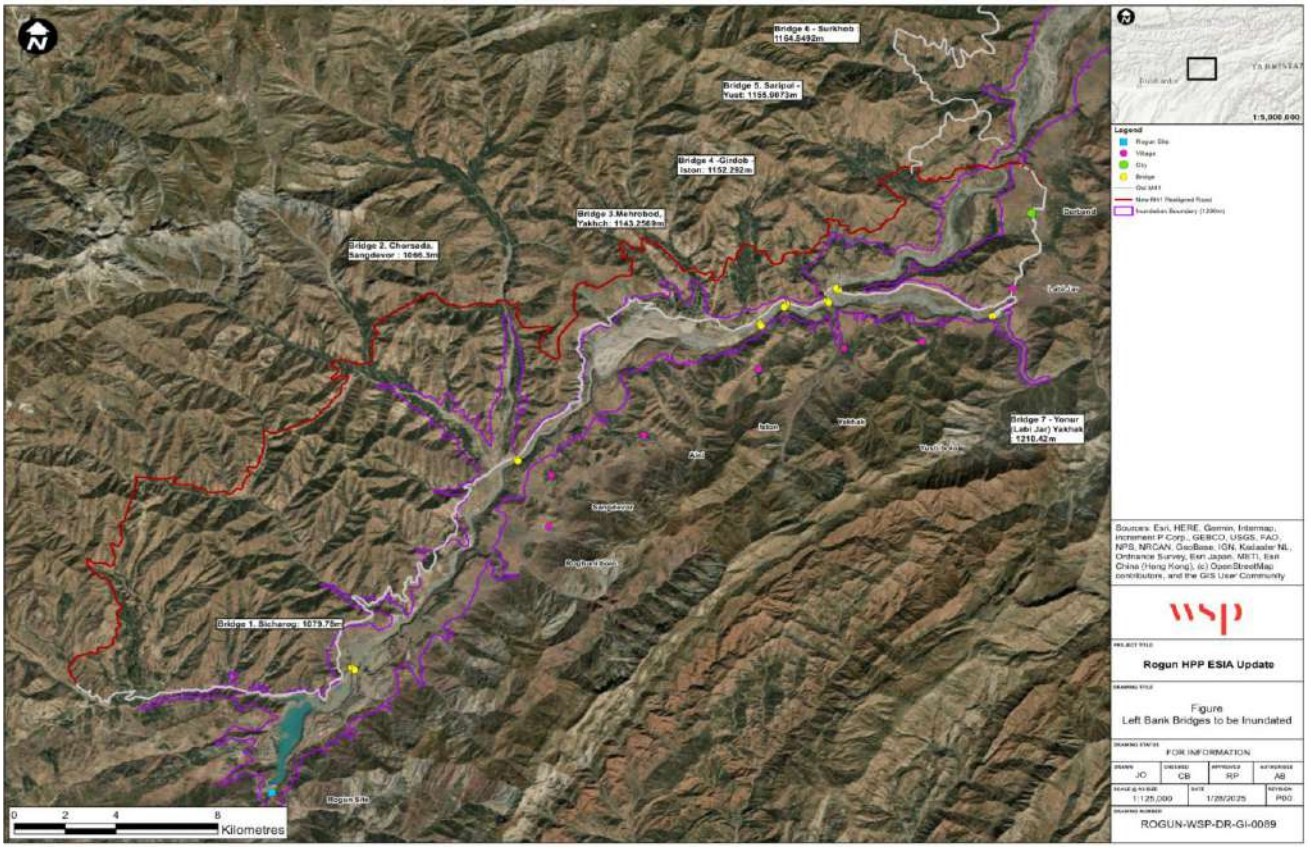
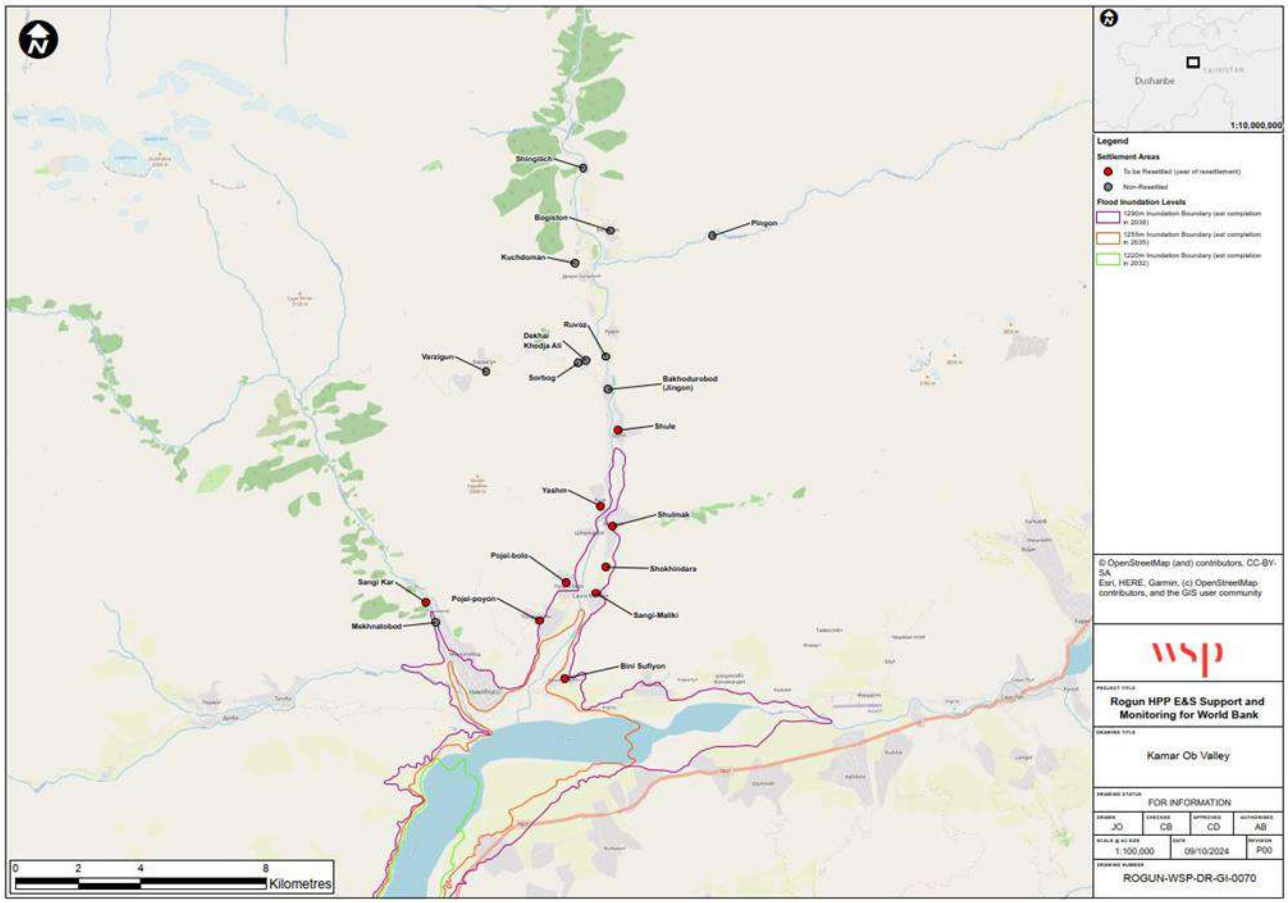


Figure 14-3 - To-be-resettled and non-resettled villages of the Kamarob Valley



14.4 ACCIDENTS AND SAFETY

14.4.1 According to 2016 WHO statistics, the country had an estimated road accident fatality rate per 100,000 population of 13.9 in 2021. For context, this figure is 6.7 and 15 per 100,000 for Europe and the world respectively (WHO, 2024). Of the fatalities, the majority relate to 4-wheeler vehicles (69%), 19% relating to pedestrians, 9% 2 to 3-wheeler vehicles, cyclists 1% and others 2%. The country does not comply with many UN Vehicle Safety Regulations, with the only compliance being import inspections.

14.4.2 Accidents are often attributed to non-compliance with traffic rules by drivers and pedestrians, illegal purchasing of drivers' licenses and inadequate road infrastructure in the country. The country has the highest road traffic accident rate in Central Asia with the WHO requesting advancing of efforts to reduce rates.

14.4.3 The Project prepares quarterly OHS reports on overall OHS performance for submission to authorities. The reports detail excess fatalities and serious incidents, particularly in relation to traffic accidents. The contents of these documents are not universally known so the material of which are unable to be reported in this baseline annex.

14.4.4 There are some settlements within or close to the construction site, surrounded by hauling roads, stockpiles and other construction site structures. Mostly, access to these villages takes place across the site, forcing pedestrians to interfere with the heavy traffic on the roads. As outlined in **Table 14-1**, data was provided by the Ministry of Transport of accidents on highways within geographic areas between 2017 and 2022.

Table 14-1 - Summary of Ministry of Transport Accident Data 2017 - 2022

Area	Type	2017	2018	2019	2020	2021	2022
Sughd province	Accidents	119	108	99	79	87	85
	Fatal	45	42	35	40	42	41
	Injured	134	115	35	71	81	85
Gorno-Badakhshan Autonomous Province	Accidents	13	12	9	14	13	12
	Fatal	11	3	17	8	16	12
	Injured	19	15	17	13	17	15
Bokhtar zone	Accidents	83	100	153	145	91	81
	Fatal	41	39	45	63	78	48
	Injured	80	90	45	149	130	65
Kulob zone	Accidents	18	42	30	19	9	10
	Fatal	24	33	42	11	18	14

Area	Type	2017	2018	2019	2020	2021	2022
	Injured	27	50	56	33	14	14
Hisor zone	Accidents	157	153	129	101	144	42
	Fatal	62	62	58	48	43	24
	Injured	163	161	131	127	126	55
Rasht zone	Accidents	8	8	4	7	3	11
	Fatal	5	5	2	7	3	6
	Injured	3	6	3	10	4	7
IRS (toll roads) responsibility	Accidents	74	84	104	86	70	63
	Fatal	57	40	66	72	54	52
	Injured	92	106	95	90	112	88
Total on roads of the Republic of Tajikistan	Accidents	1,303	1,295	1,212	1,109	1,102	1,096
	Fatal	431	395	391	376	375	416
	Injured	1,379	1,357	1,314	1,263	1,218	1,197

14.4.5 The data is for spatial areas within Tajikistan and shows that there are a high proportion of deaths per accident, but that have been reductions in the number of accidents, fatalities and casualties since 2017.

14.5 TRAFFIC FLOWS

EXTERNAL TRAFFIC FLOWS

14.5.1 The Ministry of Transport has provided information on traffic flows summarizing roads and highways data of Rogun City for January 2023, the road data pertaining to traffic flows is summarized in **Table 14-2.**

Table 14-2 - Summary of Ministry of Transport Data for Traffic Flows pm

Road/Road Section	Average Daily Traffic: Total Vehicles	Average Daily Traffic: Light Vehicles	Average Daily Traffic: Buses	Average Daily Traffic: Trucks
International roadway Vahdat-Rasht-Lakhsh (from Vahdat through Nurobod, 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 Chormagz, 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	1110	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

14.5.2 The following data has been provided:

- 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.

14.5.3 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.

14.5.4 Trucks/heavy goods vehicles (HGVs) transport building materials to site daily routing between the Site and Dushanbe, equating to approximately 33 trips to and 33 trips from the site.

The baseline situation for staff working on the site is approximately up to 12,000 workers at any one time. Estimates of existing worker travel patterns are as follows:

- Up to 4,400 in on-site accommodation;
- 1,500 live in Rogun City adjacent to the site;

- Up to 300 live outside of Rogun City within 30km of the site and are bussed to site;
- Approximately 5,000 live elsewhere in Tajikistan with a shift change every 15 days (total of approximately 10,000 workers across two 15-day shifts; and
- There are a range of shift patterns for employees, including day and night 15-day shifts and office shifts for 5.5 days per week.

SITE ENTRANCE GATE

14.5.5 Access to the site in Rogun City is via a single access point, which is security and military controlled, and is situated south of the main urban area of Rogun City and provides access to the construction site and dam wall area.

14.5.6 As of December 2024, approximately 5,000 workers live off-site, with approximately 12,500 workers living on the construction site. Off-site workers generally travel to the site on foot, car, taxi or bus. Some contractors provide bus transport to and from off-site accommodation at the start/end of shift times.

SHIFT ROTATIONS

14.5.7 Most of the workforce (excluding office workers) are on a rotational shift pattern, working 15 days on and off, on a 12-hour day or night shift. The majority of the workforce, especially if accommodated on-site, return home for their rest period. **Table 14-3** presents traffic flows on 15th September 2024 on a shift rotation day where traffic flows are assumed at peak. All figures are approximate and calculated using CCTV footage.

Table 14-3 – Shift Rotation Day Traffic Flows at the Rogun Site Entrance Gate (15th Sept 2024)

	Cars	Construction / HGVs (over 3.5 tonnes)	Pedestrians (by foot)
00:00 – 00:59	22	0	26
01:00 – 01:59	13	0	6
02:00 – 02:59	10	0	7
03:00 – 03:59	2	0	7
04:00 – 04:59	19	0	16
05:00 – 05:59	52	9	235
06:00 – 06:59	136	5	440
07:00 – 07:59	104	5	249
08:00 – 08:59	106	13	107
09:00 – 09:59	63	5	75
10:00 – 10:59	68	9	129

11:00 – 11:59	102	5	165
12:00 – 12:59	107	4	300
13:00 – 13:59	126	11	432
14:00 – 14:59	91	5	618
15:00 – 15:59	87	4	495
16:00 – 16:59	92	3	549
17:00 – 17:59	117	7	643
18:00 – 18:59	103	6	618
19:00 – 19:59	95	7	355
20:00 – 20:59	68	19	59
21:00 – 21:59	38	18	66
22:00 – 22:59	29	8	51
23:00 – 23:59	14	0	23
TOTAL	**1664**	**143**	**5671**

14.6 EXISTING TRANSPORT MANAGEMENT PLAN (TMP)

14.6.1 WeBuild developed a TMP for the HPP Rogun Lot 2, dated 24 May 2023. The TMP was prepared to manage the anticipated increase of traffic flows associated with the resumption of the main dam core activities. This plan serves to ensure that adequate procedures are in place to minimize effects due to the presence of the Project's site vehicles on the local traffic on affected road sections. This plan is being implemented by the Employer for the entire Project site, Rogun JSC. Its implementation is supervised by the HSE team of the Employer's Representative. However, given the practical issues of limited control over the entire site, the compliance is variable between the contractors, with Lot 2 contractors demonstrating the highest adherence to the requirements.

14.6.2 The TMP states that from September to December 2022, the site vehicles and machineries deployed for the works included:

- Bulldozers;
- Roller compactors;
- Tractors;
- Excavators;
- Mobile cranes;
- Dumper trucks;

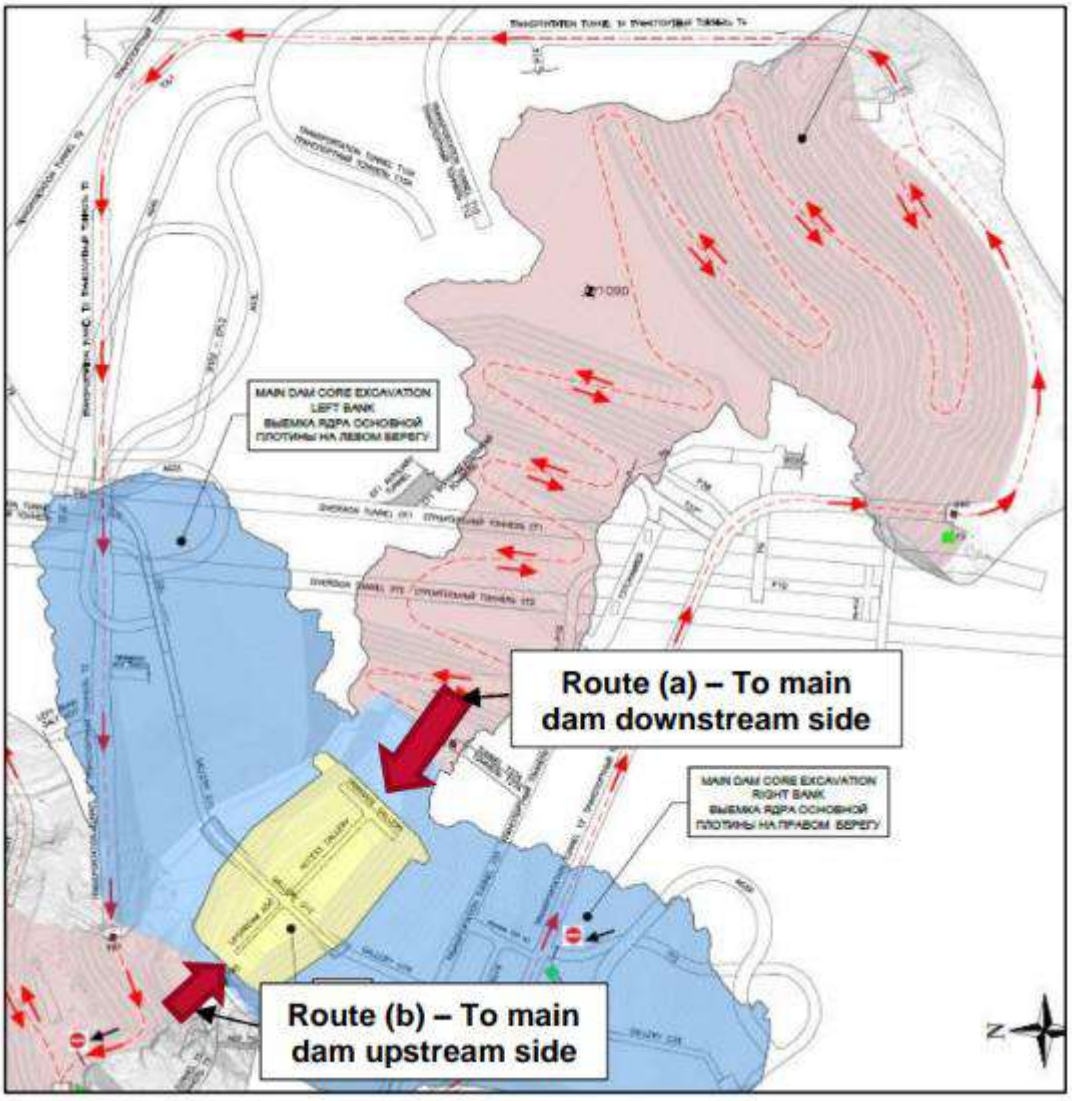
- Cement mixer trucks;
- Drilling machines;
- Fuel trucks;
- Water trucks; and
- Pick-ups.

14.6.3 Out of this list, bulldozers, roller compactors, tractors, excavators, mobile cranes and drilling machines typically are used locally at the main dam core without the need to be transported in and out of the Project site frequently. The remaining site vehicles enter and exit the main core site daily. It is understood from the TMP that the frequency of these traffic flows will increase significantly and rapidly once the concreting works gain momentum.

14.6.4 The TMP identifies that based on the current/projected site conditions, accesses to the main dam core will be via the following routes:

- a. External site road from the entrance of Tunnel T4 passing through the downstream embankment work area and heading towards the downstream side of the Main Dam Core.
- b. Tunnel road from the entrance of Tunnel T4 and passing through Tunnel T2, and finally exiting Tunnel T2 and making a left turn at the tunnel exit heading towards the upstream side of the Main Dam Core. **Figure 14-4** shows the two routes.

Figure 14-4 - Indication of routes to Main Dam Core



14.6.5 The TMP includes the following key features:

- Two-way traffic allowed as normal for routes:
  - Tunnel T22;
  - Site access to cofferdam upstream work site;
  - Site access to downstream of main dam core; and
  - Tunnel T3 from upstream tunnel entrance to junction between T3 and T5'.
- One-way traffic restriction as indicated for routes:
  - From Tunnel T4 to Tunnel T2;
  - From Tunnel T2 to Tunnel T5';
  - From Tunnel T5' to Tunnel T3; and
  - From Junction of T3/T5' to T3 exit (downstream), with special exceptions as stipulated in this section.

- During the following periods, tunnel section from the junction of T3/T5' to T3 exit (downstream) is opened to two-way traffic for specific categories of vehicles/machineries:
  - 0600 – 0700 am
  - 1200 – 1300 pm
  - 1800 – 1900 pm
  - 2400 – 0100 am
- The specific categories of vehicles/machineries allowed during the exempted time periods are:
  - Dump Truck Tonnage 30t, 40t & 50t
  - Dump Truck Articulated Tonnage 40t
  - Flatbed Tonnage 40t
  - Mobile crane Tonnage 25t, 70t, 180t
  - Auto grader 16.1t
  - Bulldozer
  - Loader Bucket 6.4 cumec
  - Manipulator 12t
  - Petrol Tanker 35

14.6.6 The TMP also includes control measures to manage road safety which comprise engineering, organizational, technical and behavioral rules that are intended to control and mitigate the risks related to road transport activities.

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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 2, Annex 10-1: Climate Change



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QUALITY CONTROL

CONTENTS

10 CLIMATE CHANGE 1

10.1 INTRODUCTION 1

10.2 PREVIOUS REPORT SUMMARY 1

10.3 LITERATURE REVIEW SUMMARY 3

10 CLIMATE CHANGE

10.1 INTRODUCTION

10.1.1. To support the Climate Risk and Vulnerability Assessment (CRVA) (presented in **Volume 1, Chapter 10: Climate Change** of this ESIA) this Annex provides a summary of previous reports provided to inform the assessment, and a hydropower literature review to inform the sensitivity of Project receptors.

10.2 PREVIOUS REPORT SUMMARY

10.2.1. A summary of the previous reports reviewed as part of the assessment are summarised below. These reports have been used to identify measures which have been incorporate into the existing and proposed Project which will reduce the vulnerability of the Project to climate change.

Environmental and Social Impact Assessment, 2014

10.2.2. 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.

10.2.3. 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.

10.2.4. An assessment of climate change and its effects on Rogun HPP was excluded from the Volume II technical annexes.

Techno-economic assessment study, 2014

10.2.5. 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.

10.2.6. 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

10.2.7. 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

10.2.8. 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

10.2.9. Recommendations from the Dam Safety Panel of Experts (DSPOE) 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

10.2.10. 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.

Procurement of Update of Hydrology and Climate Change Studies 2023

10.2.11. The proposal request (reference RHPP/CS/QCBS/05) sets out the term of reference for updating the previous hydrology and climate change studies. Specified task within the request include for:

- The review of past work and literature pertaining to hydrology and climate change for the Rogun Dam project;
- Preparation of a hydrological geodatabase containing relevant GIS-related data for the Rogun Dam basin.
- Analysis of historical hydrometric and meteorologic data for the Rogun HPP basin including river flows and sediment yield. Assess the statistical significance of the results and analyse trends.
- Re-evaluate and update the TEAS flood hydrographs for the Rogun Dam Project
- Evaluate the potential impacts of Glacial Lake Outburst Floods (GLOFs) and landslide-dam-break events on the Rogun inflow hydrographs.
- Set up a catchment model which can simulate similar hydrologic conditions, model glacial and snow melt and fooding.
- Climate Change Study to identify future trend scenarios for the key drivers of hydrologic processes in the Rogun catchment and to estimate the likely impact on the runoff-regime, floods and sediment yield.

10.2.12. Whilst it is recognised that the proposal request does not provide results or conclusion of the requested task, it does provide evidence of the detail and extent of future studies.

10.3 LITERATURE REVIEW SUMMARY

10.3.1. A literature review has been undertaken to identify how hydropower plants may be susceptible to climate change. A summary of the key findings are outlined below.

10.3.2. 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[1].

10.3.3. 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.

10.3.4. 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.

10.3.5. 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.

[1] 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)

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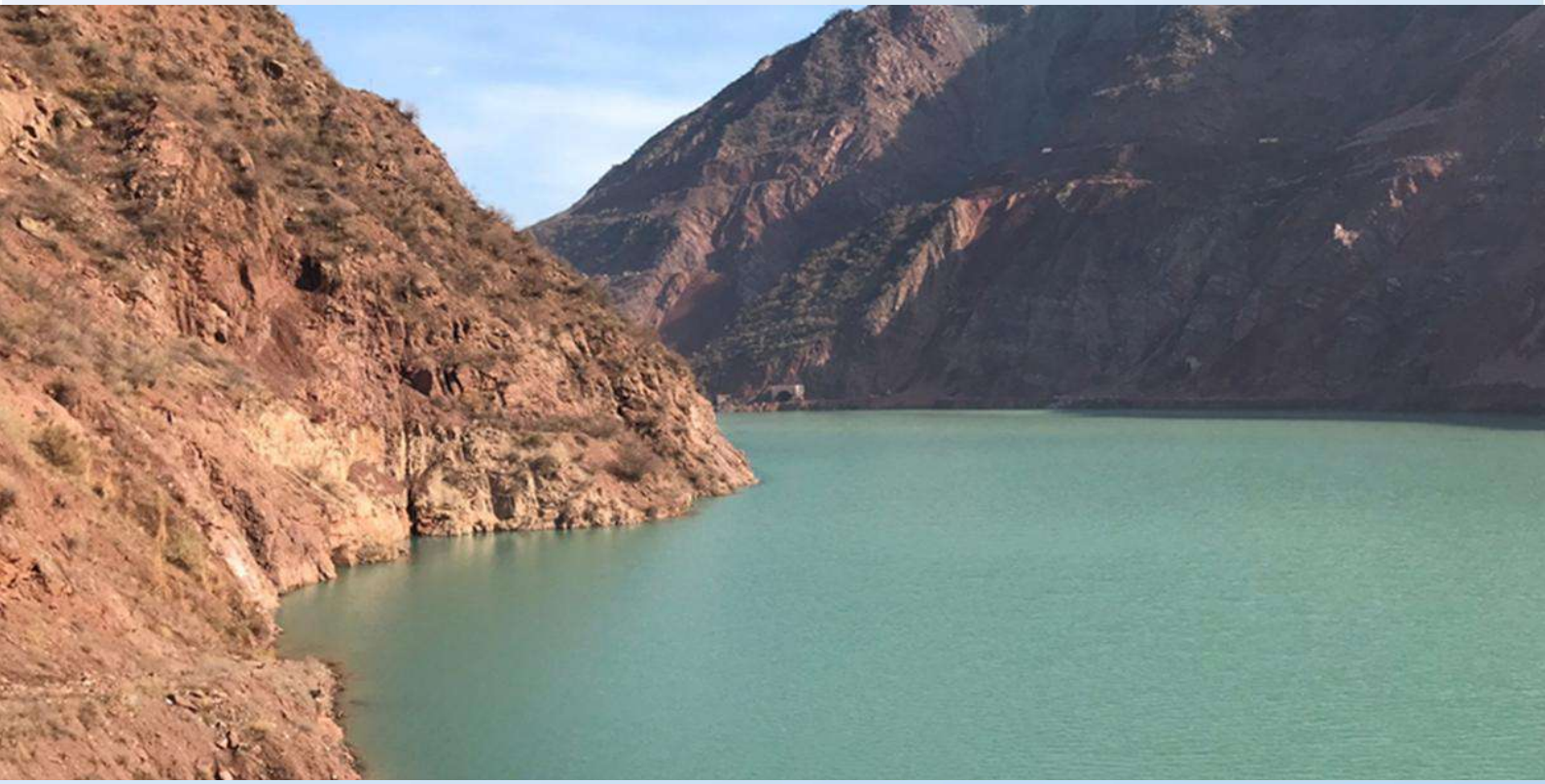
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State Enterprise “Directorate for Flooding Zone of Rogun HPP”

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 2, Annex 13-1: Minimum Environmental Flows



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CONTENTS

1. INTRODUCTION 1

1.2. PURPOSE OF THE STUDY 2

2. STANDARDS AND GUIDELINES 3

2.2. WORLD BANK 3

2.3. EUROPEAN INVESTMENT BANK (EIB) ENVIRONMENTAL, CLIMATE AND SOCIAL GUIDELINE ON HYDROPOWER DEVELOPMENT 3

3. EFLOW DETERMINATION POSSIBLE METHODS AND APPROACHES 5

3.2. SELECTED METHODOLOGY FOR THE ROGUN PROJECT 7

4. PROJECT DESCRIPTION AND HYDROLOGY IN CONTEXT TO THE EFLOW ASSESSMENT 10

5. DESIGN MITIGATION AND GOOD INTERNATIONAL INDUSTRY PRACTICE 11

6. BASELINE – CURRENT CONDITIONS 12

6.2. CLIMATE 12

6.3. STUDY AREA AND RESOURCE UNIT DELINEATION 14

6.4. SITE GEOLOGY 16

6.5. HYDROLOGY 16

6.6. BIODIVERSITY 20

7. REFERENCES 23

TABLES

Table 3-1 - Description of e-flow assessment groups (from E-flows for Morocco: Guideline and Recommendations, 2021) 5

Table 3-2 - Comparison of different methods 7

Table 6-1 - Vakhsh Average Flow Statistics at Rogun Dam over the 'Full' Dataset (Annual, April-September and October-March Periods) 17

Table 6-2 - Darband Average Flow Statistics for Annual, April-September and October-March Periods 18

Table 6-3 - Garm Average Flow Statistics for Annual, April-September and October-March Periods 18

FIGURES

Figure 1-1 - Mitigation Hierarchy Adapted from Business and Biodiversity Offsetting Programme 2009 2

Figure 3-1 – Selection of Appropriate Environmental Flow Assessment Method (adapted from Brown, C. 2016 and taken from the EIB Environmental, Climate and Social Guidelines on Hydropower Development) 7

Figure 6-1 - Average Monthly Temperature – Komsomolabad 13

Figure 6-2 - Average monthly precipitation as taken from, Pöyry, 2014 14

Figure 6-3 : Lower Vakhsh River Watershed Showing Locations of Rogun HPP and Nurek Dam 15

Figure 6-4 - Monthly hydrograph of flows at Darband (REF-Reference mean, BF-Baseflows) 20

1. INTRODUCTION

1.1.1. Environmental flows, (hereinafter referred to as E-Flows), are defined as “the quantity, frequency, timing, and quality of water and sediment flows necessary to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems” (World Bank, 2018). Other terms used in relation to E-Flows are Environmental Water, Instream Flow Requirements, Minimum Flows, Minimum Environmental Flows, Downstream Flows, Ecological Water Demand and Ecological Reserve (World Bank, 2018).

1.1.2. E-Flow assessment methods have been developing for more than 30 years, with numerous approaches being proposed. The underlying premise of such approaches is that a “natural flow regime’ of a river refers to the naturally occurring changes in water flow through the course of a year, and from one year to the next. These fluctuations are important to the ecological health of a river, and are essential in maintaining the biodiversity of rivers and their floodplain wetlands (Boivin, 2012). Managing for E-Flows simply means that enough water is left in the river to ensure downstream environments, social and economic benefits are maintained (Boivin, 2012; IUCN, 2003).

1.1.2.1. The Nurek Dam and Reservoir downstream of the proposed Rogun Dam has already impacted on the Vaksh River. Nurek Dam was constructed from 1961 to 1980 and the creation of the 10.5 km^3 reservoir and the commissioning of the hydroelectric station occurred from 1972 to 1979. This has resulted in the modification of the Vaksh River flow pattern to the following effect: According to the Nurek Phase 2 ESIA report, (OSHC "Barqi Tojik", 2020), the downstream river has adapted to the altered flow regime imposed by Nurek HPP but supports relatively limited biodiversity. Barqi Tojik, (2017), mentions that the project has no impact to the downstream disharge at a daily time scale during and after rehabilitation of the Nurek Dam given the existing operational rules and principles. Therefore no environmental flows are required given the fact that the water discharge is not modified.

1.1.3. The World Bank Group has published the Good Practice Handbook for Environmental Flows for Hydropower Projects as a Guidance for the Private Sector in Emerging Markets (World Bank, 2018).

1.1.4. The publication has been designed for practitioners, to ensure a rigorous and consistent approach is taken when assessing hydropower project impacts when determining E-Flow commitments. The handbook can be divided into nine sections covering Environmental Flows, Rivers and People, Hydropower, The Mitigation Hierarchy, Assessment Tools and methods, the Decision Tree and Adaptive Management and Management Plans (World Bank, 2018).

1.1.5. The Area of Influence (AoI) associated with the E-Flow assessment confined to the affected stretch of river, where discharge could temporarily be reduced to zero. This stretch is a very short 15 km stretch between the Rogun Dam and the upper end of Nurek reservoir at FSL. Further downstream, river discharge is regulated by Nurek and Rogun therefore has no direct effect further downstream. There are no settlements, i.e., no water users, along this 15 km stretch. The importance of this river stretch for fish is very limited and even if there were fish migrations from Nurek reservoir upstream, these would be blocked by Rogun Dam.

1.1.6. The E-Flow for this study has been calculated using the Desktop Method and compared with calculated results using the Tennant method and is based on the prescribed low-resolution method according to the WB and EIB requirements. The low-resolution method is justified based on the

potential impact of minimum flows due to the Rogun operation impacting only on the 15 km river reach between Rogun Dam and the Nurek Dam as well as further supported by minimal flow impacts as experienced downstream of Nurek due to the cascade.

1.2. PURPOSE OF THE STUDY

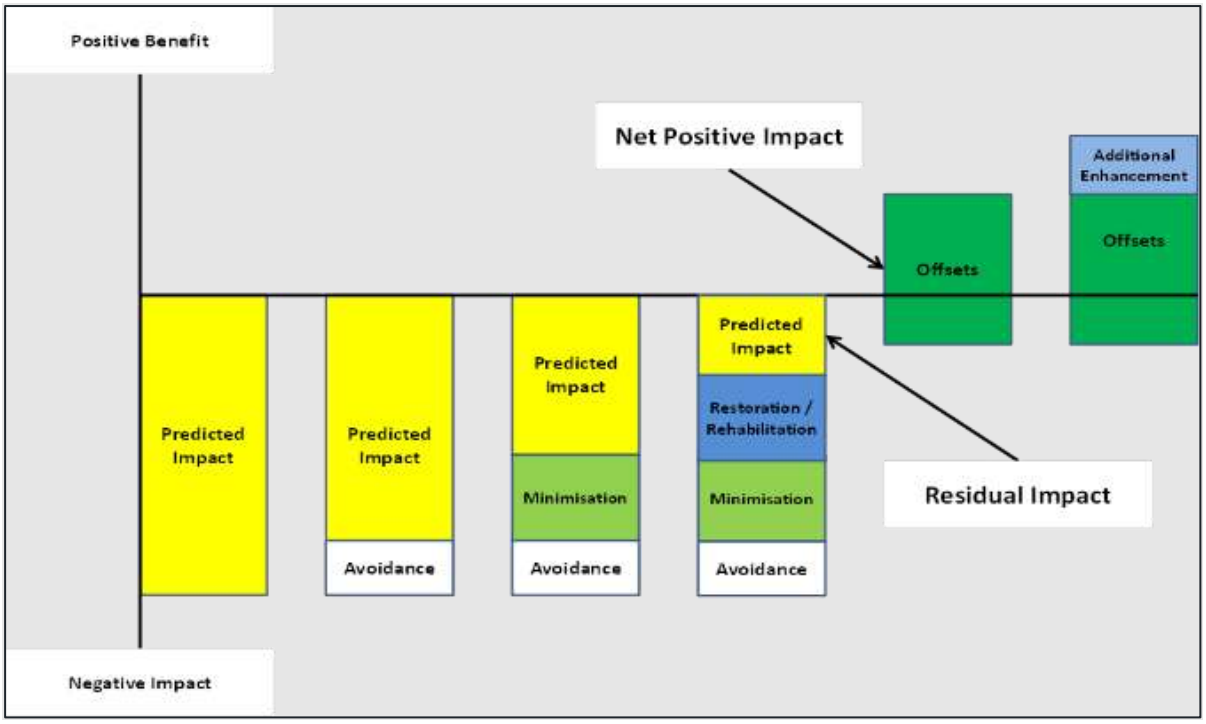
1.2.1. The purpose of this study is to determine the minimum flow requirements (E-Flows) for the Vaksh River stretch between Rogun and Nurek. This approach will aim to provide the necessary information for the design team to consider E-Flows upfront, so that mitigation measures and recommendations can be put in place to minimize impacts on the natural habitat.

1.2.2. Potential risks and impacts, which in Rogun's case are minimal, should be mitigated using the mitigation hierarchy. The hierarchy describes a stepwise approach that illustrates the preferred approach to mitigating adverse impacts as follows (**Figure 1-1**) (BBOP, 2009; World Bank, 2018):

- The preferred mitigation measure is **avoidance**: this can be achieved through the careful placement of infrastructure, as well as the design and operation thereof.
- Then **minimization**: this can be achieved through the provision of E-Flows.
- Then **rehabilitation or restoration**: this can be achieved through improved species, habitat or catchment management interventions, releases for cultural and religious rituals, or relocation of cultural infrastructure.
- Finally, **offsetting** residual, unavoidable impacts: this is the final step of the mitigation hierarchy, whereby off-site actions, such as protection of other rivers with similar biodiversity in the same adjacent catchments is undertaken.

1.2.3. These risks and mitigation are further elaborated on in Section 0.

Figure 1-1 - Mitigation Hierarchy Adapted from Business and Biodiversity Offsetting Programme 2009



2. STANDARDS AND GUIDELINES

2.1.1. This section of the report describes relevant aspects of national and international legal and regulatory frameworks relevant to environmental flows. Acts and regulations related to environmental management and protection reviewed in the context of the implementation of the project are described in the sections that follow.

2.2. WORLD BANK

2.2.1. The Good Practice Handbook for Environmental Flows for Hydropower Projects, published by the World Bank Group, provides guidance to practitioners on selecting an appropriate environmental flows assessment level for hydropower project developments, as well as guidance on taking rigorous and consistent approaches to assess and manage hydropower project impacts on downstream river ecosystems and people, through the assessment and provision of E-Flows (World Bank, 2018). The Handbook defines E-Flows as*," the quantity, frequency, timing and quality if water and sediment flow necessary to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depends on these ecosystems."*

2.3. EUROPEAN INVESTMENT BANK (EIB) ENVIRONMENTAL, CLIMATE AND SOCIAL GUIDELINE ON HYDROPOWER DEVELOPMENT

2.3.1. Chapter 3 of the European Investment Bank (EIB), Environmental, Climate and Social Guidelines on Hydropower Development, October 2019, deals with environmental issues and impacts. Specific reference is made to the EIB requirements/recommendations for Downstream Hydrology and Limnology as stated below verbatim.

22. All hydropower projects financed by the EIB must assess and make provisions for an appropriate downstream environmental flow release (EFR) and any additional mitigation measures that may be required (as a minimum these would normally include measures for fish passage) to maintain the status of freshwater and estuarine ecosystems and support existing socio-economic uses of the water resource. These measures must meet national legislative requirements, but in many cases will require additional features such as varying flow releases at different times of year in response to seasonal habitat requirements, or periodic release of flood pulses (freshets) to promote downstream sediment or nutrient transport.

23. Any proposed mitigation measures to adapt the EFR must be properly costs within the project design, which may require flexibility to incorporate future adjustments as part of an EFR strategy.

24. The method used to determine the EFR should as a minimum be consistent with national standards or approaches but must be appropriate to the scale and complexity of the project and risks involved (e.g. presence of protected areas, critical habitats, high water-use intensity). In cases where the knowledge needed to determine the EFR is lacking, the precautionary principle should be applied and a high-resolution method for determining the EFR selected.

25. Outside the EU, the applied method must be comparable in approach to those used by EU Member States.

28. The EFR regime must include a continuous programme of monitoring (including both flow and biological indicators), evaluation and adjustment - commonly referred to as adaptive

management – so that it can be periodically reviewed and where necessary modified in response to increased understanding or changes in downstream ecosystem or socio-economic conditions.

3. EFLOW DETERMINATION POSSIBLE METHODS AND APPROACHES

3.1.1. Quantifying the E-Flows of a system involves integrating hydrological, hydraulic (channel cross-sections) and ecological habitat data to establish a modified flow regime that is expected to achieve some level of ecological functioning relative to the natural condition.

3.1.2. Many methods and approaches have been developed for different countries and river types/ characteristics (e.g. seasonal, perennial and intermittent) to determine E-Flows. These E-Flow methods can be grouped into four main categories as proposed by King et al. (1999), Tharme (2003) and Horne et al. (2017) depending on the information available for the river systems, effort and time to spend on the assessment and the level of confidence required in the results. These groupings are:

A. Hydrological

B. Habitat and hydraulic rating

C. Habitat simulation

D. Holistic or ecosystem approaches

It should be noted that these groupings are not discrete, as a combination of approaches per grouping can be used or as a sub-component for an approach in another category, especially when the more holistic approaches are used. A short description of each grouping is provided in **Table 3-1**.

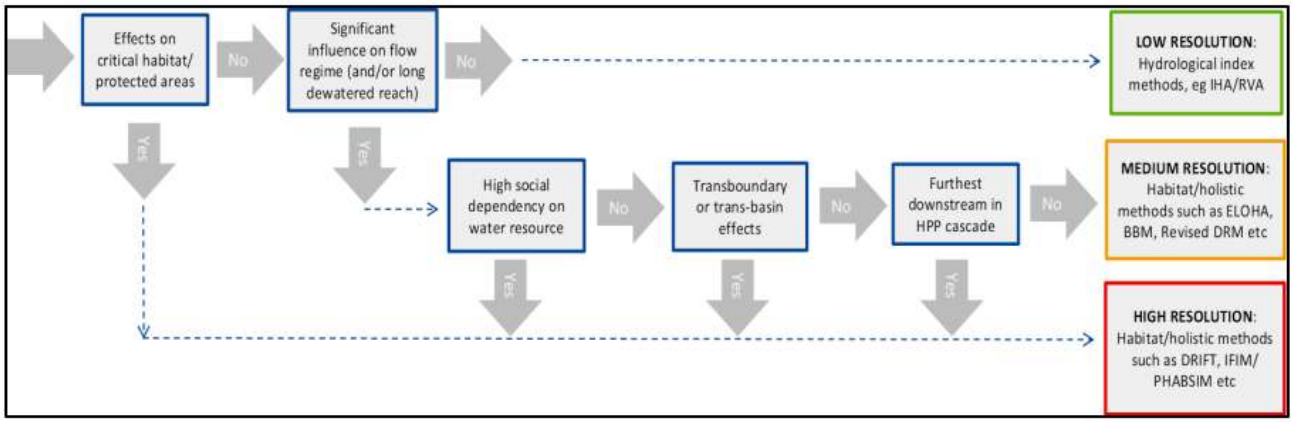
Table 3-1 - Description of e-flow assessment groups (from E-flows for Morocco: Guideline and Recommendations, 2021)

Method	Description and use
Hydrological	Data used are mainly hydrological observed or modelled monthly or daily flow time series. The e-flow is usually a fixed percentage or minimum flow per month or season to maintain or improve ecological conditions. Ecological information is limited or excluded. These are desktop methods used for reconnaissance level assessment of large river basins for water resource planning purposes.
Habitat and Hydraulic rating	Quantify relationships between discharge and biotic habitats by using changes in hydraulic variables, such as wetted perimeter, velocities or depths estimated from a hydraulic cross-section. A threshold value of these hydraulic and habitat variables is selected that would provide minimum or optimum flows to maintain habitats or ecosystems. Data include both hydraulic (cross-section) and habitat ratings, and hydrological observed or modelled monthly or daily flow time series. These are desktop methods that require some field survey, mainly hydraulic cross-sections.

Method	Description and use
	These methods can be used independently or as input to the habitat simulation methods.
Habitat simulation	These methods assess flow requirements based on biotic responses to instream habitat changes associated with changing flows by simulating the suitability of instream habitat availability for biota under different discharges. They integrate hydrological, hydraulic and indicator species data using habitat-discharge curves and tables to specify optimum flows for the biota and so to determine e-flows. These methods are not normally employed on their own, but rather they are used to provide relevant hydraulic and habitat information to assist holistic e-flow assessments (Hirschowitz, et al 2007). Data requirements are considerable, employing observed or modelled daily flow time series together with detailed habitat and biological information.
Holistic or ecosystem	Holistic or ecosystem methods assume as stated in King, et al, (1999) "… that the natural hydrological regime of a river dynamically maintains all the instream biota, channel geomorphology, and riparian, floodplain and wetland systems, as well as any estuarine and offshore coastal systems affected by river flow (i.e. the entire riverine ecosystem). It is further assumed that some baseflows and floods within the complete flow regime are more essential than others for maintenance of the riverine ecosystem. Adequate description of these flows in terms of magnitude, duration, timing, and frequency, and their incorporation in the regulated flow regime should allow the extant biotic characteristics and functional integrity of the river to persist." These methods are suited to detailed assessment of highly developed and regulated river systems and can be implemented from site to basin scale with high accuracy. They may include assessment of rivers, wetlands, groundwater and estuaries and the integration between these and can consider socio-economic, livelihoods and ecosystem goods and services. Holistic methods allow evaluation of present and future operational/ management scenarios to understand the socio-economic and ecological consequences of altered flows.

3.1.3. In addition, applying the European Investment Bank (EIB) approach for the selection of appropriate environmental flow assessment method will indicate the level of detail required for quantification of E-flows and therefore the specific method type can be validated. **Figure 3-1** illustrates the selection process to determine the appropriate environmental flow assessment method. The current site and river system is already significantly modified therefore the selection moves to "No" for the assessment of effects on critical habitat/protected areas. The reach is a short reach as of 15 km between the Rogun and Nurek Dams. Therefore, the selection process results in a "Low resolution" method.

Figure 3-1 – Selection of Appropriate Environmental Flow Assessment Method (adapted from Brown, C. 2016 and taken from the EIB Environmental, Climate and Social Guidelines on Hydropower Development)



3.1.4. The Desktop Method (Hughes and Munster, 2000) aligns with the outcome of the EIB selection process, in that this method is more rigorous than is required by the selection. This method was developed as a hydrological model for the estimation of E-Flows for planning/ reconnaissance purposes and is based on monthly hydrological flow time series. Where available, ecological information on the state of a river can be included to provide additional confidence in the results. The output of the method specifies the monthly E-Flows for different flow components (drought, maintenance low/ baseflows and floods) based on the reference hydrological flow time series.

3.1.5. The Tennant method, (Tennant, 1976) or sometimes referred to as the Montana method that is grouped as a hydrological method, was also applied for the Vakhsh River. It calculates a percentage of the annual average flow to maintain width, depths and velocities in a river and is based on limited site observations. It only specifies the minimums for winter and summer baseflows based on overall biological state that can be from severely degraded to pristine. As the method does not account for daily, seasonal or yearly flow variations, it is difficult to transfer the results to other rivers that are morphologically different.

3.2. SELECTED METHODOLOGY FOR THE ROGUN PROJECT

3.2.1. The Desktop Method (Hughes and Munster, 2000) was used to determine the E-flows.

3.2.2. A comparison of the simplified hydrological method, the Tennant method and the Desktop Method is provided in **Table 3-2**.

Table 3-2 - Comparison of different methods

Method	Features	Advantages	Disadvantages
Hydrological	Data used is mainly hydrological observed or modelled monthly or daily flow time series. The E-Flow is usually a fixed percentage or minimum flow per month or season to	Inexpensive and easy to use methods with mostly hydrological data required. Used as part of holistic methods to provide baseline analysis and information.	Low confidence estimates of E-Flows ignoring ecological considerations. Long-term implementation of these estimates may lead to degradation of ecosystems.

Method	Features	Advantages	Disadvantages
	maintain or improve ecological conditions. Ecological information is limited or excluded. These are desktop methods used for reconnaissance level assessment of large river basins for water resource planning purposes.		
Tennant (also sometimes referred to as the Montana method)	Calculates a percentage of the annual average flow (AAF) to maintain width, depths and velocities, based on limited site observations. The method recommends different percentages for winter and summer baseflow compared to the natural situation. To extrapolate to other rivers, the stream morphologies need to be similar. Provide a minimum flow and are used for planning purposes.	Desktop assessment on a basin-wide level. Requires limited or no field work. Useful for river-wide planning purposes. Make some assumptions about biota, habitats and hydraulics of a system. Pre-defined table available to choose percentage based on the state of the river.	Prescriptive approach that describes only a minimum flow. Does not consider the biota directly, although may be adjusted based on overall biological state e.g., severe degradation or pristine. Difficult to transfer the results to other rivers that are morphologically different. Does not account for daily, seasonal or yearly flow variations, thus not adequate for rivers with highly variable flows. Only limited flood requirements are specified (i.e., a single allocation of 200% AAF).
Desktop Reserve Model (DRM)	The Desktop method (Hughes and Munster, 2000) was developed as a hydrological model for the estimation of E-Flows for planning purposes. This was based largely on hydrological data but also utilises results from previous studies to develop rules for the various ecological states of the river, thus linking the hydrological characteristics of the river with ecological state. It specifies the monthly e-flows for different flow components (drought, maintenance low and high	Simple to use with low data requirement. Can be based on limited or no field surveys. Data required is limited to long-term monthly natural flow time series and an indication of the ecological state of the river reach. The method has built-in rules for various pre-defined ecological states. E-flows are provided as summary tables per month for each of the flow components as well as monthly percentiles with and without high flows.	Does not directly link the flows to habitats. This is an additional step that is required where the E-Flows are interpreted and evaluated by ecologists, using the output of hydraulic rating or habitat simulation models to check if the e-flow requirements provide the habitats for the biota. The model uses data from previous studies which may not be appropriate for a novel test site.

Method	Features	Advantages	Disadvantages
	flows) based on natural hydrological flow time series.	It is used extensively as part of the holistic models (BBM, FSR and PROBFLO) for the finalisation of e-flows per month, especially where limited ecological data is available.	

4. PROJECT DESCRIPTION AND HYDROLOGY IN CONTEXT TO THE EFLOW ASSESSMENT

4.1.1. There is no dewatered reach associated with the Project implying that no specific minimum flow would then be needed for that purpose.

4.1.2. The instream flow regime would rather be specified to be applied to the downstream reach between the HPP outlet and the upper limit of the Nurek reservoir, 15 km downstream.

4.1.3. By maintaining the Nurek Reservoir at maximum operating level all year round, the reservoir will be changed into a run-of-the-reservoir installation by the Project which will be operated in a way to maintain the flows downstream of the Nurek Reservoir.

4.1.4. The duration of the dam filling to Full Supply Level (FSL) is planned to be 7 years.

5. DESIGN MITIGATION AND GOOD INTERNATIONAL INDUSTRY PRACTICE

5.1.1. Due to the low impact foreseen on biodiversity and human livelihoods, not many design mitigation measures can be implemented. The focus of the design mitigation measures will be to minimise E-Flow impacts on the already impacted ecosystem. Outlets should be designed in such a way to ensure the releases for the minimum or drought flows to provide current seasonality (high flows during summer, low flows during winter).

6. BASELINE – CURRENT CONDITIONS

6.1.1. For the baseline assessments associated with the Climate, Geology, Geohydrology, Hydrological setting and land use, Water use, Surface Water Quantity assessment and Transboundary aspects, refer to the **Volume 1, Chapter 13:Water** of this ESIA. The key information relevant to E-Flows is summarised in the sub-sections.

6.2. CLIMATE

6.2.1. Refer to **Volume 2, Annex 7-1: Baseline Conditions Report** of this ESIA for a full climate description. The section is relevant to the E-Flow assessment as taken from **Volume 1, Chapter 13 (Water)** and **Volume 1, Chapter 9 (Greenhouse Gases)**, and **Volume 1, Chapter 10 (Climate Change)** of this ESIA.

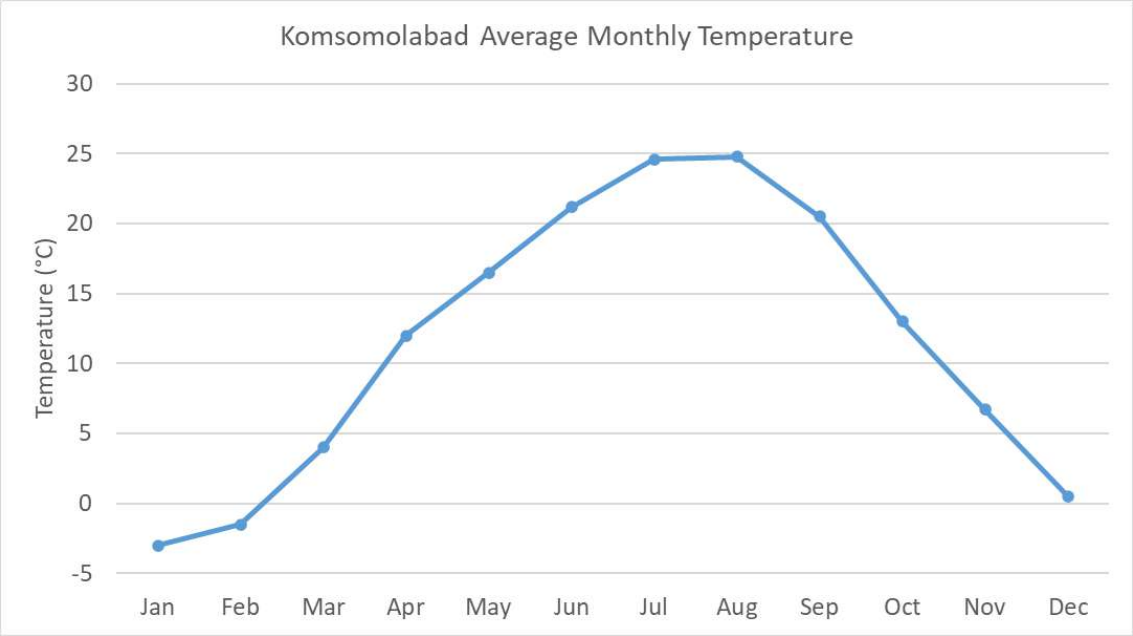
6.2.2. Tajikistan is the smallest country in Central Asia; 93% of its territory is mountainous regions and 6% is occupied by glaciers. Tajikistan is in the temperate continental climate zone and with moderate climate variables typical of Central Asia. Climate variability is linked with its geological 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 (World Bank, 2020a).

6.2.3. The glaciers are important in regulating the climate whilst retaining water and controlling flows (UNDP, n.d.). 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 (Global Support Programme, n.d.).

TEMPERATURE

6.2.4. The temperatures experienced across Tajikistan are dictated by the mountainous terrains (World Bank, 2020a). The average monthly temperature registered at the Komsomolabad weather station, ranges from a minimum of approximately -3°C in January to a maximum of 25°C in July and August. The average monthly temperatures at Komsomolabad are presented in **Figure 6-1** which has been approximated from Figure 7-2 of the 2014 Environmental and Social Impact Assessment for Rogun Hydro Power Plant (Pöyry, 2014).

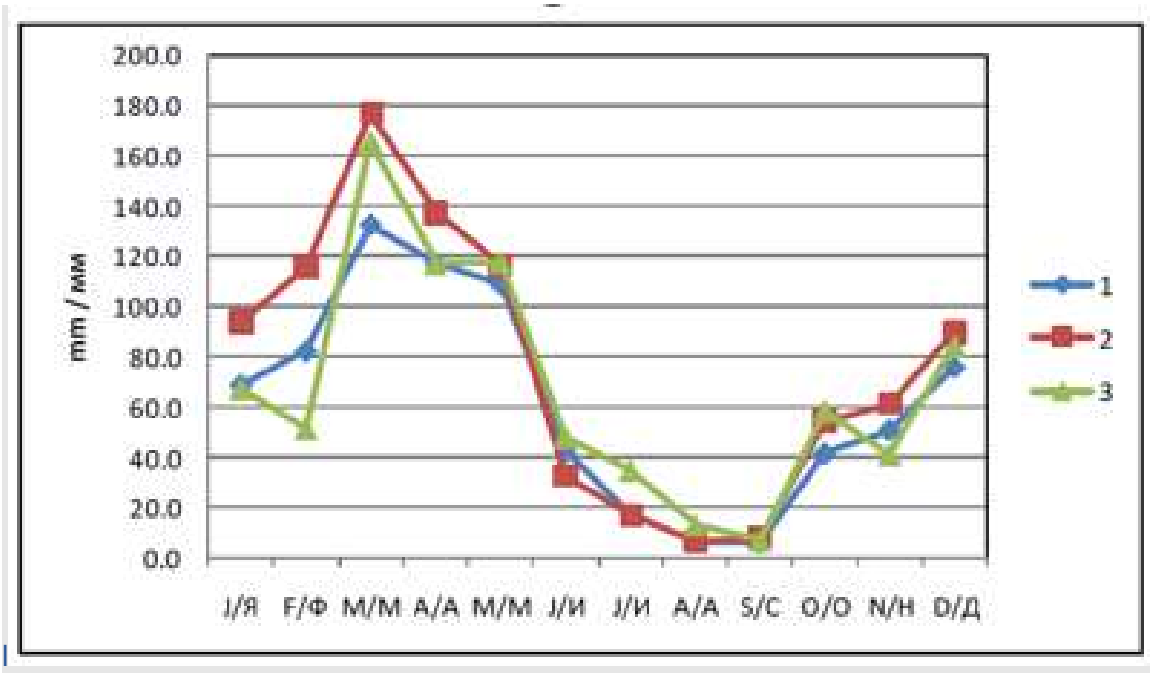
Figure 6-1 - Average Monthly Temperature – Komsomolabad



PRECIPITATION

6.2.5. Based on the data gathered from the three available weather stations, Garm, Novobod and Obigarm, as presented in the 2014 Environmental and Social Impact Assessment for Rogun Hydro Power Plant (Pöyry, 2014), 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. Refer to **Figure 6-2** for the average monthly precipitation where (1) represents data from the Garm station, (2) the Novobod station and (3) the Obigarm station.

Figure 6-2 - Average monthly precipitation as taken from, Pöyry, 2014



EVAPOTRANSPIRATION AND EVAPORATION

6.2.6. 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.

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).

CLIMATE CHANGE CONSIDERATIONS

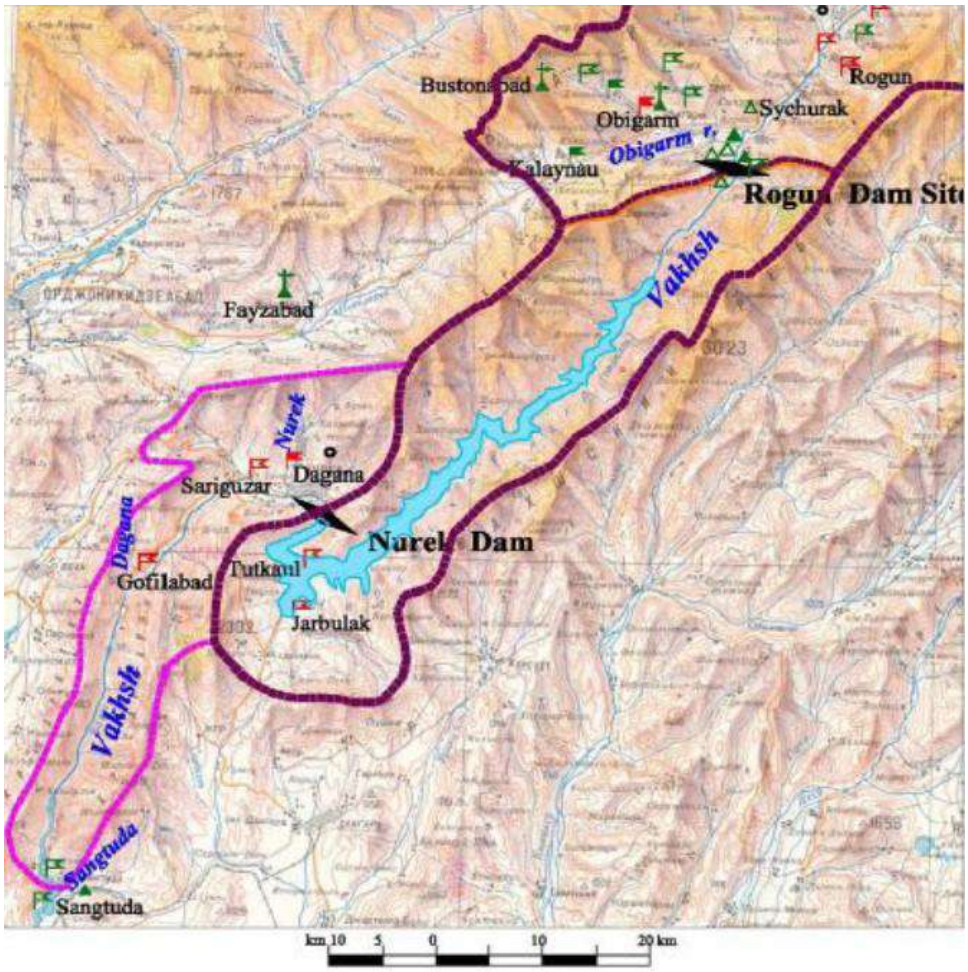
6.2.7. The EIB (European Investment Bank, 2019), recommends that climate change should be evaluated for Hydropower projects. Hydropower projects have a very long design-life and therefore long-term climate changes will become relevant to the Hydropower Plant. Climate change projections need to be incorporated into the hydrological assessment to evaluate the long-term changes in average seasonal temperatures and/or rainfall conditions. Such changes can have significant impacts on the timing and magnitude of river flows and could possibly alter the flow seasonal trends. E-Flows and its effects due to the impact of climate change must feature in the Climate Risk and Vulnerability Assessment (CRVA) for the Project.

6.3. STUDY AREA AND RESOURCE UNIT DELINEATION

6.3.1. For the purposes of this assessment reach of the Vakhsh River located downstream of the Rogun Dam and upstream of the Nurek Reservoir, incorporating a 15 km river section is relevant, refer to **Figure 6-3**.

6.3.2. For the purposes of this assessment, this extends up to a precautionary maximum distance of 750 m either side of the Project, within which a level impact from displaced biodiversity and humans can reasonably be expected to occur.

Figure 6-3 - Lower Vakhsh River Watershed Showing Locations of Rogun HPP and Nurek Dam



HYDRAULIC HABITATS AND GEOMORPHOLOGY

6.3.3. The shape and slope of river channels, influenced by geomorphological processes affect flow velocity and water depth. Channels with gentle slopes and wide floodplains can store more water helping to maintain minimum flows.

6.3.4. Geomorphological processes control sediment transport and deposition, which can alter river channels and affect flow patterns.

6.3.5. The size, shape and topography of drainage basins influence how water is collected and distributed and can impact on minimum flows if basins do not have efficient drainage networks.

6.3.6. At the dam site, the river channel is narrow and the valley profile has a relatively tight “V” shape with steep slopes. The favourable morphology of the retention structure is due to the river cutting across the general structural trend, as well because of the bedding.

6.3.7. Refer to the **Volume 1, Chapter 13: Water** and the **Volume 1, Chapter 15: Biodiversity** of this ESIA, for a more detailed description of the river geomorphology and hydraulic habitats. This section summarizes information as relevant to E-Flows only.

6.3.8. 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.

6.4. SITE GEOLOGY

6.4.1. At the dam site, the river channel is narrow and the valley profile has a relatively tight “V” shape with steep slopes. The favourable morphology of the retention structure is due to the river cutting across the general structural trend, as well because of the bedding.

6.5. HYDROLOGY

BASE FLOW AND CATCHMENT INFLOWS

6.5.1. The Vakhsh River flow assessment has been conducted as part of the assessment set out in **Volume 1, Chapter 13: Water** of this ESIA. 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 FLOW AND CATCHMENT INFLOWS

6.5.2. The Vakhsh river flow assessment has been conducted as part of the **Volume 1, Chapter 13: Water** of this ESIA. At the time of writing no direct flow measurement downstream of Rogun is available to WSP. However, 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).

6.5.3. A comparison of these datasets has been conducted in the **Volume 1, Chapter 13: Water** and it was found that the data from 2008 to 2019 present a similar box plot comparing to the dataset from 1932 to 2007, resulting in a combined boxplot where the statistics are in the same range of values of the Old dataset used for the previous studies. From this qualitative comparison it can be concluded that there is not a substantial difference in flow data, which can be used to describe the flow conditions of the Vakhsh river before the construction of Rogun dam.

PREVIOUS BASELINE

6.5.4. This assessment has been presented in the **Volume 1, Chapter 13: Water** of this ESIA**.**

6.5.5. Before the construction of the latest Rogun Dam design , the average annual flow ranged from 450 m^3/s to 867 m^3/s, with an average value of 645 m^3/s. The average flows during the spring-summer period (i.e. high flow season) are more than four times higher than the average flows in the autumn-spring period (i.e. low flow season) with an average flow of 1,054 m^3/s and 234 m^3/s respectively. The maximum average flow registered in the April-September period is 1,438 m^3/s, and the minimum is 678 m^3/s. During the October-March period the maximum average flow is 326 m^3/s and the minimum 182 m^3/s.

6.5.6. A summary of flow statistics over the 'full' dataset are provided for Annual average flows, April-September average flows and October-March average flows within **Table 6-1.**

Table 6-1 - Vakhsh Average Flow Statistics at Rogun Dam over the 'Full' Dataset (Annual, April-September and October-March Periods)

Average Flow Statistic / Percentile	Annual Period (m^3/s) Prior to latest Rogun Dam design (1932 – 2019)	April-September Period (m^3/s)	October-March Period (m^3/s)
Minimum	450	678	182
5%	515	819	200
25%	593	961	218
50%	638	1047	230
75%	703	1160	245
95%	777	1288	286
Maximum	867	1438	326

6.5.7. Additional hydrometric data has been provided by the National Agency for Hydrometeorology of the Republic of Tajikistan. Average flow statistics from two stations closest to Rogun Dam are presented in **Table 6-2** and **Table 6-3**. These stations are:

- Darband hydrometric station: located on the Vakhsh River just downstream of the confluence between the Surkhob and Obihingou rivers; and

- Garm hydrometric station: located on the Surkhob River before the confluence with the Obihingou River.

Table 6-2 - Darband Average Flow Statistics for Annual, April-September and October-March Periods

Average Flow Statistic / Percentile	Annual Period (m^3/s) Prior to latest Rogun Dam design (1932 – 2019)	April-September Period (m^3/s)	October-March Period (m^3/s)
min	239	696	192
5%	435	804	198
25%	568	939	208
50%	598	987	226
75%	649	1078	243
95%	733	1193	273
max	817	1235	290

Table 6-3 - Garm Average Flow Statistics for Annual, April-September and October-March Periods

Average Flow Statistic / Percentile	Annual Period (m^3/s) Prior to latest Rogun Dam design (1932 – 2019)	April-September Period (m^3/s)	October-March Period (m^3/s)
min	233	355	103
5%	253	380	107
25%	292	464	122
50%	323	520	128
75%	354	576	135
95%	426	714	151
max	457	760	180

CHANGE TO BASE AND INFLOWS

6.5.8. 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 wastewater. 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.

MINIMUM ENVIRONMENTAL FLOW (E-FLOW)

6.5.9. The availability of long term measured or modelled daily or monthly hydrological data to represent climatic variability, especially where high variability within year and between years are experienced, is required for the determination of the E-Flow to provide high confidence results. These flows form the baseline or reference flows to build the hydrological foundation for the determination.

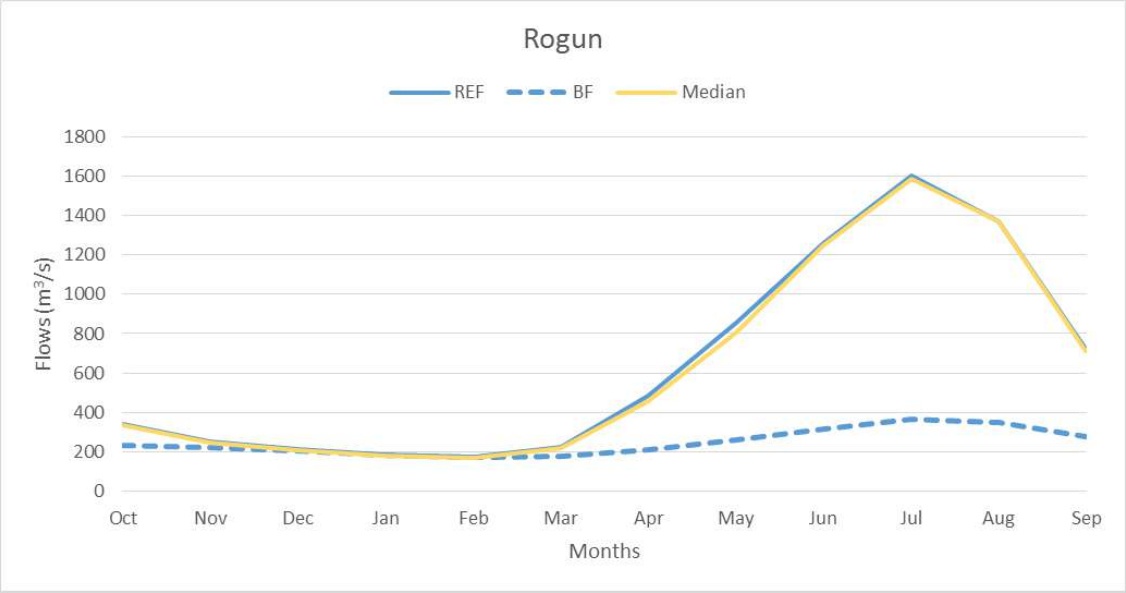
6.5.10. The reference flows can refer to natural or minimally impacted flows at certain points in the rivers (important tributaries, Environmental Flow Requirement sites, gauging weirs, or large development sites) in a catchment or at the outlet of an entire basin. If a long enough observed flow record is available from a gauging station, the record period could be separated for both baseline (before developments) and for present day development conditions. For example, if the observed flow record is from 1920 to 2015 and the only development was the construction of a dam and associated infrastructure for irrigation in 1960, the period 1920 to 1960 could be used as baseline and the latter period as present day flows.

6.5.11. The main graphs and statistics required for these flow records are hydrographs (monthly or daily), mean, median (high variability), minimum, maximum, flood peaks, etc. to provide information to the ecologists at the various selected sites where biological, vegetation and hydraulics data is available.

6.5.12. Monthly observed flows for the Vakhsh River are available from the gauge at Darband for the period 1932 to 2019 and was used as the reference flows for this assessment. The gauge is situated upstream of Rogun Dam, but after the confluence of the Surkhob and Obikhingou Rivers, thus providing good reference flows for the Vakhsh River. From the statistics calculated from the data, it was observed that the variability between years is very low (median and mean values per month

almost the same), with a reference Mean Annual Runoff of 20 309 Mm^3. A baseflow separation was undertaken using the method as developed by Smaktin in 2001. The baseflows give an indication of the flows in the river without the influence of floods and provides a guide for the determination of the low flow requirements of the E-Flows **(Figure 6-4**).

Figure 6-4 - Monthly hydrograph of flows at Darband (REF-Reference mean, BF-Baseflows)



6.6. BIODIVERSITY

AQUATIC SPECIES

6.6.1. Ecological indicators used for environmental flow determination typically incorporate fish, benthic invertebrates and instream vegetation. There is also a component that incorporates river-dependant herpetofauna, birds and mammals. Further to this, habitat connectivity and heterogeneity is considered for different species life history traits (i.e. spawning, nursery grounds, feeding).

6.6.2. In the case of the Vakhsh River between Rogun and Nurek, these indicators need to be approached in a pragmatic manner that takes into consideration the section of river that is being considered.

6.6.3. Refer to **Volume 1, Chapter 15:Biodiversity** of this ESIA for further detail on aquatic ecology within the relevant river reach.

TERRESTRIAL ECOLOGY

6.6.4. Refer to **Volume 1, Chapter 15: Biodiversity** of this ESIA for further detail. The below summarises the key information relevant to the E-Flow assessment.

Flora

6.6.5. No floral species have been noted to occur within the 15 km river reach relevant to the E-Flow assessment. Therefore, there is no impact on flora due to E-Flows.

6.6.6. No invasive plant species were noted during studies to inform the 2014 ESIA, or from field surveys in 2023 and therefore no relevance to E-Flows in the 15 km river reach.

Fauna

Mammals

6.6.7. No mammals were recorded to be present within the 15 km river reach relevant to the E-Flow assessment that would be impacted by a change in E-Flows due to the project.

Amphibians

6.6.8. 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 species were also recorded during the 2023 fields surveys and are common and widespread within the region, in areas where standing water is present. Although the species has not specifically been recorded in the 15 km river reach of interest to E-Flows, it can be likely that there is some presence of this species in this reach.

Reptiles

6.6.9. A diverse reptile fauna is present across Tajikistan, with 46 species confirmed as being present, 22 of which are endemic to the region. None of the reptile species identified is expected to be impacted due to a change in E-Flows.

Birds

6.6.10. Most species recorded are common and widespread, although 16 species are listed on the TRB and/or are of increased conservation interest/status which has been recorded from reservoirs downstream of Rogun, close to Nurek. This is beyond the river reach associated with E-Flows and therefore change in E-Flows in the study area will not impact these species to a significant extent.

HUMAN LIVELIHOODS

6.6.11. This section as taken from the **Volume 1, Chapter 13: Water** of this ESIA is relevant to the E-Flow assessment.

6.6.12. The Project site is located approximately 100 km east of the Tajik capital of Dushanbe on the Vakhsh River in the Rasht region. The Rasht region is divided into seven districts (rayons) namely, Faizobod, Rogun, Nurobod, Rasht, Tavildara, Tojikobod and Jirgital.

6.6.13. 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, comprising 75% to 35% of the land depending on altitude. Forest and scrub comprise 3% of the land, as much of the original forest that covered the Pamir mountain foothills has been cleared for grazing, Pöyry, (2014).

6.6.14. The Vakhsh river provides water for several irrigation schemes, which are all located downstream of Nurek dam. The main irrigation infrastructures are the Danghara tunnel with a capacity of 100 m^3/s, the Yavan tunnel with a capacity of 75 m^3/s and the Vakhsh main canal with a capacity of 210 m^3/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).

6.6.15. The abstraction demand for irrigation follows the vegetation period and the is subject to the crop type and elevation. A first peak in water consumption is observed in March, to artificially inundate the fields before the starting the cultures, while a second and higher peak is observed between June and August, when most of the demand is concentrated (Poyry 2014).

6.6.16. Terrestrial habitats relevant to human livelihood includes cultivated lands containing crops for humans and livestock, pasture habitats and urban areas where the settlements are located. The 2014 ESIA concluded that fish diversity and abundance within the Project AoI was low, and that fish were not economically important for the local population.

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PUBLIC

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 2, Annex 13-2: Reservoir Slope Stability



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CONTENTS

1 RESERVOIR SLOPE STABILITY 1

1.2 BASELINE DATA SUMMARY ERROR! BOOKMARK NOT DEFINED.

1.3 STANDARDS AND GUIDELINES 3

2 BASELINE DATA 4

2.1 RESERVOIR GEOLOGY 4

2.2 RECOGNISED LANDSLIDES IN THE RESERVOIR AREA 9

2.3 SPECIFIC SLOPE INSTABILITY FEATURES 10

2.4 SUMMARY OF KNOWN RESERVOIR LANDSLIDE TYPES 14

3 AREA OF INFLUENCE 15

3.2 ASSESSMENT METHODOLOGY 15

3.3 IMPACT ASSESSMENT 19

3.4 MITIGATION OF RESERVOIR SLOPE STABILITY IMPACTS 21

3.5 RESIDUAL EFFECTS 24

3.6 SUMMARY 25

3.7 REFERENCES 31

TABLES

Table 3-1 - Impact Magnitude Categories 17

Table 3-2 – Receptor Sensitivity Categories 17

Table 3-3 – Impact Significance Matrix 19

Table 3-4 – Summary of Slope Stability Assessment (Construction) 26

Table 3-5 - Summary of Slope Stability Assessment (Operation) 29

FIGURES

Figure 2-1 - Regional scale geological map of the lower half of the Rogun reservoir area (Seister 2024).. 5

Figure 2-2 - Geological map of Rogun HPP reservoir area up to 1100 m ASL (Stucky 2018) 6

Figure 2-3 - Legend for Figure 2-2 7

Figure 2-4 - Conceptual cross section of Tajik basin Fold-Thrust Belt at the dam site (Stucky 2018), refer also to Figure 2-5 7

Figure 2-5 - Typical geological cross sections through the reservoir (Stucky 2018) 8

Figure 2-6 - Map of landslide prone areas around the Rogun reservoir (ESIA 2014) 9

Figure 2-7 - Engineering geological plan from Stucky (2018a) showing 'risk areas' potentially adversely affected by impounding the reservoir to 1100 m ASL 10

Figure 2-8 - Map of the Rogun HPP reservoir and catchment showing landslides inferred from InSAR data (after Jones et al 2021). The detailed areas are presented in Figure 9 showing interpreted landslide type for each feature 12

Figure 2-9 - Interpreted landslide type for features identified from InSAR data by Jones et al (2021) 13

1 RESERVOIR SLOPE STABILITY

1.1.1. This annex describes the current understanding of landslide hazard of the reservoir slopes that may be affected by the Project activities, the potential impacts of reservoir induced landslides and potential mitigation strategies.

1.1.2. A comprehensive description of baseline conditions regarding geomorphology and soils and geology is presented in **Volume 2, Annex 7.1: Baseline Conditions Report** and a summary is provided in **Volume 1, Chapter 7** of this ESIA. An assessment of the potential Project impacts on reservoir slope stability is presented in Section 22.5. Where necessary, mitigation measures for the avoidance of impact, impact minimization and/or long-term management are included in Section 22.6.

1.1.3. Condition of the slopes around the reservoir has been described at a preliminary level in ESIA (2014) and TEAS (2014). No additional field or remote assessment has been reviewed in preparation of this document. Knowledge of reservoir landslide assessment, behaviour, consequences and management has been reviewed and incorporated from various literature sources (including ICOLD Bulletin 124 and Reimer (1991)), which describes a large number of case studies of reservoirs affected by slope instability. Relevant data from studies that have included the Rogun reservoir area and other similar large reservoirs have also informed this assessment.

1.1.4. To a limited extent, A comprehensive assessment of the potential impacts of reservoir slope instability is currently underway for the Project area for the full raise to 1290 m ASL, which will inform the reservoir filling schedule. potential impacts related to reservoir slope instability have been assessed previously (including a specific assessment for raising the water in the reservoir to 1100 m ASL) and are summarised in this document.

1.2 BASELINE DATA SUMMARY

POYRY (2014) ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR ROGUN HYDRO POWER PLANT

1.2.1. The 2014 ESIA report discussed the findings of the review of previous Project reports relating to slope stability within the Project area of influence and noted:

- The soils associated with Quaternary deposits are most prone to erosion and the exposure of the reservoir to landslides, mud and debris flows is mostly from its left bank with a few million cubic meters estimated as the maximum volume for such events; and
- An assessment of the landslide risk in the reservoir area has been carried out by the Institute of Geology, Earthquake Engineering and Seismology of the Academy of Sciences of the Republic of Tajikistan and landslide prone areas, where landslide processes have been observed and are expected, are divided into areas:
  - on the shoreline of the future reservoir, which therefore can be affected by the oscillation of the reservoir water level
  - out of the reservoir area (in brown in **Figure 2-7**), which therefore are not influenced by it, but could block tributaries of the Vakhsh river.
- Areas of highest risk for landslides, which might be influenced by the drawdown of the reservoir, are located between Chorsada and Nurobod, and near the confluence of Surkhob and Obihingou rivers, both on the right bank of the river. While landslides in these areas are not expected to

present the risk of impulse waves overtopping or damaging the dam and the hydraulic facilities, they present a risk for the settlements located nearby.

COYNE ET BELLIER (2014) TECHNO-ECONOMIC ASSESSMENT STUDY FOR ROGUN HYDROELECTRIC CONSTRUCTION PROJECT

1.2.2. The report titled Phase II: Project Definition Options Volume 3: Engineering and Design Chapter 3: Design of Alternatives specifically noted that:

- "*With regard to geodynamics phenomena, rockfalls, collapses and landslides are intensively developed on and around the dam site. Rockfalls are common, especially when raining, due to the steepness of slopes and differential erosion between the interlayered siltstones and sandstones*.";
- The right bank of the Vakhsh is characterised by a peculiar morphological feature; the so-called 'disturbed zone' and "… *the presence of large potentially unstable masses in the front part of this structure, at the foot of which large amount of debris produced by the scouring of the slope accumulate*"; and
- Slope instability is common in the diverse tributaries of the Vakhsh River, especially the Obi-Shur River, which joins with the Vakhsh River on left bank immediately downstream of the dam site that is a source of mudflows that, in May 1993, temporarily dammed the Vakhsh River resulting in the flooding of the lower intake tunnels and the transformer house.

STUCKY (2018A) SLOPE STABILITY ASSESSMENT FOR LAKE FILLING TO THE INTERMEDIATE 1100 M ABOVE SEA LEVEL (ASL) STAGE

1.2.3. This report described a detailed analysis of slope stability of a number of 'risk-areas' around the reservoir that may be affected by lake filling to the intermediate 1100m ASL stage and provided a description of known reservoir slope stability but does not assess all potential reservoir landslide risks associated with raising the reservoir to final elevation.

STUCKY (2018B) DAM BREACH ASSESSMENT OF THE INTERMEDIATE 1100 M ASL RESERVOIR STAGE

1.2.4. This report presented the results of a dam breach assessment of the dam in the intermediate 1100 m ASL reservoir stage. The assessment concludes that a breach of this dam configuration would cause significant damage downstream but be contained with the Nurek Dam reservoir, without overtopping.

SEISTER (2024) SEISMIC HAZARD UPDATE STUDY AT ROGUN DAM

1.2.5. A comprehensive seismic hazard assessment is presented in this report including the results of a probabilistic seismic hazard assessment that describes known seismic sources and distributed seismicity models for the region, estimates of ground shaking for a range of likelihood, probabilistic fault displacement hazard assessment for several faults located close to the dam site, an assessment of reservoir triggered seismicity during and following reservoir filling and as assessment of topographic amplification around the reservoir area.

OTHER LITERATURE

1.2.6. Research publications such as Reimer (1992), Havenith et al (2018), Jones et al (2021) and Metzger et al (2021) provided relevant information on reservoir landslide case studies, local slope stability characteristics and tectonic setting. Tang et al (2019) describes some of the reservoir

landslides activated by filling of the Three Gorges Reservoir in China. Strom (2013) describes some potential impacts of large landslides within the Rogun HPP catchment.

1.3 STANDARDS AND GUIDELINES

1.3.1. Management of reservoir slope instability risk will need to be compliant with all applicable Tajik legislation. Primarily this is anticipated to relate to the management of dam safety. Many countries do not have applicable legislation or guidelines for managing reservoir slope instability and rely on guidance developed by other organisations as described below.

1.3.2. Guidance on investigating and managing reservoir slope instability risk is provided by ICOLD Bulletin 124, which is frequently referenced in this document.

1.3.3. ICOLD Bulletin 124 describes current good international practice for investigating, monitoring and mitigating risk of reservoir landslides. The general approach incorporates thorough geological investigations to identify potential slope instability that could affect the reservoir, followed by assessment of the associated risk to life safety, the environment and infrastructure. Driven by the results of these assessments, risk mitigation strategies are developed, which usually include deformation monitoring and associated emergency management plans if unacceptable slope behaviour is identified, and potentially engineering mitigation measures such as drainage of groundwater, buttressing and slope modification.

2 BASELINE DATA

2.1 RESERVOIR GEOLOGY

2.1.1. The geology/geomorphology of the Rogun HPP is characterised by mountainous terrain, the incised Vakhsh River and a number of tectonically active faults. The tectonic setting is the western end of the India/Asian collision zone, characterised by oblique compression of up to about 20 mm/year. The oldest rocks exposed in the catchment are the Paleozoic Tien Shan granitic basement (pink areas in **Figure 2-1**), which outcrop from the Obidjushon River on the right bank (north side) of the reservoir area, from upstream of the dam site and on left bank (south side) of the reservoir from the Khodja-Alisho River, about 6 km upstream of the dam site. The Tien Shan rocks are complexly juxtaposed with younger rocks by a series of thrust and reverse faults. The overlying rocks comprise the Cretaceous/Tertiary aged Tajik Depression sedimentary sequence (green units in **Figure 2-1**), which have been folded and uplifted by activity of the Tajik basin Fold-Thrust Belt. A more detailed geological map of the dam site and lower reservoir area is presented as **Figure 2-2** and **Figure 2-3**, showing the distribution of Quaternary deposits and recognised faults as well as the distribution of underlying rock types. The complex thrust fault system of the Tajik basin Fold-Thrust Belt is illustrated conceptually in **Figure 2-4**. **Figure 2-5** depicts a series of geological cross sections through the reservoir.

2.1.2. A number of faults that have been recognised in the vicinity of the Rogun HPP are associated with this tectonic setting, including the Vakhsh Thrust fault which is one of the highest strain structures in the region (**Figure 2-1**). The Ionaksh Fault passes through the dam site and the Gulizindan Fault around the left abutment of the dam.

2.1.3. The Tajik Depression sedimentary sequence comprises Jurassic to Cretaceous age argillite, sandstone, mudstone, limestone and includes evaporites such as gypsum.

2.1.4. Separating the Palaeozoic basement and Tajik Depression sequence is a series of younger Tertiary age limestone and terrigenous sediments that accumulated in a foreland basin and are now tectonically incorporated between the older formations.

2.1.5. Thick quaternary loess deposits are common, particularly overlying the basement rocks and extensive alluvial fans characterise the left bank of the reservoir.

2.1.6. The high rate of crustal tectonic deformation in the area leads to a high rate of earthquake activity, including six magnitude M7 and 18 M6.5 earthquakes in the past 115 years (Metzger et al 2021). Estimates of ground shaking for a range of likelihood are presented by Seister (2024) indicating a high seismic hazard in the area.

Figure 2-1 - Regional scale geological map of the lower half of the Rogun reservoir area (Seister 2024). The pink areas are underlain by Paleozoic Tien Shan granitic basement and the remaining areas are underlain by Cretaceous/Tertiary aged Tajik Depression sedimentary sequence.

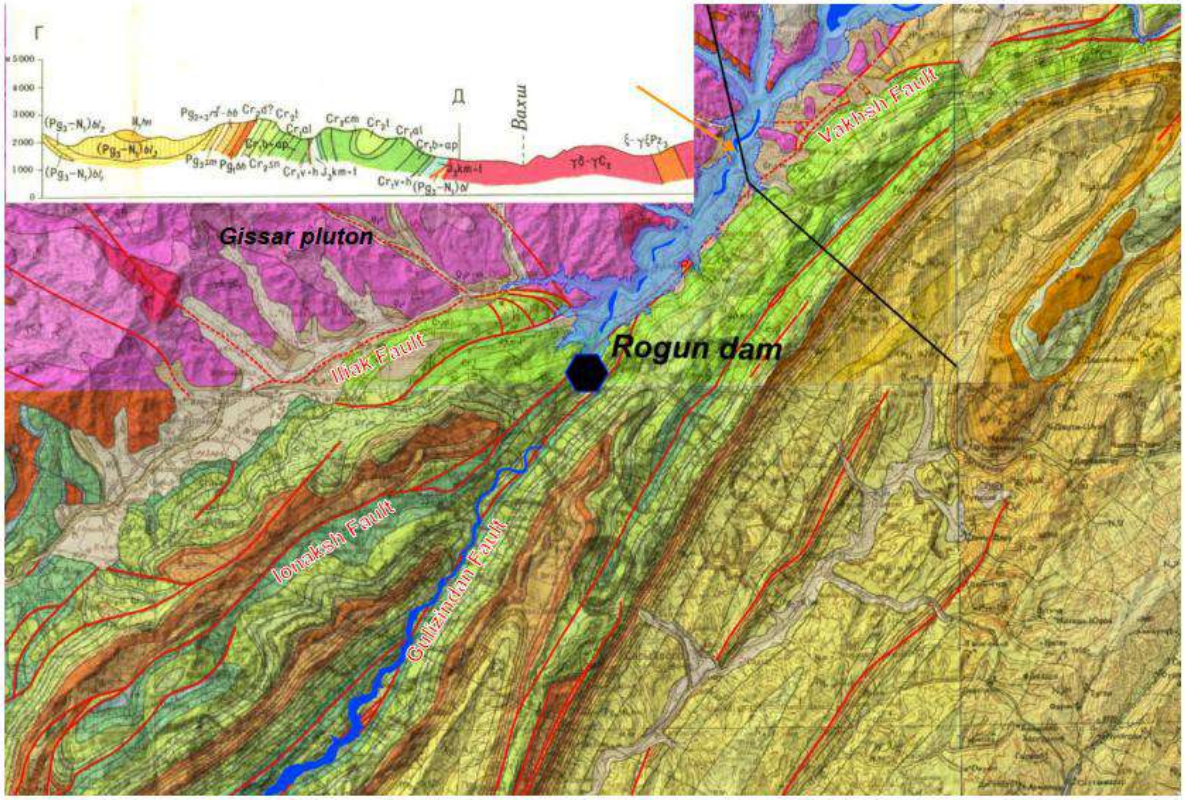


Figure 2-2 - Geological map of Rogun HPP reservoir area up to 1100 m ASL (Stucky 2018)

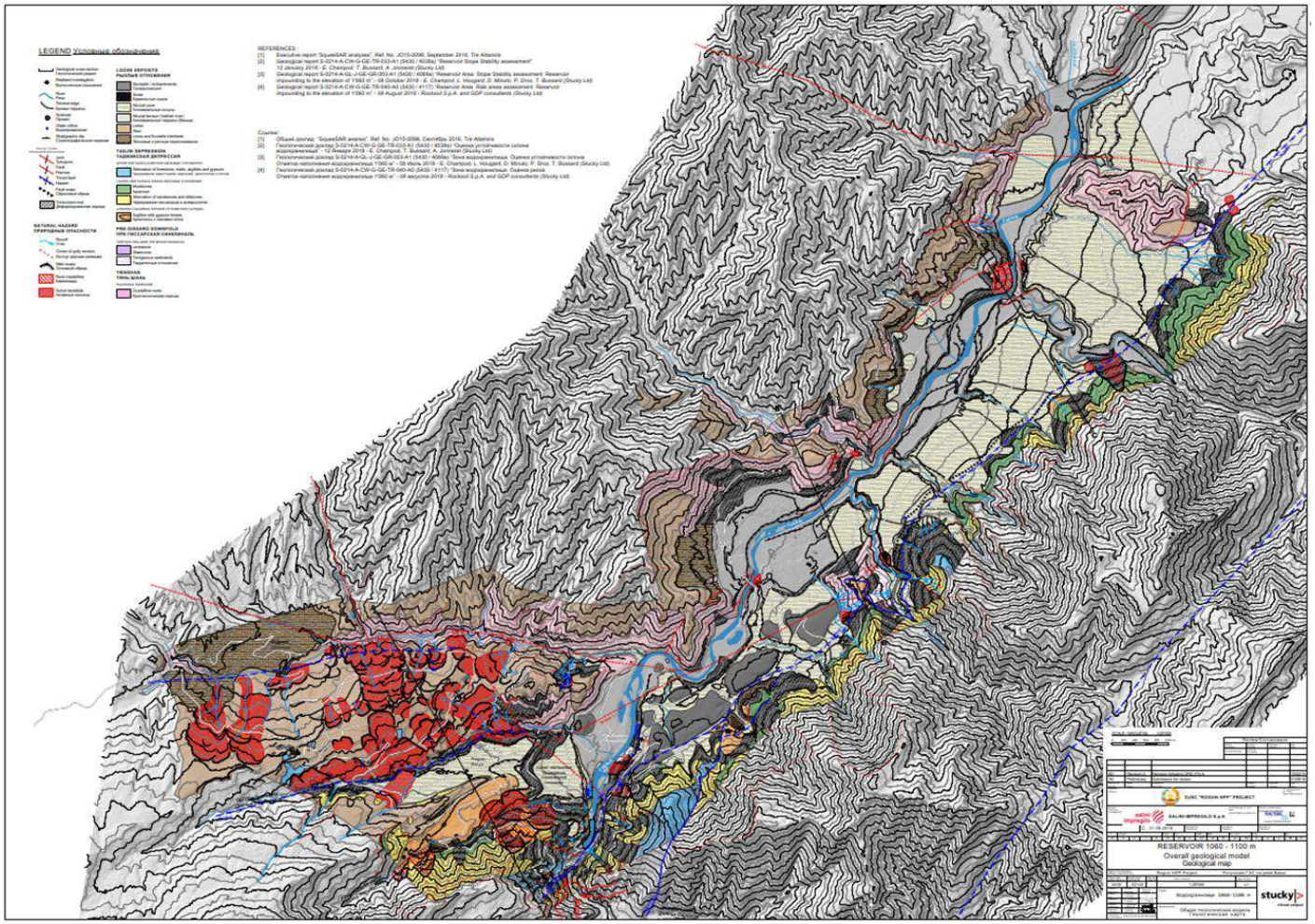


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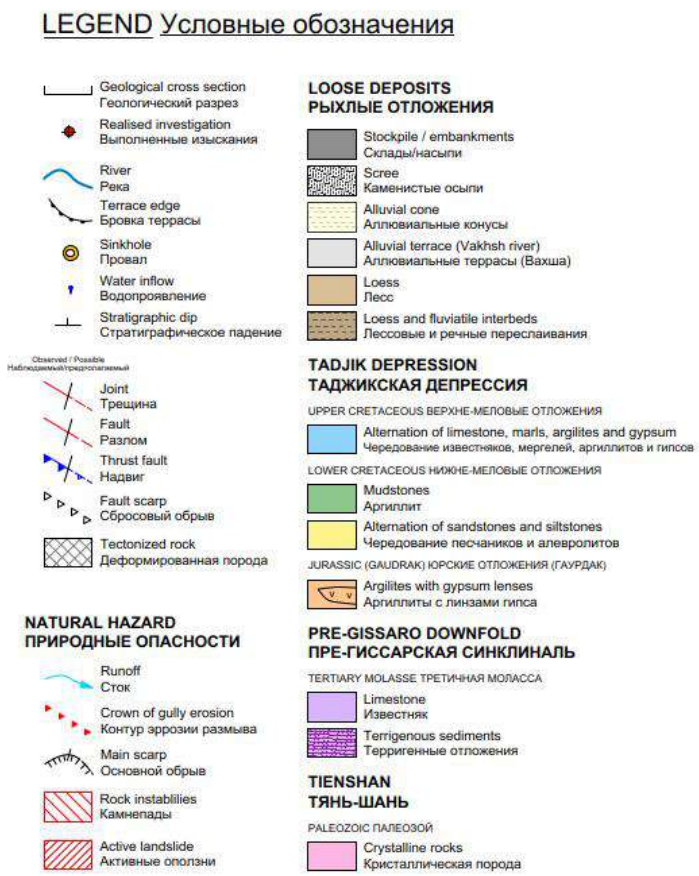


Figure 2-4 - Conceptual cross section of Tajik basin Fold-Thrust Belt at the dam site (Stucky 2018), refer also to Figure 2-5

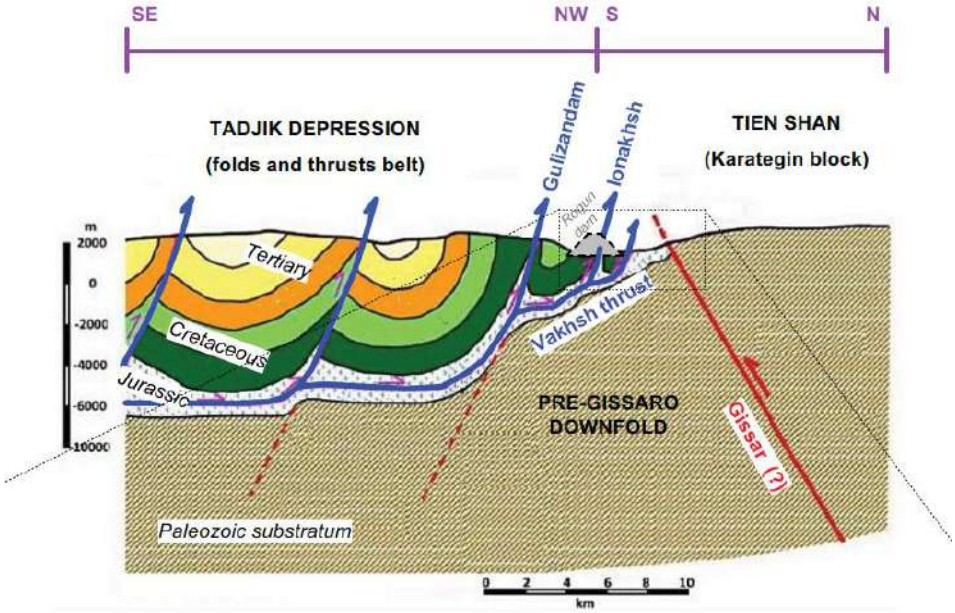
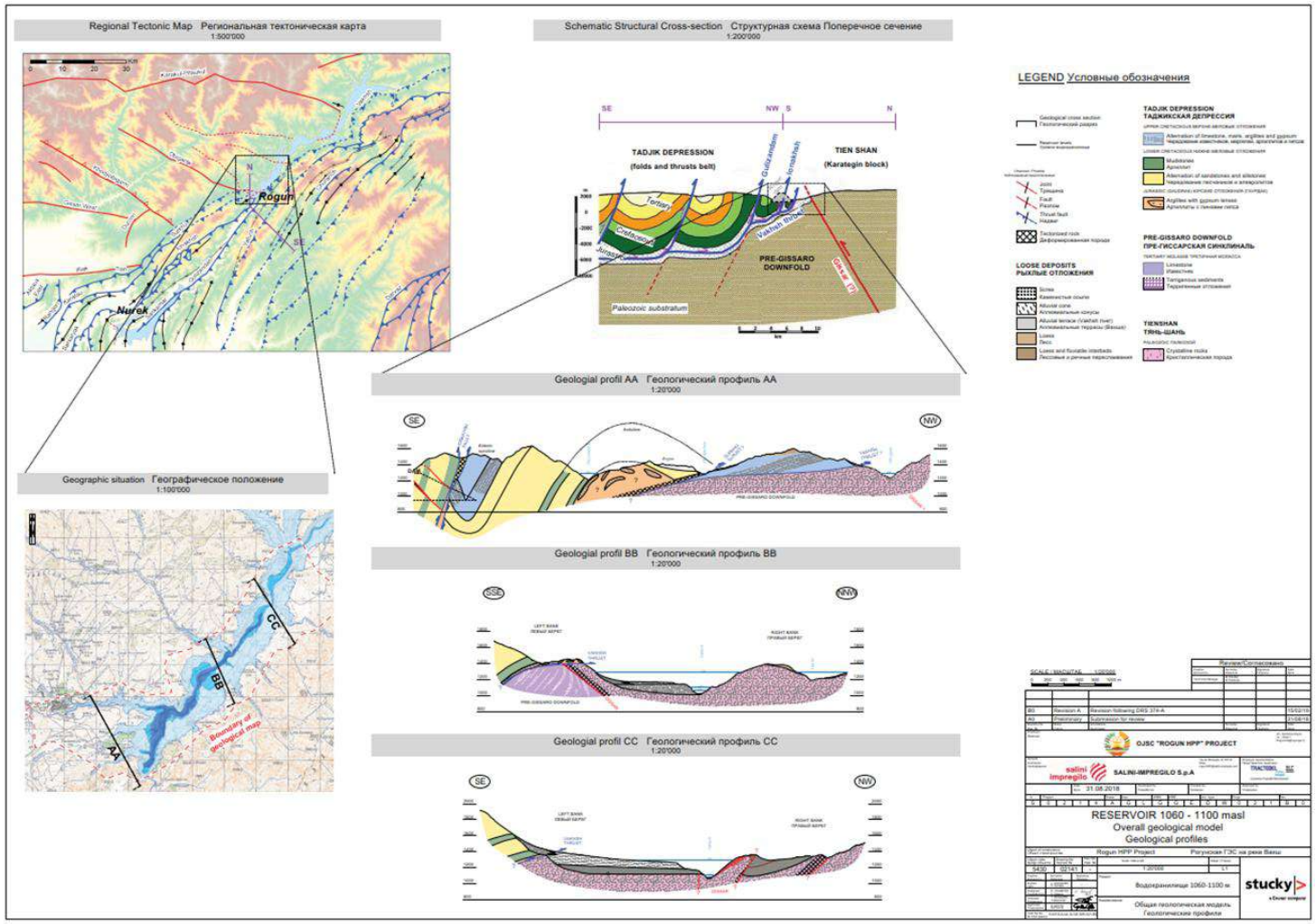


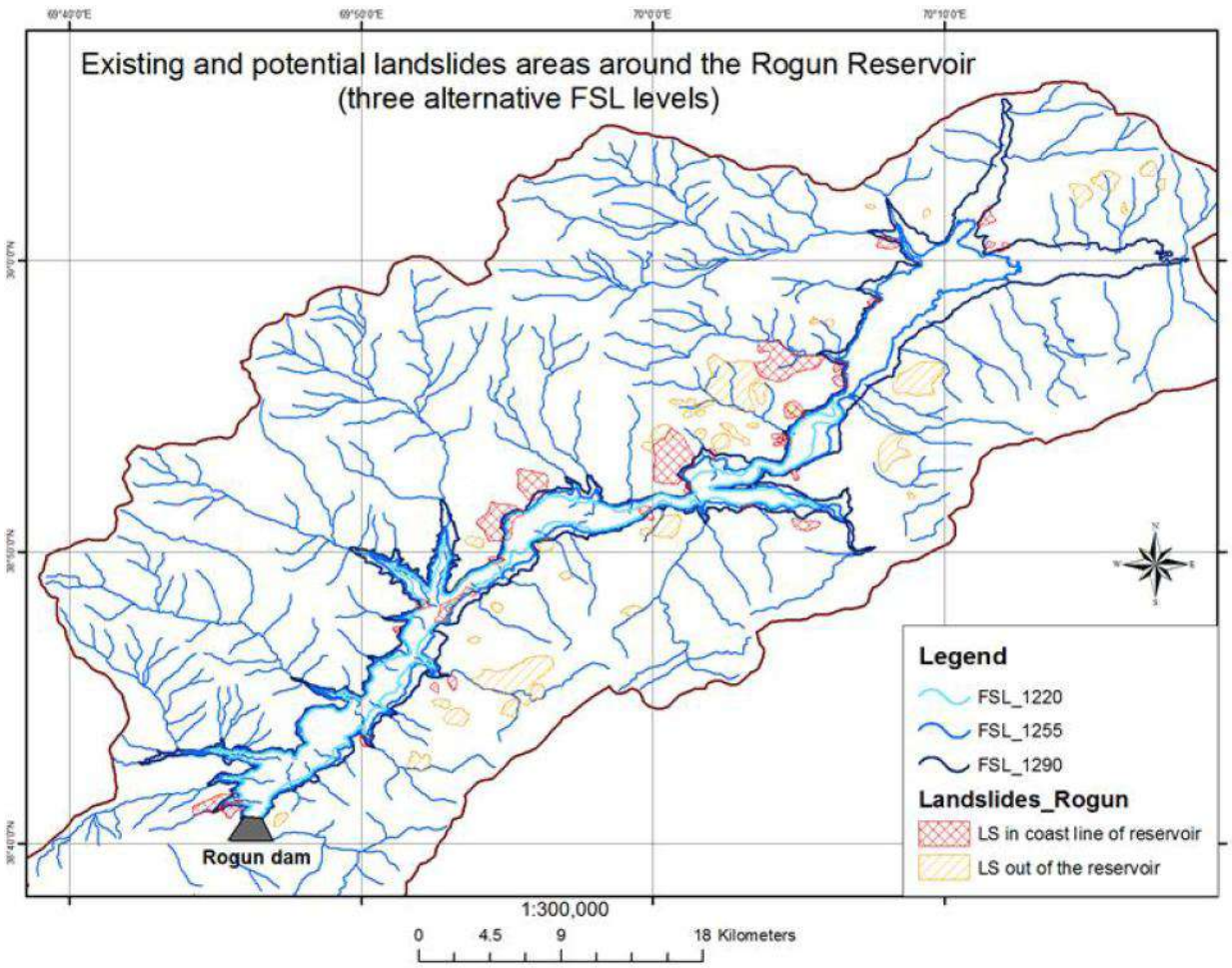
Figure 2-5 - Typical geological cross sections through the reservoir (Stucky 2018)



2.2 RECOGNISED LANDSLIDES IN THE RESERVOIR AREA

2.2.1. Technical studies for the Project have identified landslide processes within the reservoir area (for example ESIA 2014, TEAS 2014, Stucky 2018a). **Figure 2-6** from ESIA 2014 shows recognised landslides around the reservoir that could be directly affected by reservoir inundation (in red hatching) and landslides that are outside the reservoir footprint but that could affect tributary rivers (yellow hatching). Reservoir landslide studies indicate potential effects could include slope movement resulting from changed groundwater systems in response to the reservoir rising or impulse waves created by impact of a large, fast-moving landslide into the reservoir displacing water in front of the moving mass. In addition, a number of independent research studies have presented relevant slope instability information to characterise aspects of landslide hazard in the reservoir and catchment area (for example Jones et al 2021). Landslides that are large enough to block the reservoir or any tributary to the reservoir represent a potential 'landslide dam' breach hazard. Breaching of a landslide dam within the reservoir area, such as by overtopping, can result in large outflows that can represent a hazard to communities around the reservoir and the dam and associated structures.

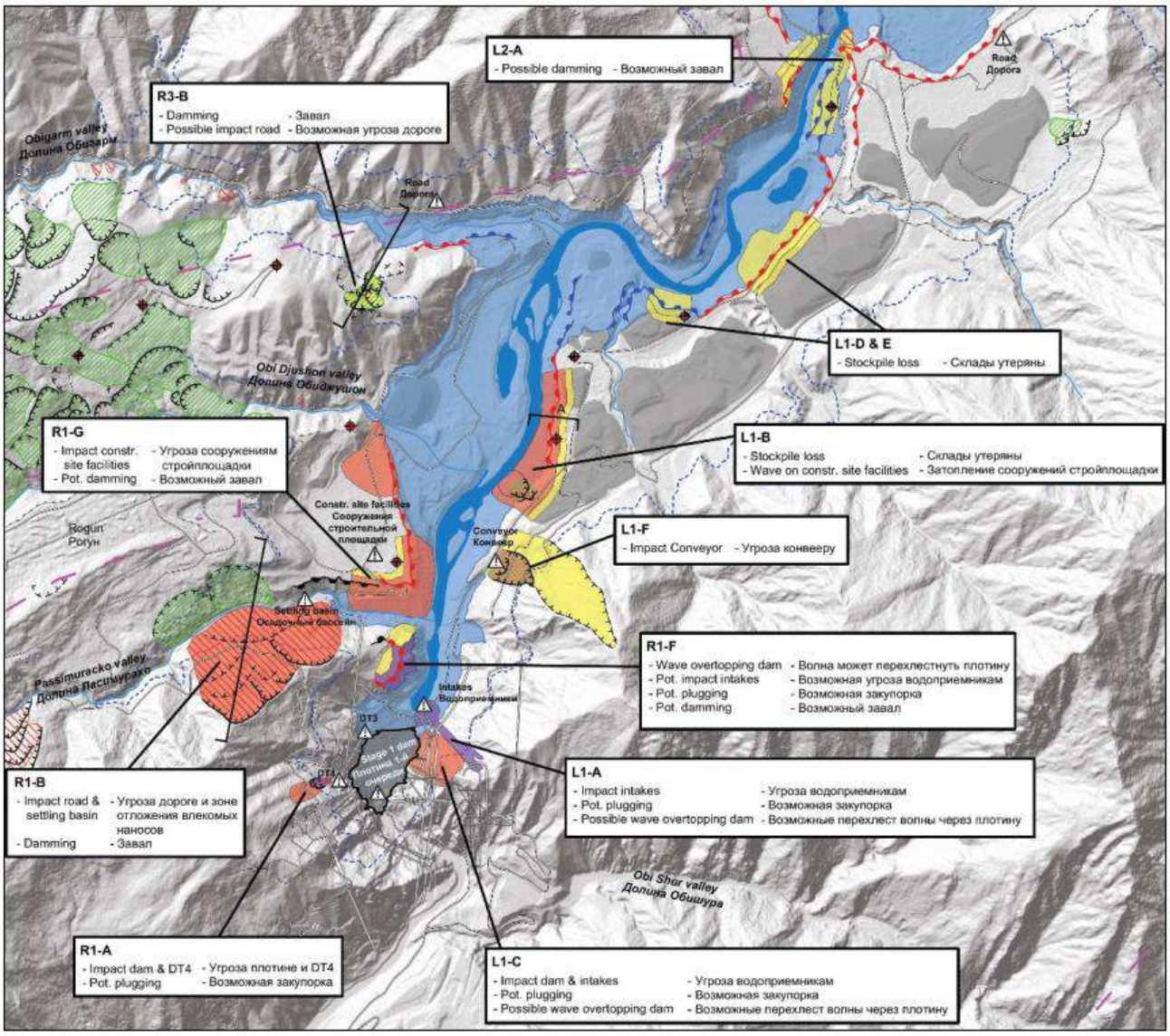
Figure 2-6 - Map of landslide prone areas around the Rogun reservoir (ESIA 2014)



2.3 SPECIFIC SLOPE INSTABILITY FEATURES

2.3.1. A site specific analysis of areas around the reservoir that could be affected by lake filling to 1100 m ASL has been prepared by consultants for the Project (Stucky 2018a). The assessment specifically addresses the slope instability associated with a number of 'risk-areas' that could be affected by raising the lake to the intermediate 1100 m ASL elevation. The risk-areas include slopes that are not currently recognised as landslides but are potentially susceptible to slope movement in response to rising groundwater levels or toe erosion as a result of the reservoir. Risks associated with lake filling include potential for landslide dams and damaging impulse waves that could affect the dam or other infrastructure around the impoundment. The assessment includes geological models for each slope area, stability analysis and recommendations for deformation monitoring. The report does not include any assessment of slopes that may be affected by future impoundment raises from 1100 m ASL to the proposed final 1290 m ASL level.

Figure 2-7 - Engineering geological plan from Stucky (2018a) showing 'risk areas' potentially adversely affected by impounding the reservoir to 1100 m ASL



2.3.2. It characterizes the slope instability hazards affected by lake filling to 1100 m ASL as (locations shown in **Figure 2-7**):

- 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.

2.3.3. The potential consequences of the above hazards include local instability, impulse waves mainly affecting the construction site, local landslide dam and impulse waves potentially overtopping the dam. Potential triggers include the changed groundwater regime during lakefilling, earthquake shaking and toe erosion. While the assessment predates the site-specific seismic hazard assessment prepared by Seister (2024), the peak ground accelerations assumed are similar. While this assessment only focusses on the identified areas that may be affected by raising the reservoir to 1100 m ASL (and not subsequent reservoir raising), similar effects are anticipated to occur during later impoundment filling to the full reservoir and operation. The main populations at risk from impulse waves and flooding from these features are Obigarm, Pasi Muhraho and Rogun City (refer to **Figure 2-9**).

2.3.4. A landslide feature referred to as the ‘atypical zone’ (ATPZ) occupies an area of about 5km2 on the right bank of the Vakhsh River, downstream of the dam site, with a maximum disturbed depth of up to about 150m. This is an important feature because it has the potential to interrupt the power generation, to flood the powerhouse and damage its equipment and installations, to damage the outlets of the diversion tunnels and/or to affect the spillway discharge capacity.

2.3.5. In 1949 the M7.4 Khait earthquake occurred in the Rogun catchment generating large rockfalls, rock avalanches and many large flow slides within the loess soils burying several villages and killing an estimated 7200 people (Evans et al 2009). The impact of the earthquake indicates that widespread landslides would be expected during a future large landslide within the catchment, that could generate landslide dams or significant impact waves in the reservoir. The effects of the Khait earthquake also indicate the importance of considering landslide hazard when designing relocated infrastructure and residential areas.

2.3.6. Strom and Zhirkevich (2013) describe a debris flow from the Obi-Shur Creek tributary that blocked the Vakhsh River just downstream from the dam causing inundation of the underground powerhouse and breached the coffer dam, resulting in significant project delays. Mitigation in the form of a retention dam on Obi-Shur Creek was subsequently constructed to retain material from a future debris flow in the catchment. A subsequent debris flow occurred during 2024 and resulted in some flooding of the construction site.

2.3.7. Potential for landslide dams is described by Strom and Zhirkevich (2013) with a high level assessment of potential inflows to the reservoir resulting from breach of a landslide dam. This assessment concludes that the inflow volume for a foreseeable landslide dam failure could be accommodated by the proposed dam given the large size of the reservoir and large freeboard.

2.3.8. Jones et al (2021) presents the results of a study of slope instability of the 10,000 km² catchment of the Rogun HPP. This study maps active landslides using analysis of satellite borne InSAR imagery and infer 222 active features in the study area (**Figure 2-8** and **Figure 2-9**). Most of the features are inferred to be rock slope deformation, rockslides, or soil creep with mean velocity of about 0.3 to 0.5 m/year and volume of up to 100 million m³. There are limitations to the data including a lack of field verification for the landslides, relatively low resolution of the data (smaller landslides may not be identified), lack of data while there is snow cover and maximum measurable velocity (of about 0.85 m/year) which may exclude identification of some faster moving landslides. Therefore, the study does not represent a comprehensive assessment of reservoir landslides. However, the study confirms that large creeping landslides are present in the catchment, presumably in geology similar to the reservoir slopes. Jones et al (2021) infer that rapid failure of such features could lead to landslide dams. While the size of the reservoir is large compared to the identified landslides, and therefore it is unlikely that a landslide dam could block the reservoir following lakefilling, it is possible that a landslide dam could form during lakefilling while the reservoir is narrower. It is also possible that failure of a landslide dam in a tributary of the reservoir could lead to inundation of areas around the impounded reservoir as a result of a sudden, large inflow into the reservoir.

Figure 2-8 - Map of the Rogun HPP reservoir and catchment showing landslides inferred from InSAR data (after Jones et al 2021). The detailed areas are presented in Figure 9 showing interpreted landslide type for each feature

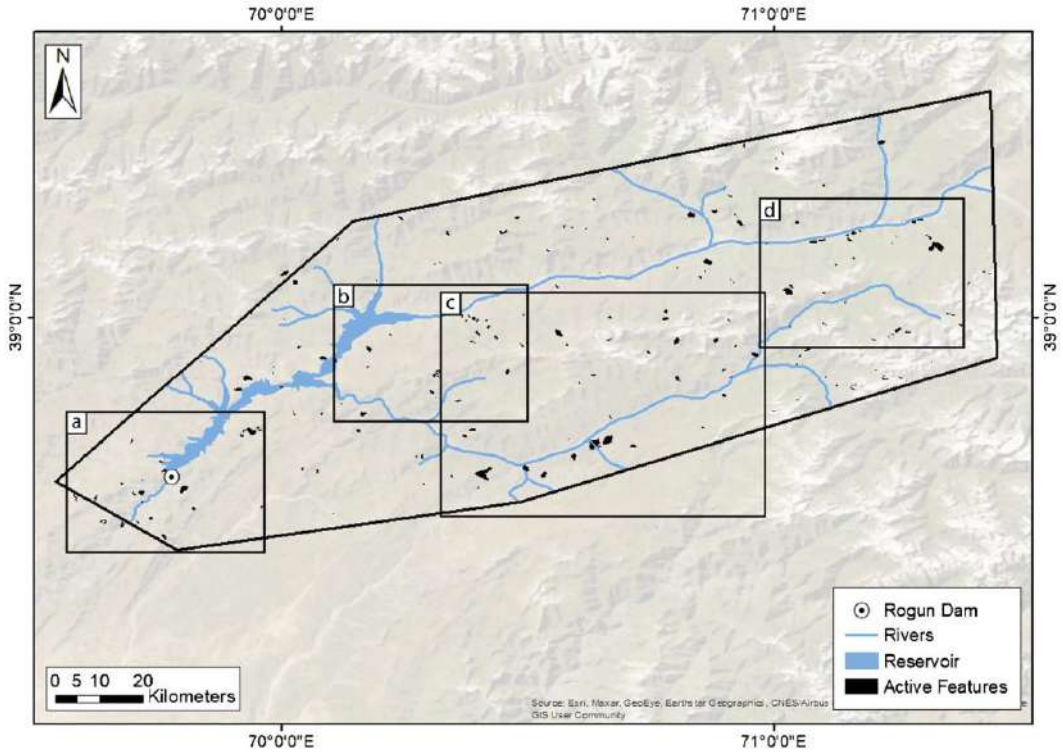
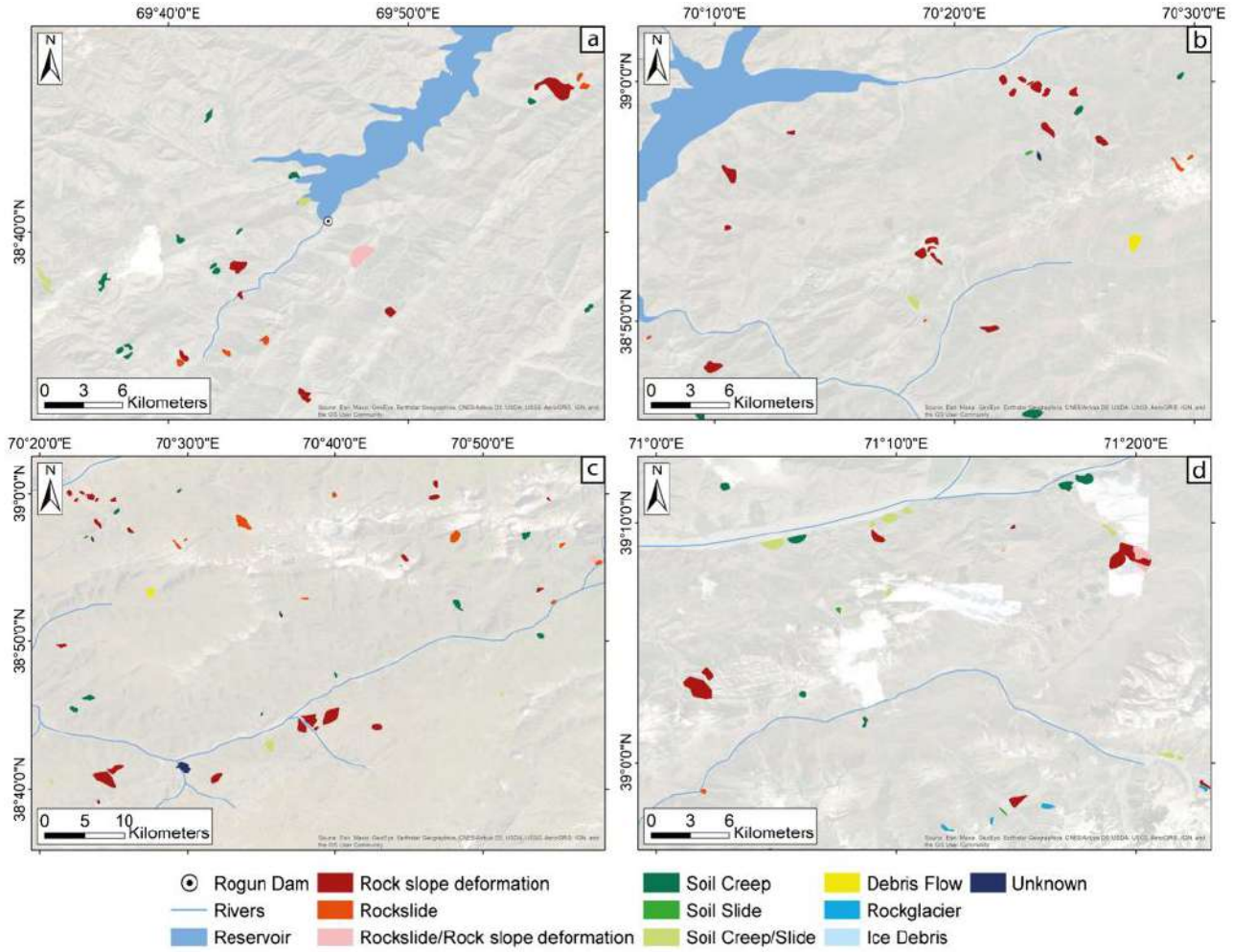


Figure 2-9 - Interpreted landslide type for features identified from InSAR data by Jones et al (2021)



2.3.9. An analysis of expected changes in climate over the century (**Volume 1, Chapter 10: Climate Resilience**) indicates that summer precipitation is expected to decrease, but winter precipitation will increase significantly. The total annual precipitation is expected to increase as a result. Temperatures are expected to generally increase and as a result, more precipitation is expected to occur as rain and less as snow. Glaciers in the upper catchment of the Project are expected to continue melting with increased melt water flooding in the next few decades. The effect of the above changes in climate are expecting to include an increase in rate of landslide processes due to rainfall triggering, particularly more fluid landslide types such as debris flows and mud flows. Increased landslide activity in the glaciated upper catchment is expected due to retreat of glacial ice support of adjacent mountain slopes.

2.4 SUMMARY OF KNOWN RESERVOIR LANDSLIDE TYPES

2.4.1. The key recognised landslide types and mechanisms include:

- Scree deposits and ‘ancient landslides’ around the dam site and intake 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 Mm³;
- A very large structurally controlled landslide estimated to be 30Mm³ in volume (ATPZ) on the right bank downstream of the dam;
- 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; and
- Large scale topographic adjustment or landslide deformation is implied by ‘seismic scarps’.
- Debris flows or mud flows are common in the area (reported as annual occurrences) and can be of very large volume (up to several thousands or millions m³).

2.4.2. Rock slopes surrounding the reservoir that are in situ or are currently not recognised as landslides may also be susceptible to large scale collapse as a result of strong earthquake shaking. If such slopes collapse into the reservoir, potentially damaging impact waves could occur.

3 AREA OF INFLUENCE

3.1.1. The potential Area of Influence (AoI) of reservoir landslide impacts includes the reservoir perimeter with the area most likely to be affected being close to the reservoir rim and including a buffer of about 1 km from the reservoir edge. In addition, the area downstream from the dam is also potentially affected by reservoir landslides because a landslide impact wave could lead to overtopping of the dam.

3.2 ASSESSMENT METHODOLOGY

3.2.1. The potential impacts of landslides into and around the reservoir that may arise as a result of the Project during the construction and operation phase are considered using the approach outlined in this section. This approach follows the general impact assessment described in **Volume 1, Chapter 5: ESIA Methodology** of this ESIA.

3.2.2. Reservoir slope stability risk caused by impoundments has historically had significant impacts on communities, the environment and infrastructure and the proposed Rogun HPP will create a large reservoir that will introduce new landslide risks. The reservoir will affect slope stability risk in a number of ways:

- Some slopes will be modified by earthworks associated with the Project;
- Slopes will have increased groundwater levels due to the reservoir reducing stability of existing landslides or slopes that have not previously experienced significant instability;
- Impact of landslides into the reservoir may generate impulse waves that could inundate surrounding land or overtop the dam. Overtopping of the dam could lead to significant damage and potentially result in a dam failure, leading to uncontrolled release of the reservoir;
- Landslide dams in tributary rivers may fail by overtopping and create a large inflow into the reservoir that could inundate surrounding land that is not currently at risk from inundation and overtop the dam; and
- Changed land use around the reservoir area could increase the landslide risk by increasing the vulnerability of communities and infrastructure at threat from landslide movement or landslide impact waves.

3.2.3. Impacts caused by construction of assets outside the reservoir area are not considered to be a potential cause of reservoir instability because they may not be directly affected by the impounded reservoir.

IMPACT PREDICTION

3.2.4. This assessment describes the potential impacts of landslides into the reservoir on the physical, biological, cultural or human environment. The impact assessment also considers the existing and potential controls or mitigating elements that could be adopted.

3.2.5. Specific landslide impacts cited by ICOLD Bulletin 124 from historical case studies that could affect the reservoir and environs include:

- Large scale landslide movement of pre-existing features or first-time failures;
- Superficial slides or activation of frontal lobes of pre-existing landslides;
- Wave erosion around reservoir;
- Landslide dams and subsequent dam breach floods;

- Impact (or impulse) waves;
- Additional potential impacts (but less likely to affect the reservoir) include:
  - Sliding of sediment deltas within the reservoir;
  - Slides downstream of the dam caused by scour, seepage or scour;
  - Internal erosion due to fluctuating water levels;
  - Subsidence and collapse of loss soils;
  - Collapse of karst terrain (related to gypsum or evaporite soils);
  - Flotation of peat or pumiceous soils;
  - Accelerated breakup and retreat of glaciers; and
  - Dissolution of evaporite rocks.

3.2.6. The potential effects of the above landslide impacts could include:

- Upstream flooding caused by a landslide dam;
- Damage to downstream communities and to the dam caused by breaching of a landslide dam in the reservoir or catchment;
- Direct landslide impact or impulse wave damage to the dam or ancillary structures;
- Overtopping of the dam by a large impulse wave or inflow from a landslide dam breach affecting infrastructure and communities downstream of the Project area. This effect could be severe given the possibility of breach of Rogun Dam and the presence of other hydropower assets, large population and critical food production areas in the downstream areas;
- Impulse wave damage and flooding of shoreline communities and infrastructure;
- Damage by air blasts caused by rapid landslides in narrow valleys; and
- Blockage by debris of low level outlets.

3.2.7. Additional impacts to the Project may occur, including:

- Operational constraints on the reservoir;
- Project delays or even abandonment;
- Cost of mitigation works to offset the effect of the reservoir on landslide risk;
- Loss of reservoir storage;
- Land use loss or restrictions along the reservoir shoreline;
- Loss of recreational value; and
- Reduction in water quality.

3.2.8. A dam breach assessment for the reservoir raise to 1100 m ASL prepared by Stucky (2018b) indicates that overtopping of the dam at the intermediate crest stage will cause significant damage downstream of the dam but will not overtop the Nurek Dam. A dam breach assessment of the full reservoir to 1290 m ASL is a critical input to assessing the potential consequences of reservoir landslides and is currently being undertaken by the design team.

IMPACT MAGNITUDE

3.2.9. The qualitatively categorization of the magnitude of the potential impact is described in **Table 3-1**

Table 3-1 - Impact Magnitude Categories

Impact Magnitude	Description of Impact
Large	Landslide impact wave inundating shoreline community and causing multiple fatalities or major damage to critical infrastructure (for example impact wave inundates shoreline homes, hospitals, detroys bridges, etc.)
Medium	Presence of reservoir significantly increases likelihood of landslide impact wave inundating shoreline community and causing multiple fatalities during future large earthquake. Landslide movement causes irreparable damage to homes, critical infrastructure.
Small	Shoreline erosion or landslide movement causes minor damage to communities, infrastructure (minor loss of agricultural land, repairable damage to roads, homes, etc.)
Very Small	Nuisance value damage (readily repairable) to caused by landslide movement to non-critical reservoir edge property.
Beneficial	A positive impact

RECEPTOR SENSITIVITY

3.2.10. A receptor is the element of the receiving environment that is impacted, i.e. component of the physical, ecological, or human environment. The receptors in the context of landslides are identified as:

- life safety of populations that could be impacted,
- infrastructure around the reservoir perimeter ranging from occupied land to essential infrastructure and
- valued ecological or archaeological features around the reservoir perimeter that could be inundated or damaged by landslide movement.

3.2.11. To identify the sensitivity of potential receptors, a scale of relative sensitivity presented in **Table 3-2**.

Table 3-2 – Receptor Sensitivity Categories

Receptor Sensitivity	Rationale
High	Communities of more than 100 households that are within 1 km of the reservoir at full height and less than 100 m elevation above FSL. Critical infrastructure located with 1 km of the reservoir at full height and less than 100 m elevation above FSL. Archaeological, historical and paleontological sites considered to be of international or national importance with the greatest potential for further, significant associated discoveries to be made. Cultural sites which have

Receptor Sensitivity	Rationale
	been frequented by the local community for longstanding cultural purposes.
Medium	Communities with households between 100 and 10 that are within 1 km of the reservoir at full height but more than 100 m elevation above FSL. Critical infrastructure located within 1 km of the reservoir at full height, but more than 100 m above FSL. Archaeological, historical and paleontological sites considered to be of regional importance. Cultural sites which may be no longer in use but are known to the community and associated with settlement history/oral history.
Low	Communities of less than 10 households that are further than 1 km of the reservoir at full height. No critical infrastructure within 1 km of the reservoir at full height. Archaeological, historical and paleontological features reservoir at full height. Cultural resources which are very common and potentially moveable.

EVALUATION OF SIGNIFICANCE

3.2.12. Subsequent to establishing the magnitude of impact and sensitivity of the receptor, the impact significance is described in the matrix provided in **Table 3-3**. For the purpose of this ESIA, major and moderate impacts are deemed to be significant, while minor and negligible impacts are not considered significant.

Table 3-3 – Impact Significance Matrix

Impact Magnitude	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

3.3 IMPACT ASSESSMENT

3.3.1. This section describes the assessment of the potential impacts of landslides on the reservoir, the dam and communities surrounding the Project for both the construction phase and the operational phase.

CONSTRUCTION

Bulk Earthworks

3.3.2. Construction activities such as bulk earthworks preparing a dam site or shaping dam foundations can potentially directly initiate slope instability. The magnitude of the impact of a slope failure due to bulk earthworks would be **small** for communities given that the sensitivity of communities is **low** as there are no communities, no critical infrastructure or heritage resources that are of local importance within 1 km of the construction activities. The significance of the effect is **negligible**.

OPERATION

3.3.3. Reservoir filling is expected to have **significant impacts** on stability of the slopes around the reservoir. The period of lake-filling, including operational reservoir fluctuations during that period and the following years or decades, and any additional adverse loading conditions, such as earthquakes or floods, are expected to have the associated highest likelihood of adverse reservoir landslide impacts. The potential impacts described above are therefore most likely to occur during those times.

3.3.4. An analysis of the potential impacts of slope instability is required to assess the risk posed by the Project. This analysis will need to consider the communities, environment and infrastructure that will occupy the area around the reservoir that could be impacted by direct landslide displacement, flooding by an impact wave, inundated by a landslide dam or affected by flooding downstream of the

dam in the case of overtopping. **Section 3.4** describes measures that will need to be implemented to mitigate slope instability impacts.

3.3.5. A summary of the slope stability impacts for the operational phase is provided in the following sections.

Landslide induced impact waves

3.3.6. The presence of a reservoir introduces the potential for impact waves generated a landslide entering the reservoir impacting on communities, infrastructure and the environment adjacent to the reservoir. It is also possible that a landslide induced impact wave could damage or overtop the dam and cause damage downstream. The magnitude of the impact of landslide induced impact waves could be **large**, resulting in multiple fatalities, particularly **high** sensitivity communities and critical infrastructure around the reservoir edge (within 1 km of the reservoir and less than 100 m elevation above FSL). The significance of the potential for landslide induced impact waves is therefore **major**. Mitigation for the potential impact of landslide induced waves is to evaluate the potential for landslides around the reservoir perimeter and moving communities and critical infrastructure outside the potential impact zone if necessary. If communities and critical infrastructure is moved outside the area potentially affected by impact waves, the significance could be **minor** or **negligible**.

Large scale landslide movement around the reservoir perimeter

3.3.7. Interaction of the reservoir inundation and fluctuation during operation could increase activity of existing landslides or trigger new landslides. The magnitude of the impact of large scale landslide movement could be **medium**, for **high** sensitivity communities and critical infrastructure around the reservoir edge (within 1 km of the reservoir and less than 100 m elevation above FSL, in areas that are prone to landslide development). The significance of the potential for large scale landslide movement around the reservoir perimeter is therefore **major**. Mitigation of the potential impact of large scale landslide movement around the reservoir perimeter is to evaluate the likely performance of the areas around the reservoir. In areas where large scale landslide behaviour is judged to be likely to occur, communities or critical infrastructure could be relocated, or engineering works undertaken to reduce the likelihood of large scale movement. The significance could therefore be reduced to **minor** or **negligible**.

Landslide dam breach in reservoir tributary

3.3.8. Flood outflows from a breached landslide dam in a tributary of the reservoir could be very large and raise reservoir levels significantly. However, the large size of the reservoir and the fluctuating operational reservoir level will tend to mitigate the potential impact. The magnitude of impact is expected to be **small**, even for **high** sensitivity communities around the reservoir edge. The significance of landslide dams in reservoir tributaries is therefore potentially **moderate**. Mitigation for the impact of landslide dams is monitoring to ensure that any landslide dam is identified before there is any likelihood of a breach. Given sufficient warning and an emergency management plan, the risk to human life is expected to be low and consequently the significance of landslide dam breach is potentially **minor**. The potential for damage to communities living within the tributary valleys as a result of breach of a landslide dam, is not considered here because the risk exists without the proposed reservoir.

Reservoir shore erosion

3.3.9. Erosion and minor landslide movement is anticipated to occur around the reservoir perimeter following filling. From a reservoir landslide perspective the magnitude of impact is expected to be **small**, even for **high** sensitivity communities around the reservoir edge. The significance of shoreline erosion is therefore potentially **moderate**. Mitigation of the impact of shoreline erosion requires evaluation of the potential erodibility of the ground around the reservoir perimeter. Where erosion effects are predicted to be significant, relocation of some dwellings, buildings or other infrastructure may be required, or engineering works constructed to mitigate the erosion risk. Given these considerations, the residual effect of shoreline erosion is anticipated to be **minor**.

3.4 MITIGATION OF RESERVOIR SLOPE STABILITY IMPACTS

3.4.1. Before raising the dam height beyond the level for which slope stability assessment was completed in 2018, an effective programme of landslide reconnaissance, investigation and monitoring is an important tool in understanding the risk associated with reservoir filling and operation and the effect of the reservoir on the surrounding environment. Critical elements of managing reservoir landslide risk include comprehensive assessment of the slopes that will surround the final reservoir, including the one currently underway for filling up between 1100 m ASL and FSL of 1290 m ASL, and catchment as well as an assessment of the potential consequences of landslides entering the reservoir. The assessment of reservoir slopes should be undertaken by engineering geologists and geotechnical engineers with extensive experience of investigating landslides and developing risk mitigation. The assessment of reservoir landslides must be overseen by a suitable independent review panel experienced in reservoir landslide management to ensure that current international best practice is met. Assessments of reservoir slopes are required to be completed ahead of raising the reservoir to ensure that any mitigation measures, including engineered measures and emergency management plans, can be undertaken before the risk is realised. These studies will guide design development in accordance with the recommendations of the Dam Safety Panel of Experts (DSPoE) and international standards for reservoirs for such large dams.

3.4.2. Seismic stability of slopes, including recognised landslides, around the reservoir should be analysed taking into account the results of the recent seismic hazard assessment (Seister 2024), including assessment ground motions, reservoir triggered seismicity rates and topographic amplification. Consideration may need to be given of the variability of ground shaking hazard around the reservoir, given its large size, which is not reported in the current seismic hazard assessment.

3.4.3. Assessment of the potential effects of reservoir landslides on the Project must take into account the expected changes in climate. This is important because predicted increase in winter rainfall and glacial melting may have a significant impact on the likelihood and consequences of landslides affecting the reservoir.

3.4.4. Hazard avoidance in siting: Avoid placing temporary infrastructure (e.g. construction camps, laydown areas) in known hazard-prone areas such as historic landslide tracks. This approach is consistent with the World Bank Environmental and Social Standard 4 (ESS4), which requires that infrastructure be designed and located to minimise community exposure to natural hazards.

3.4.5. Emergency preparedness planning: Develop and disseminate site-specific emergency response plans for landslides. These must be aligned with the broader Emergency Preparedness and Response Framework required under ESS4 and reviewed by the DSPoE.

3.4.6. Training and capacity building: Deliver hazard awareness training for all construction contractors and site personnel, including safe working practices, response procedures, and interpretation of early warnings. This supports both occupational safety and community safety risk reduction.

3.4.7. Early warning and monitoring systems for planning construction activities: Although not formally mandated at the pre-construction stage, the establishment of monitoring networks for rainfall, river stage, slope movement, and seismic activity is strongly recommended to support hazard-informed design and construction planning. These systems should be so designed that they can be ultimately integrated into an early warning framework and inform hazard response protocols approved by the DSPoE, in line with good international practice and World Bank's policies on Safety of Dams.

3.4.8. During Construction: Slope stabilisation and excavation control: Implement targeted slope protection measures such as bolting, drainage, mesh, and shotcrete at high-risk excavation zones, tunnel portals, and dam abutments. Excavation sequencing must be guided by slope risk zonation and validated through continuous geotechnical supervision.

3.4.9. Real-time monitoring systems: Maintain and expand monitoring networks slope deformation, and seismic activity across active construction zones. Threshold-based warning systems should trigger predefined response protocols and site evacuation if needed as per plans developed and adopted above.

3.4.10. First filling hazard assessment: For impoundment beyond 1100m ASL, complete the detailed risk assessment of slope stability and reservoir rim behaviour under changing hydraulic conditions, which has commenced in (2025). Conduct numerical modelling where needed to assess potential for reactivation of landslides or new instability zones.

3.4.11. Controlled first filling plan: Develop the Filling Plan and confirm its review by DSPoE review followed by their No Objection. The plan should include staged impoundment targets, continuous monitoring of slope response, clear decision points for hold levels, and protocols for controlled releases in case of instability or unforeseen inflow events.

3.4.12. During Operation phase: Protocols to be put in place to monitor landslide-prone slopes along the reservoir perimeter, particularly areas with known instability, fractured geology, or signs of previous movement. Long-term slope stability modelling may be required in zones identified in detailed assessment of slope stability – Stucky 2018a and the assessment currently underway for slopes at 1100 m ASL and up to 1290 m ASL.

3.4.13. This should be in conjunction with the permanent network of seismic and ground deformation monitoring stations, given the site geology including the presence of Ionaksh and other significant faults. Reservoir-triggered seismicity and long-term slope movement around the reservoir rim should be tracked and evaluated periodically, particularly after large flood events or seasonal drawdown.

3.4.14. Use the channels available as part of the agreements related to Amu Darya water management to maintain open communication with downstream riparian states during abnormal or emergency operations including more advanced joint early warning mechanisms that strengthen real-time communication with downstream operators and authorities to support pre-emptive actions to reduce losses along the cascade.

3.4.15.

SUMMARY OF MITIGATION MEASURES

3.4.16. Effective management of reservoir slope stability risk requires:

- Sound knowledge of the reservoir geology, existing slope instability affecting the reservoir area and potential mechanisms of first-time failures that may occur when the changed conditions of the reservoir are implemented. Investigations of reservoir slopes must be undertaken by a suitably experienced team, well in advance of reservoir raising to ensure that landslide risks can be managed;
- Assessment of the potential impacts of the foreseen landslide types and expected behaviour on the area potentially affected;
- If the likelihood of unacceptable impacts occurring is too high, then a strategy for mitigating the effects will need to be implemented. This could include significant impacts on the Project as described above. Engineering measures to mitigate the effects of reservoir slope stability risk have been implemented on various dam projects around the world, including monitoring, drainage works, bulk earthworks and buttressing, and moving communities or critical infrastructure away from areas potentially affected by landslides or impact waves;
- An effective monitoring programme, likely including deformation and piezometric monitoring, when combined with a detailed knowledge of landslide mechanisms and behaviour, should be implemented and maintained to demonstrate that engineering assumptions about landslide behaviour remain valid and that landslide risk is being managed effectively;
- A controlled lakefilling programme, accompanied by the above monitoring programme, will be required to manage the potential effects of lakefilling. The proposed lakefilling will take about 16 years to reach full storage level. This relatively long lakefilling programme will be helpful in understanding the progressive effects of the reservoir on surrounding slopes; and
- An effective emergency management plan must be developed ahead of raising the reservoir. The emergency management planning must take into account the results of reservoir landslide investigations and assessments of the potential consequences of landslides. The emergency management plan must clearly define roles and responsibilities of decision makers and key workers, define required response to potential emergency triggers including earthquakes, flooding, landslide dams and dam breach, include dissemination of appropriate information to the potentially affected communities, and preparedness training for parties responsible for emergency response.
- Oversight of reservoir landslide assessment and monitoring by an independent review panel of experts to ensure that international best practice is being considered and implemented where needed. Specific issues that will be reviewed by the panel of experts include:
    - Confirmation that the assessment of reservoir landslides has been thorough and robust.
    - Confirmation that the potential impacts of reservoir landslides have been adequately assessed, including the potential life safety risks to communities surrounding and downstream of the reservoir.
    - Confirmation that the reservoir landslide monitoring programme is appropriate for the types of landslides that have been identified and that frequency of data collection and reporting is appropriate.
    - Regular review of the behaviour of reservoir landslides is acceptable and the risk is appropriately managed.

3.5 RESIDUAL EFFECTS

3.5.1. It is anticipated that a long-term landslide management system will be developed and implemented prior to lakefilling and continued for the operational life of the reservoir. The elements of the management plan are described in Section 9. This approach to managing reservoir landslide risk is in line with international practice as described in ICOLD Bulletin 124. As described in **Section 3.3** the residual impact of reservoir landslides should be **minor**.

3.5.2. An effective reservoir landslide management system is expected to maintain long term risk to acceptable levels.

3.6 SUMMARY

3.6.1. Reservoir landslides have the potential to severely impact communities and infrastructure around the reservoir. Impacts include inundation by impact waves, damage due to large scale ground deformation, landslide dam breach flooding and reservoir edge erosion. The potential significance of these impacts could be **moderate** or **major**. However, with a thorough evaluation of the slopes surrounding the reservoir, appropriate planning, potential engineering mitigation works and development of emergency management plans, the impact significance of reservoir landslide could be reduced to **minor**.

Table 3-4 – Summary of Slope Stability Assessment (Construction)

Impact Factor	Landslide induced impact waves inundating areas around the reservoir rim, including the dam	Stability around reservoir perimeter leading to property and infrastructure damage
Receptor	Human receptors – people living around the reservoir perimeter and downstream of the dam	Human assets - Private and public property and associated infrastructure around reservoir perimeter
Sensitivity	**High**	**High**
	Communities are potentially highly vulnerable to sudden inundation by impact waves	Property and infrastructure may be highly vulnerable to landslide activity due to reservoir filling and operation
Type	**Negative**	**Negative**
	Potential for multiple fatalities	Potential to damage large areas of property around reservoir perimeter
Extent	**Local**	**Local**
	Most likely to affect people close to the reservoir rim	Most likely affected area is local to reservoir perimeter (perhaps within 1 km of reservoir edge)
Duration	**Medium-term**	**Medium-term**
	Highest risk period is during and immediately following reservoir filling	Highest risk period is during and immediately following reservoir filling
Frequency	**Infrequent**	**Infrequent**

Impact Factor	Landslide induced impact waves inundating areas around the reservoir rim, including the dam	Stability around reservoir perimeter leading to property and infrastructure damage
	Reservoir landslide impact into the reservoir may occur as a result of infrequent triggers (e.g earthquakes) once the slopes have equilibrated following lake filling	Landslide activity could be sudden and damaging, intermittent or slow and prolonged
Likelihood	**Unlikely**	**Likely**
	Possible, but can be managed with best practice management of reservoir landslide risk	Some small scale landslide activity is likely around reservoir perimeter, large scale landslides are less likely
Reversibility	**Irreversible**	**Irreversible**
	Potential for fatalities	Landslide damage could be remediated or could lead to relocation of infrastructure to unaffected areas
Magnitude	**Large**	**Medium**
	Potential for fatalities	Landslide activity could affect large areas of land surrounding the reservoir
Significance	**Major**	**Moderate**
	Potential for fatalities	Likely that relocation of assets and infrastructure can be achieved safely
	Yes	**Yes**

Impact Factor	Landslide induced impact waves inundating areas around the reservoir rim, including the dam	Stability around reservoir perimeter leading to property and infrastructure damage
Additional Mitigation?	Ongoing investigation of potential reservoir landslide mechanisms, risk assessment, mitigation if required, effective landslide management planning	Ongoing investigation of potential reservoir landslide mechanisms, risk assessment, mitigation if required, effective landslide management planning
Residual Significance	**Minor**	**Minor**

Table 3-5 - Summary of Slope Stability Assessment (Operation)

Receptor	Impact	Sensitivity	Magnitude (without? mitigation)	Impact Significance	Mitigation
Communities and infrastructure around or downstream from reservoir	Inundation by landslide impact wave leading to potential fatalities and loss of infrastructure	High	Large	Major	▪ Ensure relocated communities and infrastructure are outside the potentially impacted area. ▪ Reservoir landslide assessment and management planning. ▪ Development of an effective monitoring programme. ▪ Effective emergency management planning to allow evacuation if imminent failure is predicted. ▪ Engineering measures to stabilise susceptible slopes.
	Inundation by landslide dam initiated by reservoir operation	High	Large	Major	▪ Ensure relocated communities and infrastructure are outside the potentially impacted area. ▪ Reservoir landslide assessment and management planning. ▪ Effective emergency management planning to allow evacuation. ▪ Development of an effective monitoring programme. ▪ Engineering measures to control effects of landslide dam.
	Landslide dam in catchment	Medium	Large	Major	▪ Ensure relocated communities and infrastructure are outside the potentially impacted area. ▪ Reservoir landslide assessment and management planning. ▪ Effective emergency management planning to allow evacuation. ▪ Development of an effective monitoring programme. ▪ Engineering measures to control effects of landslide dam.
	Infrastructure (eg. roads, buildings) landslide damage in response to	Medium	Medium	Moderate	▪ Rebuild infrastructure away from landslide affected area. ▪ Engineering controls to improve resilience of infrastructure to landslide movement. ▪ Engineering measures to stabilise landslide movement.

Receptor	Impact	Sensitivity	Magnitude (without? mitigation)	Impact Significance	Mitigation
	reservoir operation				
Hydropower infrastructure	Dam breach or overtopping by landslide impulse wave or landslide dam failure	High	Large	Major	▪ Consideration in dam design for wave protection including large freeboard and erosion protection ▪ Effective monitoring landslide programme to identify potential failures or landslide dams in catchment ▪ Effective emergency management planning procedures to warn downstream communities and infrastructure including the cascade of hydroelectric dams and infrastructure.
	Direct landslide impact on dam and power infrastructure	High	Large	Major	▪ Effective investigation, design and remedial works of slopes around the Project site as part of design and construction. ▪ Effective monitoring programme for any slopes that could affect safe operation of the Project infrastructure. ▪ Effective emergency management planning to mitigate the effects of slope instability post construction.
	Direct landslide impact on dam and power infrastructure	High	Large	Major	▪ Effective investigation, design and remedial works of slopes around the Project site as part of design and construction. ▪ Effective monitoring programme for any slopes that could affect safe operation of the Project infrastructure. ▪ Effective emergency management planning to mitigate the effects of slope instability post construction.

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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 2, Annex 13-3: Water Resource Modelling



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CONTENTS

1 INTRODUCTION 1

2 REGIONAL SETTING 2

3 VAKHSH CASCADE OF HPPS 5

4 MODELLING APPROACH 7

5 MODEL INPUTS 9

5.1 HYDROLOGY 9

FLOWS 9

PRECIPITATION 12

EVAPORATION 12

6 RESERVOIR CHARACTERISTICS 12

6.1 ROGUN RESERVOIR 12

6.2 NUREK RESERVOIR 14

7 RESULTS 17

7.1 MODEL CALIBRATION PERIOD 17

8 ROGUN RESERVOIR FILLING 20

9 JOINT OPERATION OF ROGUN AND NUREK 27

ASSESSMENT OF FLOW CHANGES BETWEEN ROGUN AND NUREK RESERVOIRS 27

ASSESSMENT OF FLOW CHANGES DOWNSTREAM OF NUREK RESERVOIR 28

10 CONCLUSIONS 31

11 REFERENCES 32

TABLES

Table 5-1 – Average monthly evaporation depths 12

Table 6-1 - Characteristics of Rogun Reservoir 13

Table 6-2 – Rogun Reservoir Basin Stage-Storage-Area Curve 13

Table 6-3 – Key characteristics of the Nurek Reservoir 14

Table 6-4 - Nurek Reservoir Basin Stage Storage Curve 15

Table 8-1 - Planned impoundment elevations, water volumes that can be stored at the elevations 20

Table 8-2 - Summary of annual allocation, actual use, differential and annual flow volume at Rogun Dam Site 21

Table 8-3 - Total volume, average annual total, annual minimum total for the lowest flow period for the filling periods **Error! Bookmark not defined.**

Table 8-4 - Percentiles of simulated releases (m^3/s) from Nurek with and without Rogun for 3 filling rates. (Percentage change shown in brackets) 26

FIGURES

Figure 2-1 – Rogun Dam locality map 3

Figure 2-2 – Rogun Dam location map, Vakhsh River and tributaries 3

Figure 3-1 - Schematic of cascade of HPP (taken from (OSHPC Barki Tojik, 2013)) 5

Figure 4-1 - Operating rule curve used to calculate the discharges from Nurek Reservoir (taken from (OSHPC Barki Tojik, 2013)) 8

Figure 5-1 – Monthly inflows into Rogun Reservoir 10

Figure 5-2 – Annual inflows into Rogun Reservoir 10

Figure 5-3 – Box and Whisker plot of monthly streamflow record into Rogun Reservoir 11

Figure 5-4 – Cumulative plot of total streamflow into Rogun Reservoir 11

Figure 5-5 –Average monthly precipitation depths 12

Figure 6-1 – Rogun Dam Stage-Storage-Area Curve 13

Figure 6-2 – Nurek Reservoir Basin Stage-Storage-Area Curve 16

Figure 7-1 - Simulated and historical Nurek outflows from the TEAS ((OSHPC Barki Tojik, 2013)) 17

Figure 7-2 – Simulated Nurek Reservoir outflow results from the assessment model 18

Figure 7-3 - Comparison of simulated and historic average monthly outflow volumes from Nurek Reservoir 19

Figure 7-4 - Comparison of flow duration curve of simulated and historic discharges from Nurek Reservoir 19

Figure 8-1 - Annual allocation, actual use, differential and streamflow at Rogun Reservoir site 23

Figure 8-2 - Plot of simulated volumes in storage during filling of Rogun for the three filling rates 24

Figure 8-3 – The minimum simulated flow rates in each month downstream of Rogun for the three fill rates compared to the inflow and EWR flows 25

Figure 9-1 – Plot of average monthly inflows and outflows from Rogun Reservoir over the simulation period 2025 to 2115 27

Figure 9-2 – Median of simulated releases from Nurek Reservoir with and without Rogun Reservoir in place 28

Figure 9-3 - Plot of accumulative volume flowing into Rogun, released from Rogun and from Nurek Reservoirs 30

APPENDICES

APPENDIX A

DOCUMENT LIMITATIONS

ABBREVIATIONS

Abbreviation	Full phrase
ESIA	Environmental and Social Impact Assessment
EWR	Environmental Water Requirements
HPP	Hydropower Plant
masl	Meters Above Sea Level
MW	Megawatt
MOL	Minimum Operating Level
TEAS	Techno-Economic Assessment
FSL	Full Storage Level

1 INTRODUCTION

1.1.1. The Environmental and Social Impact Assessment (ESIA) for the Rogun Hydropower Plant (HPP) being constructed on the Vakhsh River in Tajikistan is being updated. The Rogun Dam is located in the upper reaches of the Vakhsh River at the head of a cascade of HPPs. The Nurek Reservoir is the next reservoir and HPP downstream of Rogun Reservoir. Nurek Dam is located about 70 km downstream of the Rogun Dam with the incremental catchment area between Nurek and Rogun Reservoirs contributing an insignificant streamflow volume. Water is abstracted for irrigation and domestic use from the Vakhsh River.

1.1.2. The construction of Rogun Reservoir has started with two turbines available for electricity generation. The dam will be raised to its final crown elevation of 1 300 meters above sea level (masl) by 2033 (WSP, 2024). The hydropower capacity will also be increased to 3 600 MW by 2032 with the installation of a further 4 turbines and the upgrade of the existing two turbines.

1.1.3. The impact of the change in flow rates and flow pattern on the ecology and the downstream users are of concern related to filling and operation of the Rogun HPP. The flow changes between Rogun and Nurek Reservoirs as well as below Nurek Reservoir are assessed in this report using a simulation model of the Rogun and Nurek Reservoirs based on the operating rule described in the Techno-Economic Assessment (TEAS) of the Rogun Hydroelectric Project (OSHPC Barki Tojik, 2013).

2 REGIONAL SETTING

2.1.1. The Vakhsh River catchment is part of the Amu Darya River Basin. The location of the Vakhsh River catchment in the Amu Darya River Basin is shown in **Figure 2-1**. The Amu Darya River water resource is shared between Afghanistan, Uzbekistan, Turkmenistan, Tajikistan, Kirgizstan and the Aral Sea. The allocation of the water resource between the basin countries, other than Afghanistan, is governed by the Nukus Declaration and Protocol 566. The Amu Darya Basin Water Organisation implements the declaration and protocol.

2.1.2. Rogun HPP is located approximately 70 km upstream of the Nurek Dam on the Vakhsh River. The Rogun Dam site is located 34 km downstream of the confluence of the Surkhob and Obihingou Rivers, which are the two main tributaries of the catchment and join to form the Vakhsh River (**Figure 2-2**). At the Rogun Dam site, the Vakhsh River drains a catchment area of approximately 30 390 km² and at this location the river flows through a narrow, 400 to 500 m deep V-shaped gorge with gradients of the valley sides up to 50° (Pöyry Energy Ltd, 2014).

2.1.3. The Surkhob River flows from the north-eastern part of the catchment, bordered to the north by the Pamir mountains. The Obihingou flows from the south-eastern part of the catchment and drains the mountains of the central Pamir, particularly the Somoni Peak Range at 7 495 mamsl.

2.1.4. Approximately 30% of the Vakhsh River catchment lies above 4 000 mamsl, within the snow and glacier cover zone. Among the many glaciers which feed the Vakhsh tributaries, the Fedchenko Glacier is reported to extend 77 km, and is the world longest glacier outside the Polar Regions, with a maximum thickness of 1,000 metres. Within the catchment, the total glacier area is estimated to be between 3 882 km² and 5 000 km², which represent between 13% and 16% of the Vakhsh River catchment at Rogun Dam (Coyne et Bellier, 2014b).

Figure 2-1 – Rogun Dam locality map

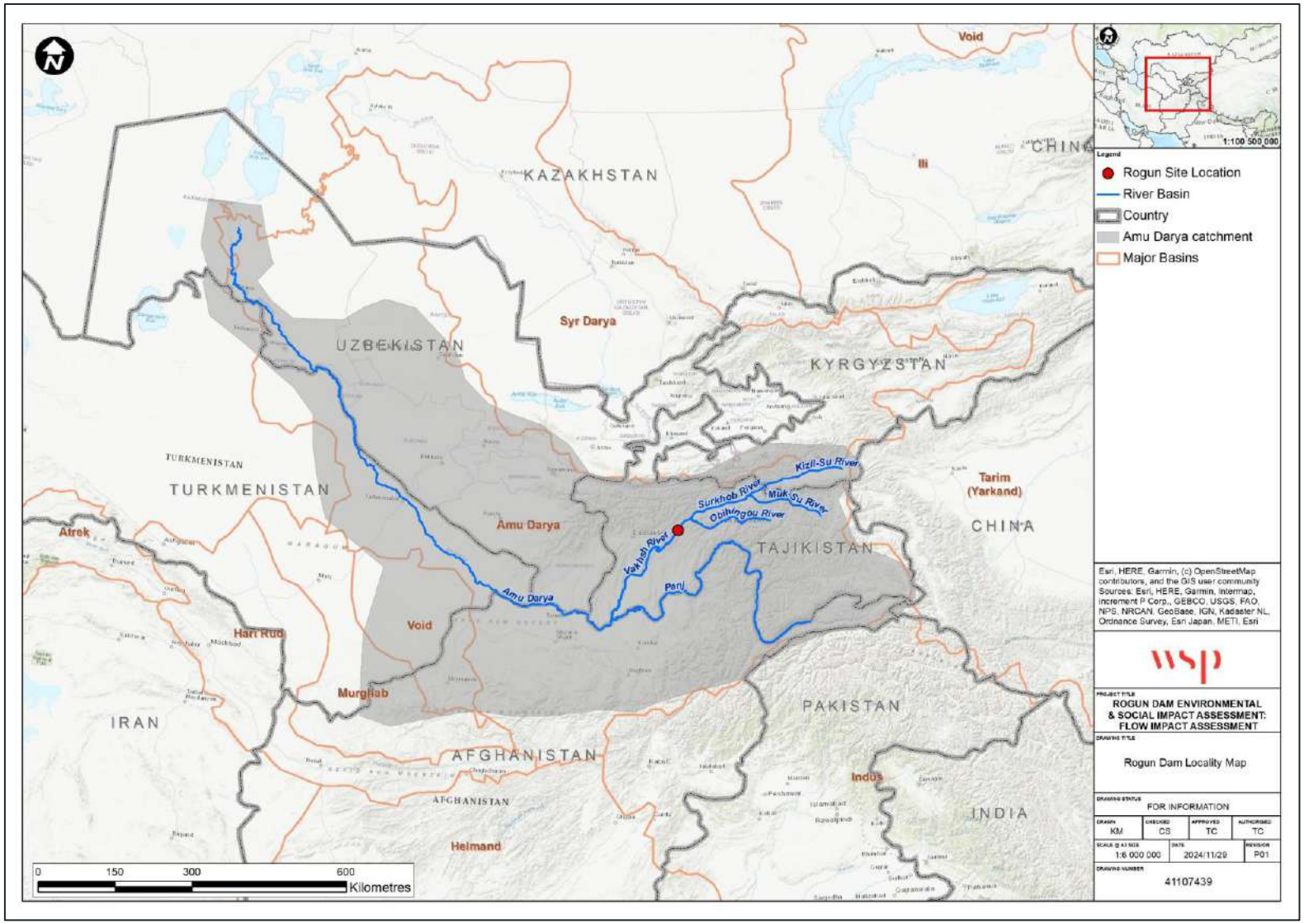
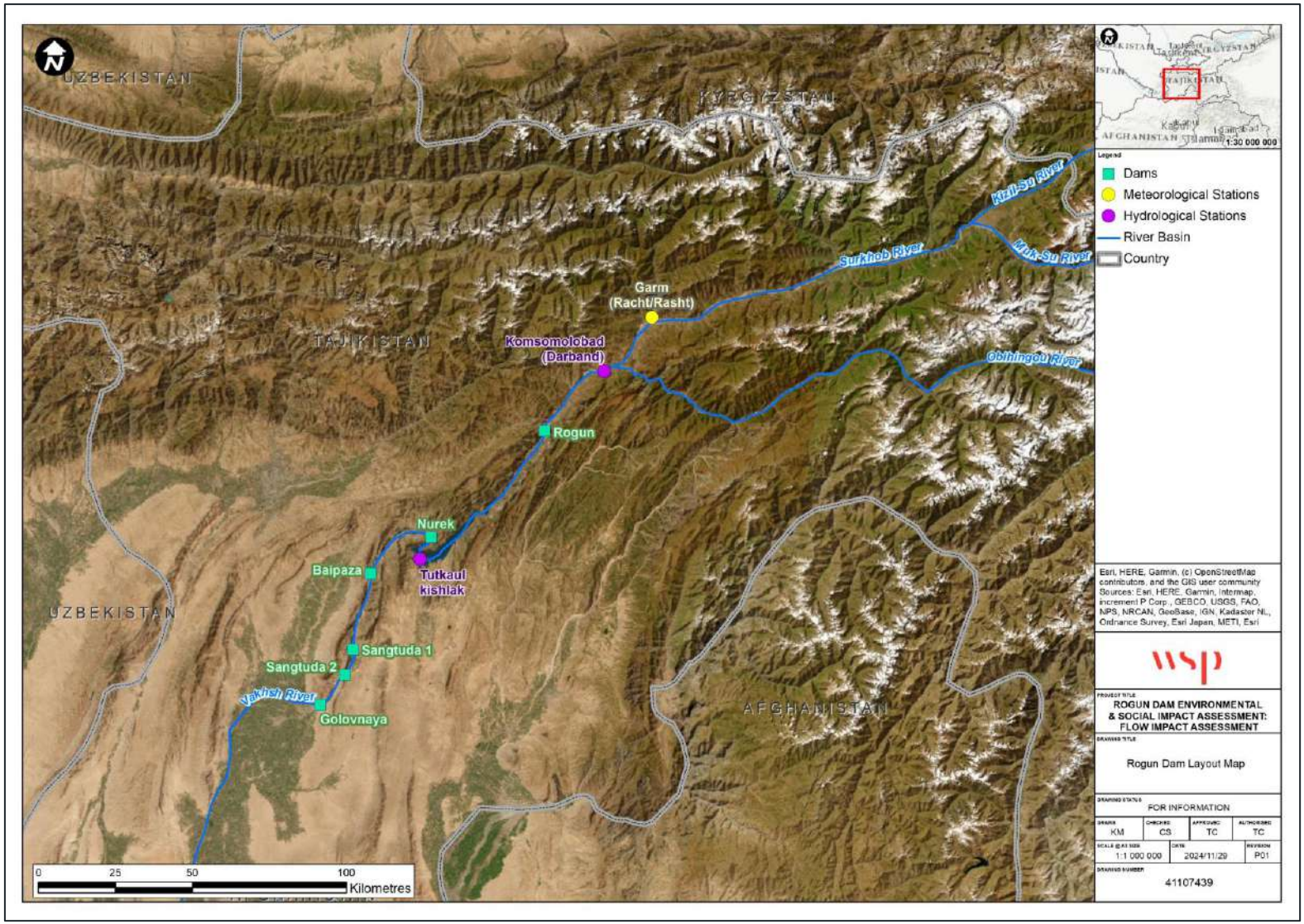


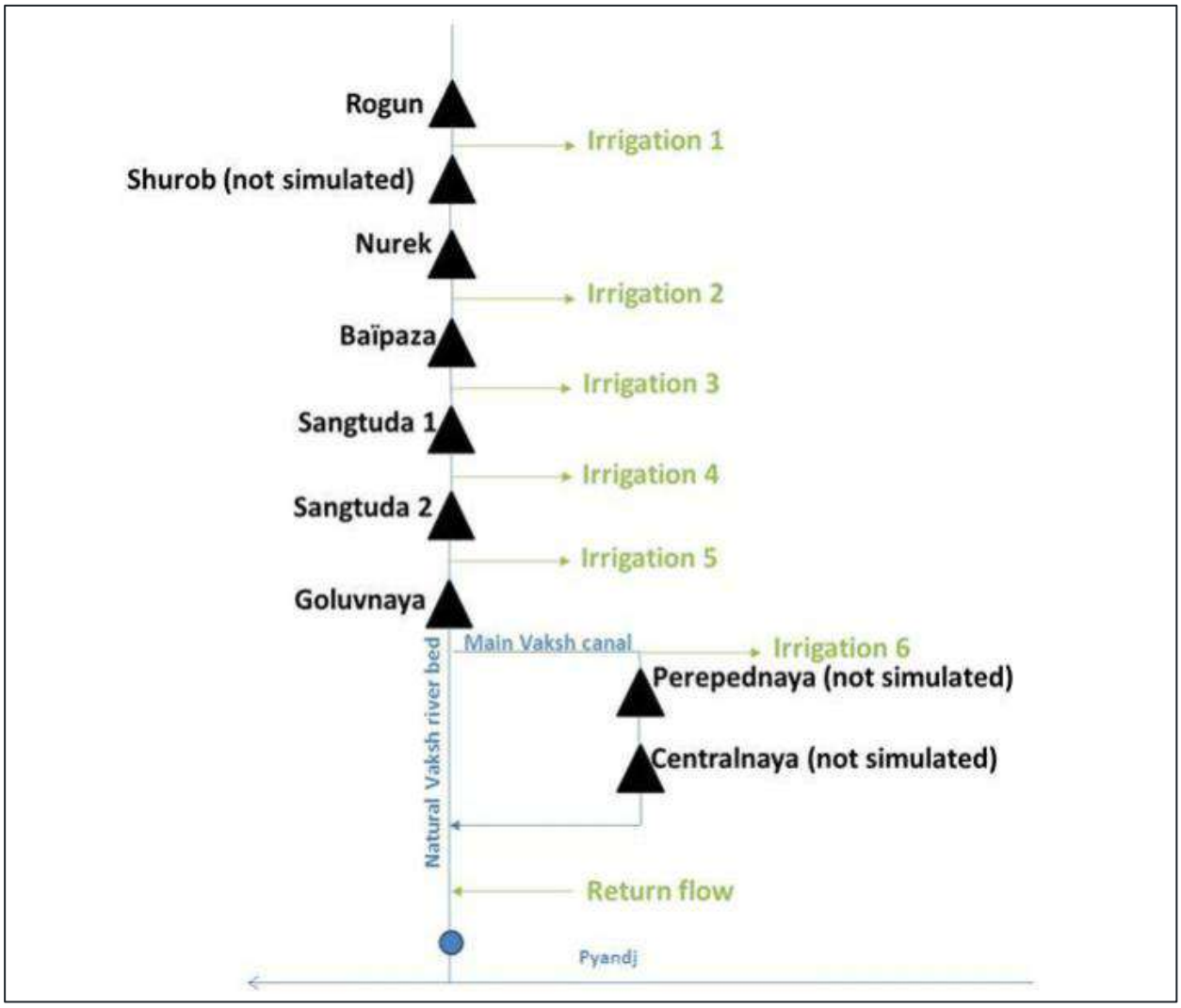
Figure 2-2 – Rogun Dam location map, Vakhsh River and tributaries


UZBEKISTAN
KYRGYZSTAN
TAJIKISTAN
AFGHANISTAN
Garm
(Racht/Rasht)
Komsomolobad
(Darband)
Rogun
Nurek
Baipaza
Tutkaul
kishlak
Sangtuda 1
Sangtuda 2
Golovnaya
Vakhsh River
Surkhob River
Kizil-Su River
Muk-Su River
Obihingou River
0
25
50
100
Kilometres
1:30 000 000
Legend
Dams
Meteorological Stations
Hydrological Stations
River Basin
Country
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 DAM ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT: FLOW IMPACT ASSESSMENT
DRAWING TITLE
Rogun Dam Layout Map
DRAWING STATUS
FOR INFORMATION
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REVISION
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DRAWING NUMBER
41107439

3 VAKHSH CASCADE OF HPPS

3.1.1. A schematic of the cascade of HPP and locations of the irrigation abstractions is shown in **Figure 3-1**. The Rogun (once construction completed) and Nurek Reservoirs are the largest reservoirs in the cascade and have sufficient capacity to provide flow regulation. The Shurob Reservoir is planned to be constructed between Rogun and Nurek Reservoirs. The Shurob Reservoir is being planned and is not considered in the simulations. The capacity of the remaining reservoirs in the cascade are small and are treated as run of river HPPs. There are abstractions for irrigation and some domestic use from the reservoirs and river reaches between the reservoirs. Water is abstracted from the river into the Main Vakhsh canal to supply water for irrigation and two HPP before returning water to the river. The return flows include irrigation flushing water and the return from the Main Vakhsh canal. The full cascade was simulated in the TEAS (OSHPC Barki Tojik, 2013). In the current assessment, the full cascade is not modelled. The Rogun and Nurek Reservoirs are modelled to assess the change in flows in the river reach between Rogun and Nurek Reservoirs and the flows downstream from Nurek Reservoir resulting from Rogun HPP.

Figure 3-1 - Schematic of cascade of HPP (taken from (OSHPC Barki Tojik, 2013))



3.1.2. The construction of Nurek HPP began in 1961 and the first turbine was operating in 1972. By 1979, 9 turbines had been installed giving a total of 2 700 MW. The hydropower capacity was increased to 3 000 MW in 1988 (OSHC Barqi Tojik, 2020). The capacity of the dam has reduced due to sedimentation. The rate of sedimentation of Nurek Reservoir will be reduced by Rogun Reservoir.

3.1.3. The construction of Rogun Dam started in the 1970s and has been through a number of stop/start cycles with the project implementation resuming in 2008. The coffer dam was destroyed in 1993 by a flood. Maintenance work was undertaken on the dam in about May 2008 to prevent additional damage to the dam structures already built. Water is currently impounded to an elevation of 1 075 masl and conditions are being discussed to enable impoundment to an elevation of 1 100 masl planned for mid-October 2026 (Gruner, 2024). The impounding of water to the reservoir Full Storage Level (FSL) of 1 290 masl is planned to be able to start by November 2033.

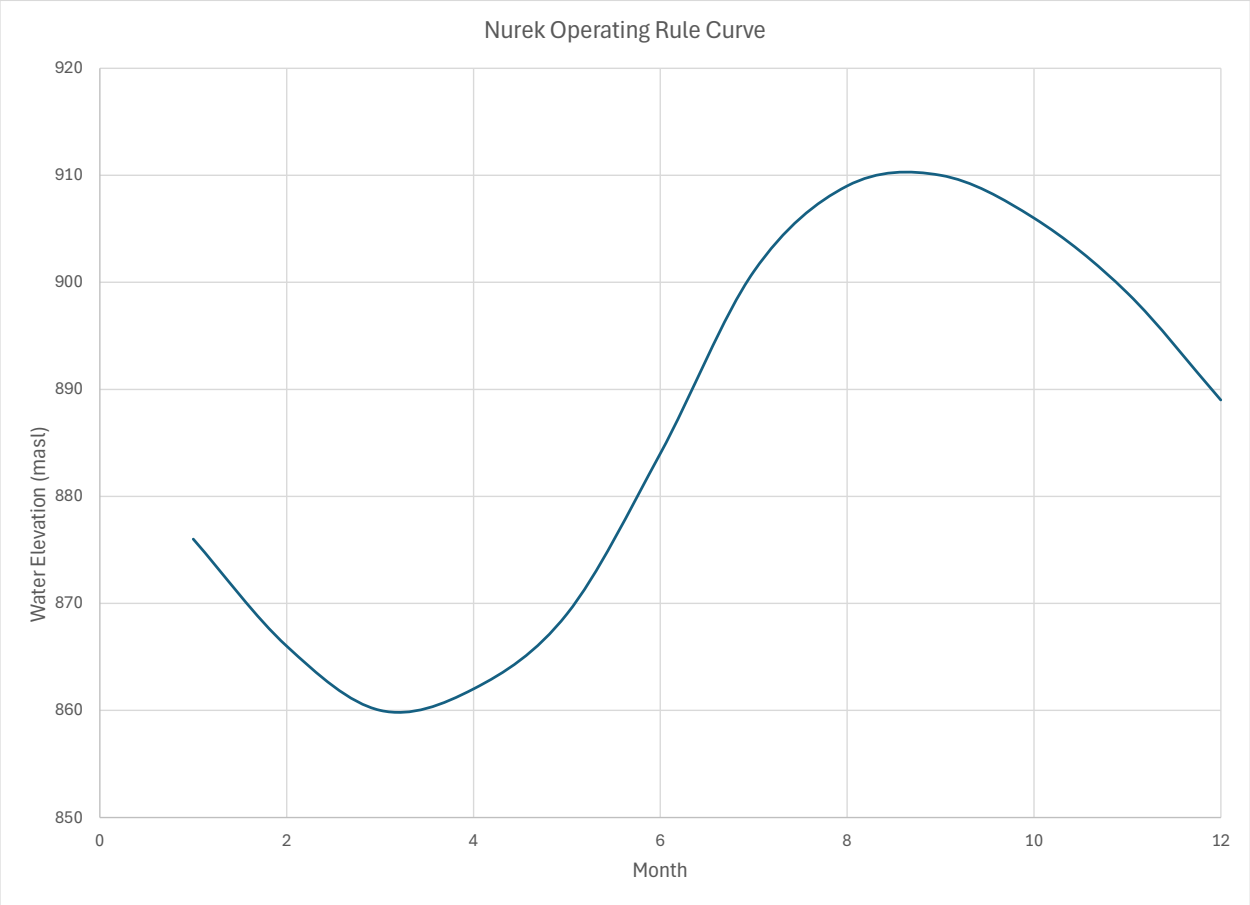
4 MODELLING APPROACH

4.1.1. A simulation model was built of the Rogun and Nurek Reservoirs using the GoldSim simulation software (www.Goldsim.com). The model used the monthly average flow and precipitation data for the period 1932 to 2022 as input. Flow and precipitation data were time shifted by a year to allow the simulation of the system for different sequences of flow and precipitation. Time shifting allows for the assessment of the impact of wet and dry periods on filling times and flow changes due to Rogun Reservoir.

4.1.2. The rules developed in the TEAS were applied in the model to calculate the discharge from the reservoirs. The results of the TEAS showed that the optimal rule to operate the Nurek and Rogun Reservoirs was to use Rogun Reservoir for regulation and operate Nurek Reservoir similar to a run of river HPP. The application of this rule resulted in the discharges from the Nurek and Rogun reservoirs being similar. The present model was set up to operate the reservoirs using this rule.

4.1.3. The approach followed in the TEAS was to calibrate an operating rule based on the measured releases from Nurek Dam over the period 1991 to 2008. The construction of Rogun Reservoir was halted during this period and the coffer dam was destroyed in 1993 by a flood. Maintenance work was undertaken on the dam in about May 2008 to prevent additional damage to the dam structures already built. The construction of the dam was resumed in 2016. The flows at a monthly time step were unlikely to have been affected by the construction of Rogun Dam during the period 1991 to 2008. An operating rule curve based on the average monthly measured water elevations in the reservoir was adjusted in the TEAS simulation model to achieve the best calibration against the measured outflows from the reservoir and energy production. The operating rule curve of monthly water elevations is presented in **Figure 4-1**. The Operating Rule Curve represents the desired water level in the reservoir. Water is stored or discharged through the turbines and spillways to reach the water level imposed by the rule. The rule shows that water is stored in the reservoir over the high flow summer period for release during the winter period to generate energy during the winter period.

Figure 4-1 - Operating rule curve used to calculate the discharges from Nurek Reservoir (taken from (OSHPC Barki Tojik, 2013))



4.1.4. The model was applied to Nurek without Rogun Reservoir. The discharges from the reservoir were simulated for the calibration period for the TEAS (1991 to 2008). The monthly averages and the flow duration curves obtained from the simulation results were compared to TEAS results to confirm the correct operation of the model.

4.1.5. The Rogun Reservoir was added to the model with the discharges from Rogun as the inflows to Nurek. The operation rule was applied to Nurek Reservoir to calculate the outflows required from the reservoir as per the operating rule curve. The calculated outflows were then applied to Rogun Reservoir to ensure that the same releases required from Nurek Reservoir were made from Rogun. In this way, the Nurek Reservoir will operate similar to a run of river HPP. Additional water will be released from Nurek Reservoir when the releases from Rogun do not meet the releases required from Nurek when applying the operating rule curve. The model was applied to the Rogun Reservoir filling and operations. Statistics of the discharges from the reservoirs were compared to the natural flows and discharges from Nurek Reservoir if Rogun Reservoir had not been built.

5 MODEL INPUTS

5.1 HYDROLOGY

FLOWS

5.1.1. Due to the limited flow timeseries available at the Rogun Dam location, a monthly flow record was compiled (Coyne et Bellier, 2014a) by combining data from different hydrometric stations, as follows:

- From 1932 to 1972: flow rates recorded at Tutkaul gauging station (see **Figure 2-2**).
- From 1973 to 1988: flow rates at Tutkaul are reconstituted based on observations made at Komsomolabad. Correlations between the two stations are based on two periods of common record (1949-1957 and 1963-1972).
- From 1988 to 2008: flow rates are calculated based on Nurek HPP inflows.
- From 2008 to 2022: flow rates were provided by the World Bank. WSP understands that the flow rates for this additional (2008 to 2022) data have been calculated as per Nurek HPP data.

5.1.2. The inflows to the Nurek Reservoir calculated using the Nurek HPP data are considered to be valid for the Rogun site given the incremental catchment area between the dams is small (less than 3% of the catchment) (Coyne et Bellier, 2014b). The flows calculated using the Nurek Reservoir HPP flows are considered representative of the flow conditions at Rogun Reservoir.

5.1.3. In summary, the Rogun Reservoir flow data used for this assessment has been sourced from:

- (Coyne et Bellier, 2014b): Appendix 2, Table 1, for the period 1932-2007; and
- World Bank provided data, for the period 2008-2022.

5.1.4. The average monthly streamflow record, annual totals and a box and whisker plot of the average monthly flows are plotted in **Figure 5-1** and **Figure 5-2** and **Figure 5-3** respectively. The plot of the accumulative total of the runoff volumes is shown in **Figure 5-4**.

5.1.5. The plots highlight the following:

- The streamflow is seasonal with the low flows occurring during the winter period. The lowest flows occur in February before the snow melt starts in spring.
- The flows during the winter period do not vary significantly and range from 0.3 to 0.9 km^3/month.
- The annual streamflow total is variable ranging from 13 km^3/yr to 26 km^3/yr with an average of 20 km^3/yr (634 m^3/s).
- The highest streamflow occurs in July.
- The streamflow during the summer months is more variable than the winter streamflow.
- The plot of the accumulative streamflow total shows a consistent slope and does not highlight any anomalies.

Figure 5-1 – Monthly inflows into Rogun Reservoir

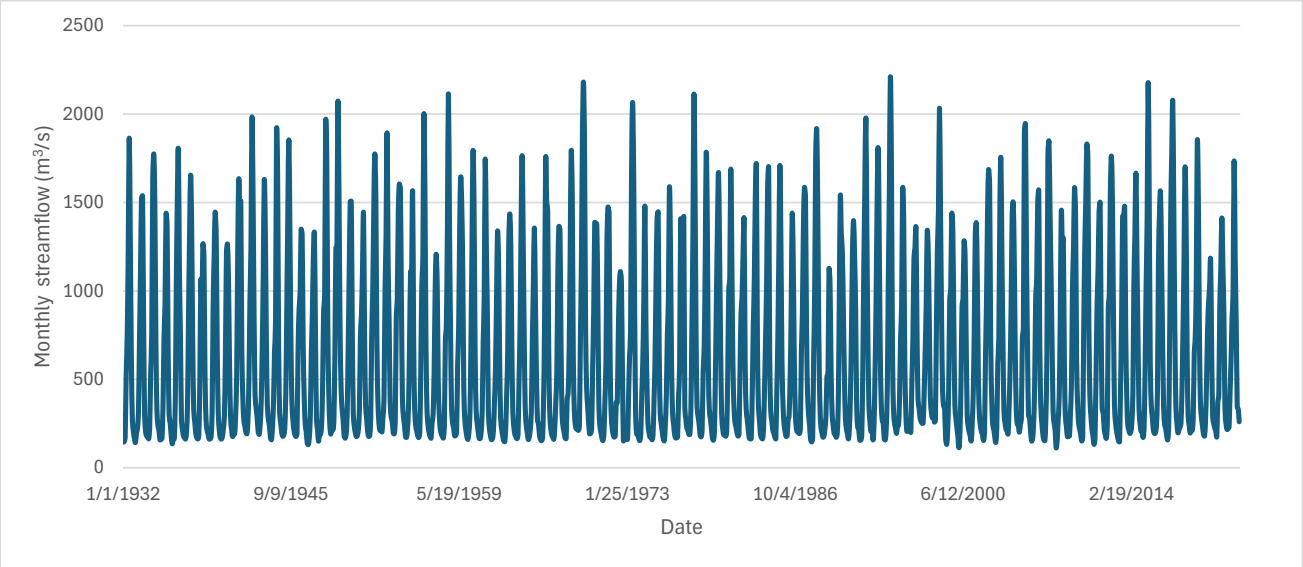


Figure 5-2 – Annual inflows into Rogun Reservoir

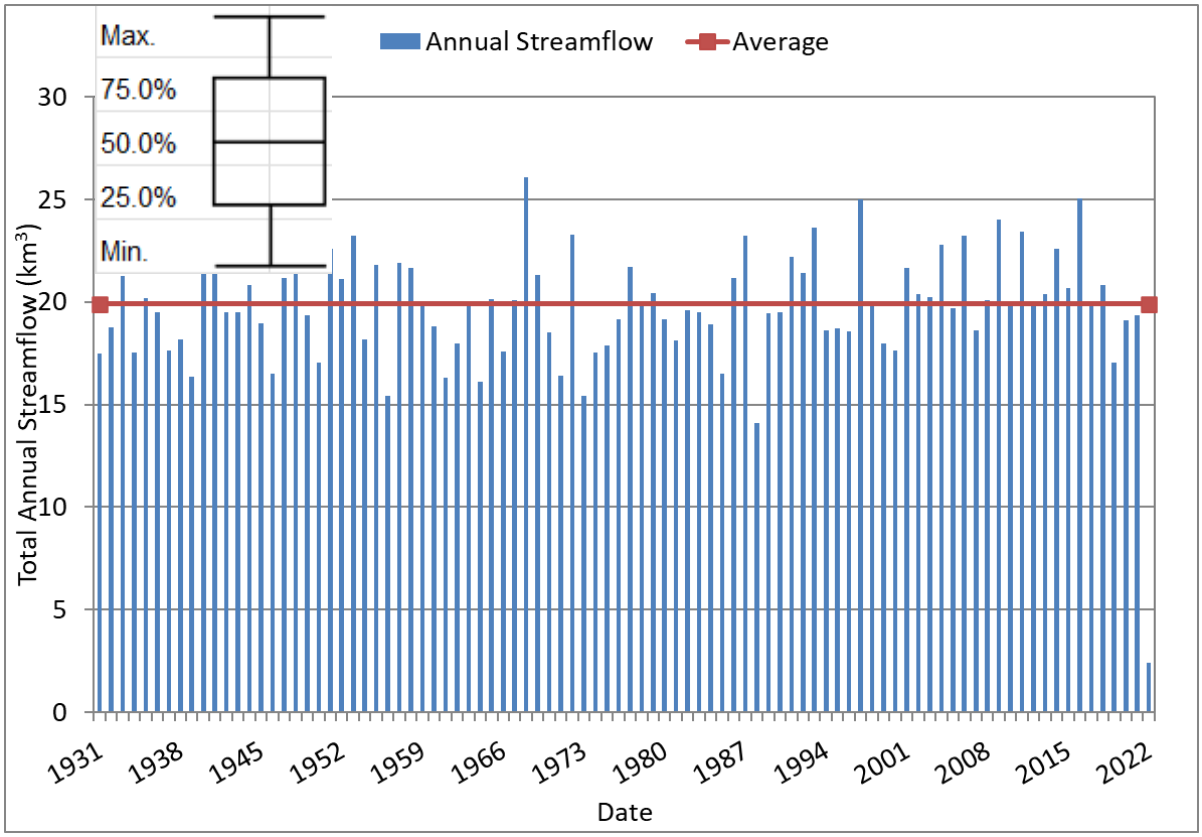


Figure 5-3 – Box and Whisker plot of monthly streamflow record into Rogun Reservoir

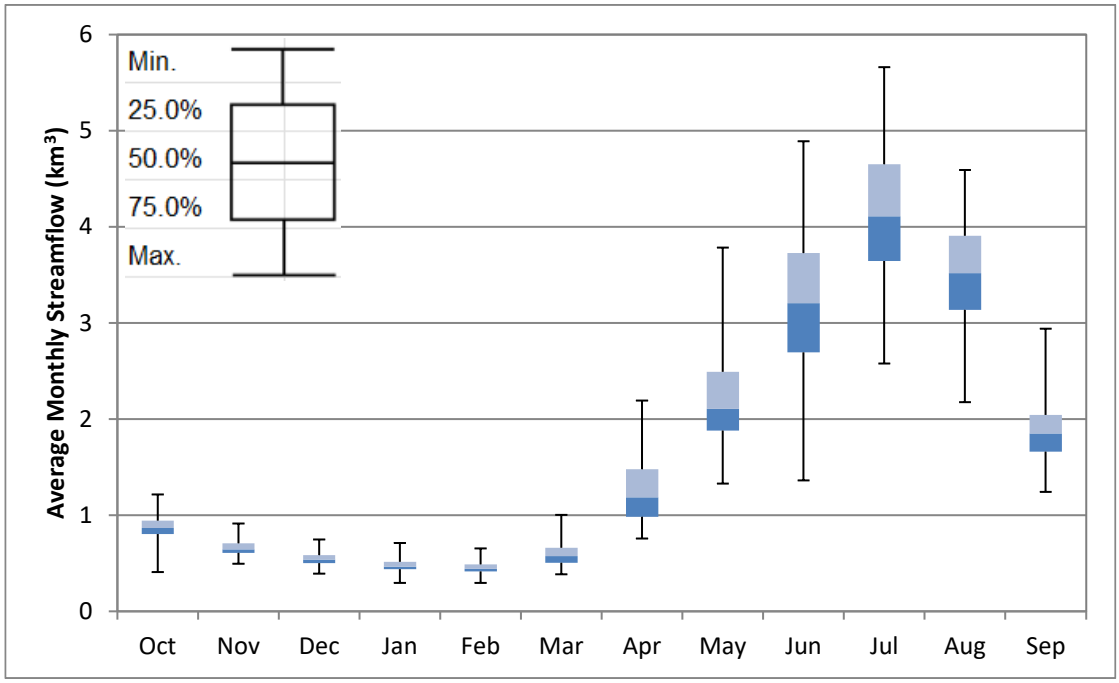
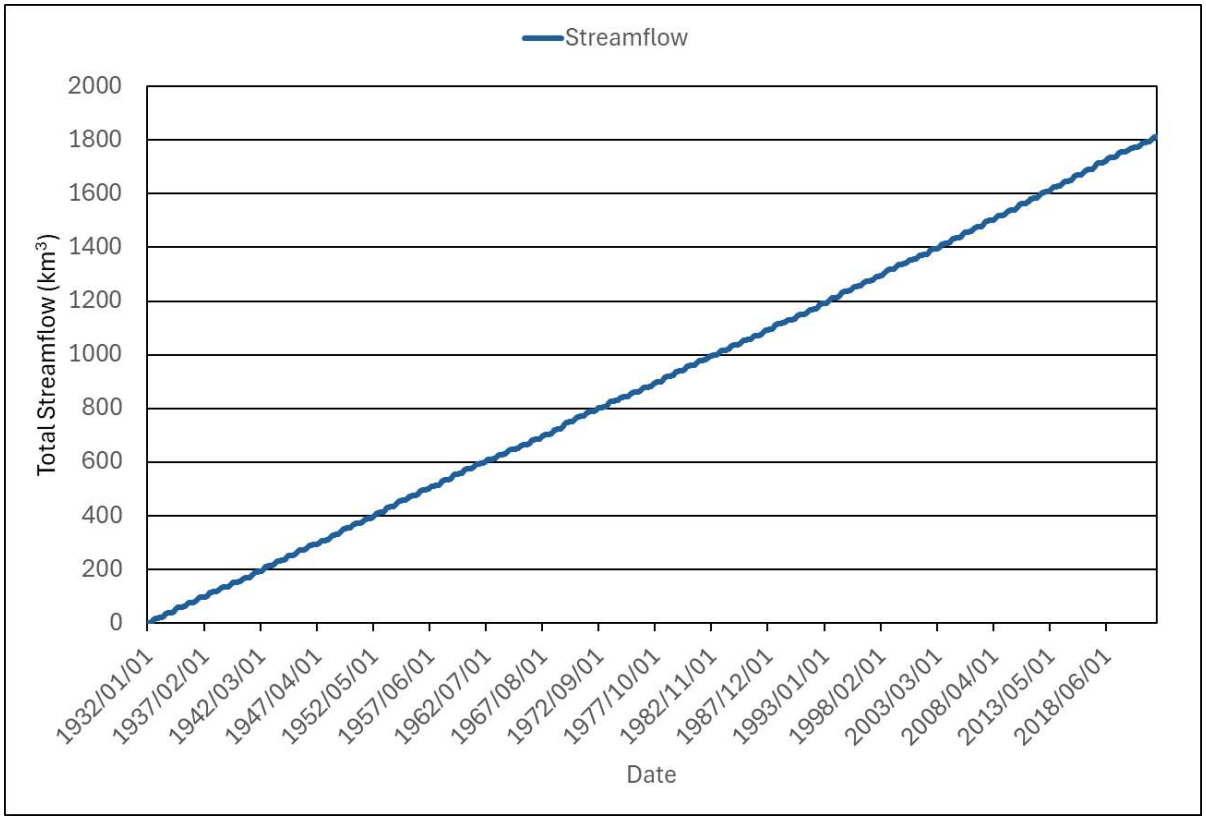


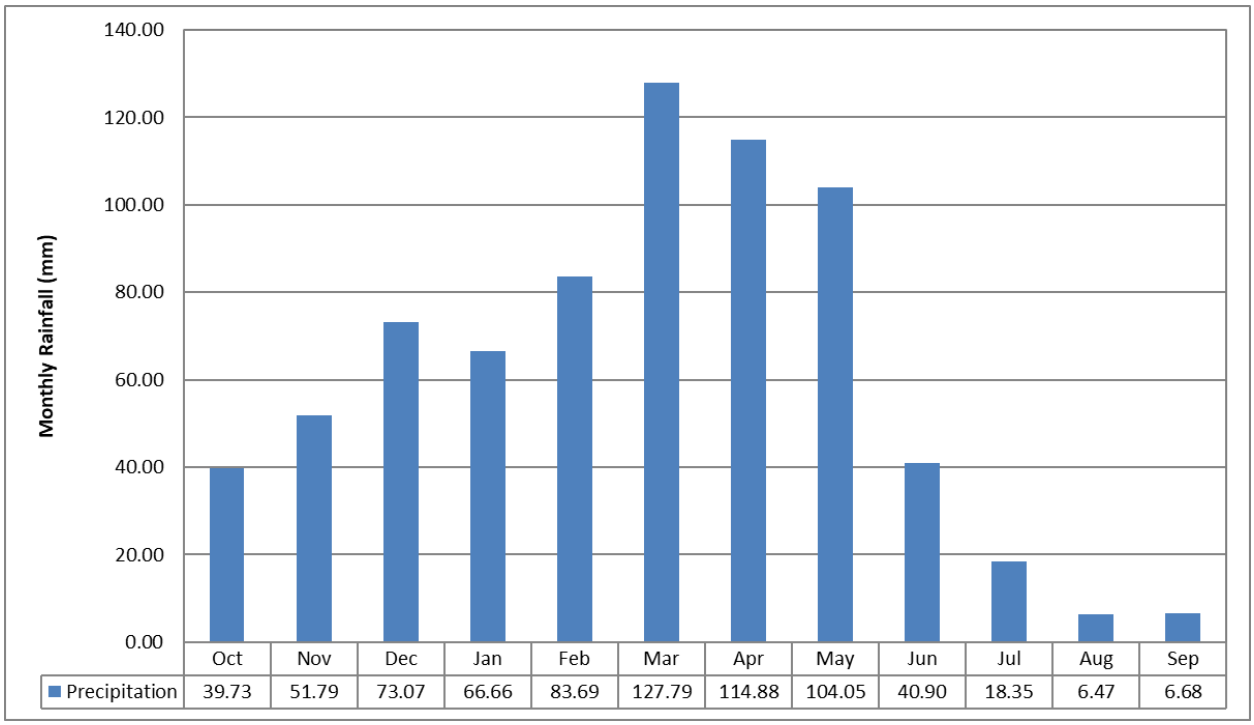
Figure 5-4 – Cumulative plot of total streamflow into Rogun Reservoir



PRECIPITATION

5.1.6. Most of the precipitation in the project area falls during the winter and spring months, while precipitation is low in the summer months. Winter precipitation falls mainly as snow (Coyne et Bellier, 2014a). A monthly precipitation record was sourced from the Garm meteorological station located in the area of the Rogun HPP dam at an elevation of 1 316 meters above mean sea level (mamsl). The station had a record with data available from 1931 to 2010. The monthly average precipitation is plotted in **Figure 5-5**. The precipitation depths were taken to be water depths.

Figure 5-5 –Average monthly precipitation depths



EVAPORATION

5.1.7. Evaporation data was obtained from the reservoir simulation report (OSHPC Barki Tojik, 2013). The average monthly depths are presented in **Table 5-1**. The average monthly depths are used to estimate the volumes evaporated from the water surface in the reservoirs.

Table 5-1 – Average monthly evaporation depths

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
Evaporation (mm)	43	0	20	25	39	73	105	138	128	89	91	54	805

6 RESERVOIR CHARACTERISTICS

6.1 ROGUN RESERVOIR

6.1.1. The characteristics of the final Rogun HPP are summarised in **Table 6-1**. As of late 2024, the dam has been constructed to an elevation of 1 100 masl with two turbines (U5 and U6) installed (WSP,

2024). The available power of the turbines is anticipated to be 408 MW by 2027 with the replacement of the runners. The dam will be raised to a final full storage level (FSL) of 1 290 masl by November 2033 with a minimum operating level (MOL) of 1 185 masl (Tractebel Engineering S.A./ELC Electroconsult S.P.A., 2024). The MOL is the level in the reservoir below which the water level should not be lowered to prevent sediment and debris from entering the turbines. A further 2 turbines (U3 and U4) will be added by January 2029 when the dam reaches 1 175 masl with the final two turbines added by July 2031 when the dam reaches 1 230 masl in about 2032.

Table 6-1 - Characteristics of Rogun Reservoir

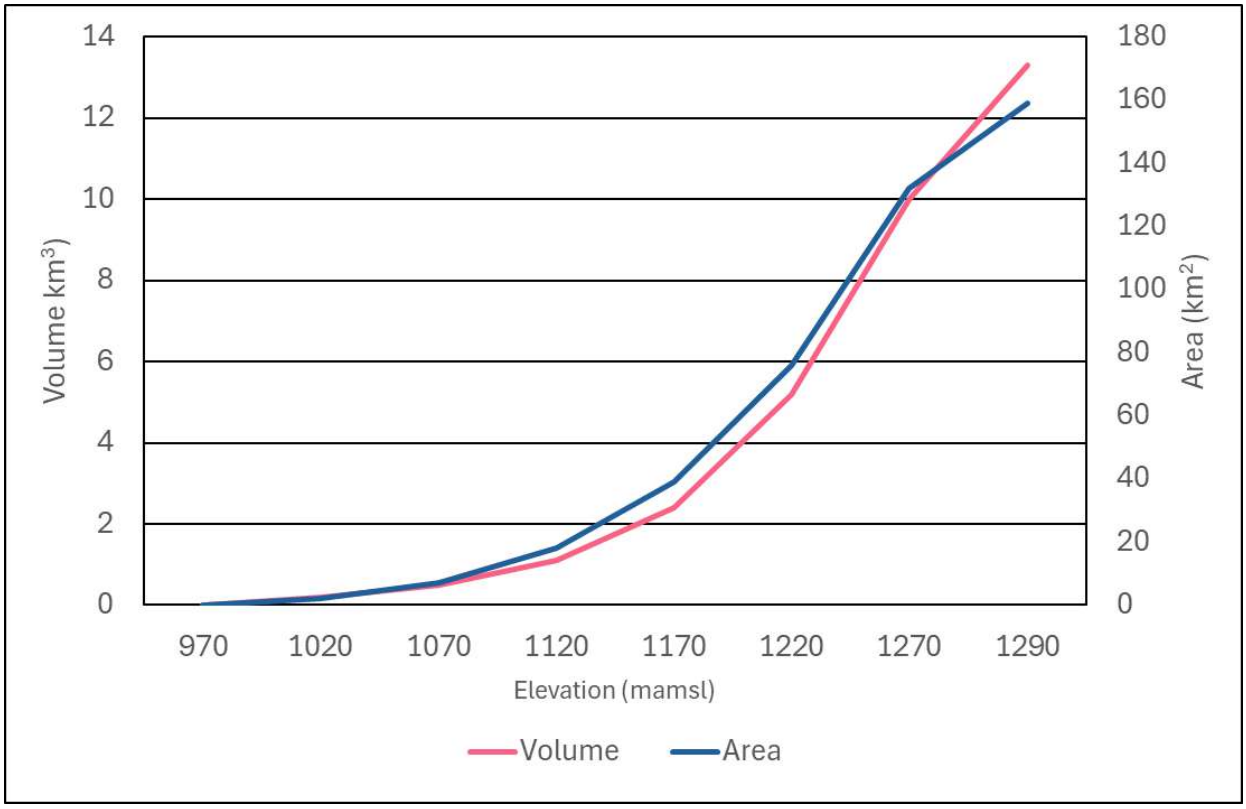
Characteristic	Value
Current (2025) storage level (masl)	1 100
Current (2025) storage capacity (km^3)	0.86
Final FSL (masl)	1 290
Final Minimum Operating Level (MOL) (masl)	1 185
Final dam embankment crest elevation (masl)	1 300
Final full storage capacity (km^3)	13.3
Inundation area at FSL (km^2)	159

6.1.2. The stage-storage-area curve for the Rogun Reservoir basin is given in **Table 6-2** and plotted in **Figure 6-1**.

Table 6-2 – Rogun Reservoir Basin Stage-Storage-Area Curve

Stage	Elevation (mamsl)	Volume (km^3)	Area (km^2)
-	970	0	0
-	1 020	0.2	2
-	1 070	0.5	7
-	1 120	1.1	18
-	1 170	2.4	39
-	1 220	5.2	76
-	1 270	10.0	132
FSL	1 290	13.3	159

Figure 6-1 – Rogun Dam Stage-Storage-Area Curve



6.2 NUREK RESERVOIR

6.2.1. Bathymetric surveys of the dam basin have been undertaken but the accuracy of the surveys have been questioned (OSHPC Barki Tojik, 2013). The two approaches used to estimate the stage storage curve for the reservoir basin were:

- A formula was developed for the TEAS using the measured water levels and inflow and outflow volumes from Nurek (OSHPC Barki Tojik, 2013).
- The available radar and satellite survey data was also used to estimate the storage characteristics of the reservoir basin. The water storage volumes below the water surface were not able to be measured as the radar did not penetrate through the water surface and radar/satellite data was not available for the period before the dam started filling.

6.2.2. The key characteristics of the reservoir are given in **Table 6-3** and the stage storage curves of the reservoir basin using the formula and the available survey data are listed in **Table 6-4**. The curves using the two methods are very similar. The storage volumes estimated using the survey data were used in the simulations. The stage-storage-area curves are plotted in **Figure 6-2**.

Table 6-3 – Key characteristics of the Nurek Reservoir

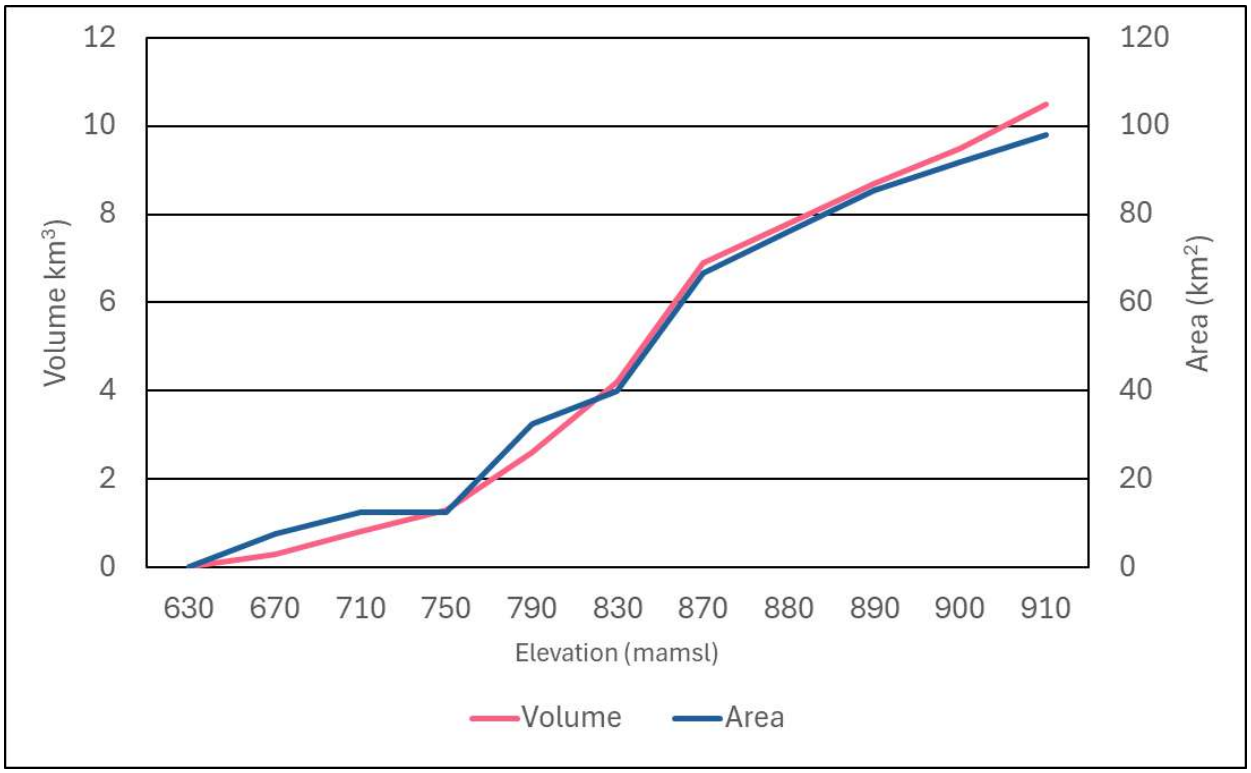
Characteristic	Value
FSL (masl)	910
Minimum Operating Level (masl)	857
Full Storage Capacity (FSC) (km³)	10.5

Characteristic	Value
Inundation area at FSL (km^2)	98

Table 6-4 - Nurek Reservoir Basin Stage Storage Curve

Elevation (masl)	Volume formula (km^3)	Volume Survey (km^3)
630	0.0	0
670	0.1	0.3
710	0.4	0.8
750	1.2	1.3
790	2.5	2.6
830g	4.4	4.2
870	7.0	6.9
880	7.8	7.8
890	8.7	8.7
900	9.6	9.5
910	10.5	10.5

Figure 6-2 – Nurek Reservoir Basin Stage-Storage-Area Curve



7 RESULTS

7.1 MODEL CALIBRATION PERIOD

7.1.1. The simulation model used in the TEAS was calibrated against the measured outflows from Nurek Reservoir for the period 1991 to 2008. The construction of Rogun Reservoir was halted during this period and the coffer dam was destroyed in 1993 by a flood. Maintenance work was undertaken on the dam in about May 2008 to prevent additional damage to the dam structures already built. The construction of the dam was resumed in 2016. The flows at a monthly time step were unlikely to have been affected by the construction of Rogun Dam during the period 1991 to 2008. The simulation model built for this assessment was run for the same period and operating rules and the simulated discharges compared to the results from the TEAS. The results from the TEAS are shown in **Figure 7-1** and from the simulation model developed for this assessment in **Figure 7-2**. The average flows and the flow duration curve comparing the simulated and historic outflows from Nurek Reservoir are shown in **Figure 7-3** and **Figure 7-4** respectively.

7.1.2. The results from the model developed for this water resource assessment have similar patterns, monthly average flows and flow duration curve to the historic Nurek Reservoir outflows. The model is considered suitable for use in assessing the impact on the flows resulting from the filling and operation of Rogun Reservoir.

Figure 7-1 - Simulated and historical Nurek outflows from the TEAS ((OSHPC Barki Tojik, 2013))

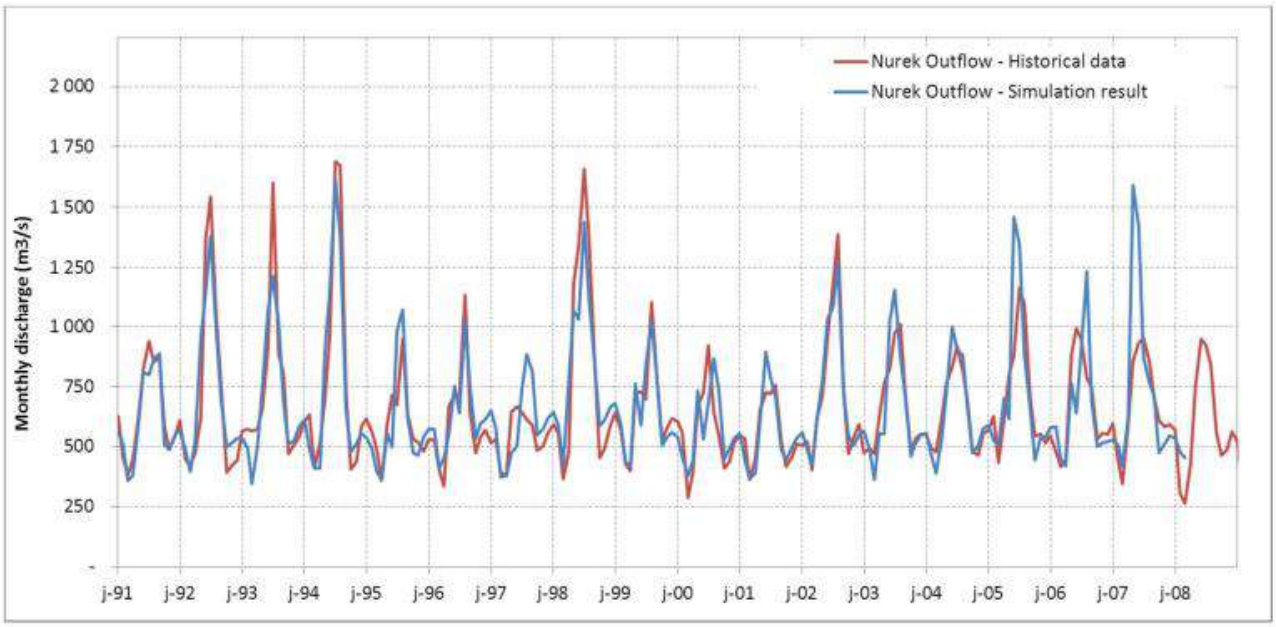


Figure 7-2 – Simulated Nurek Reservoir outflow results from the assessment model

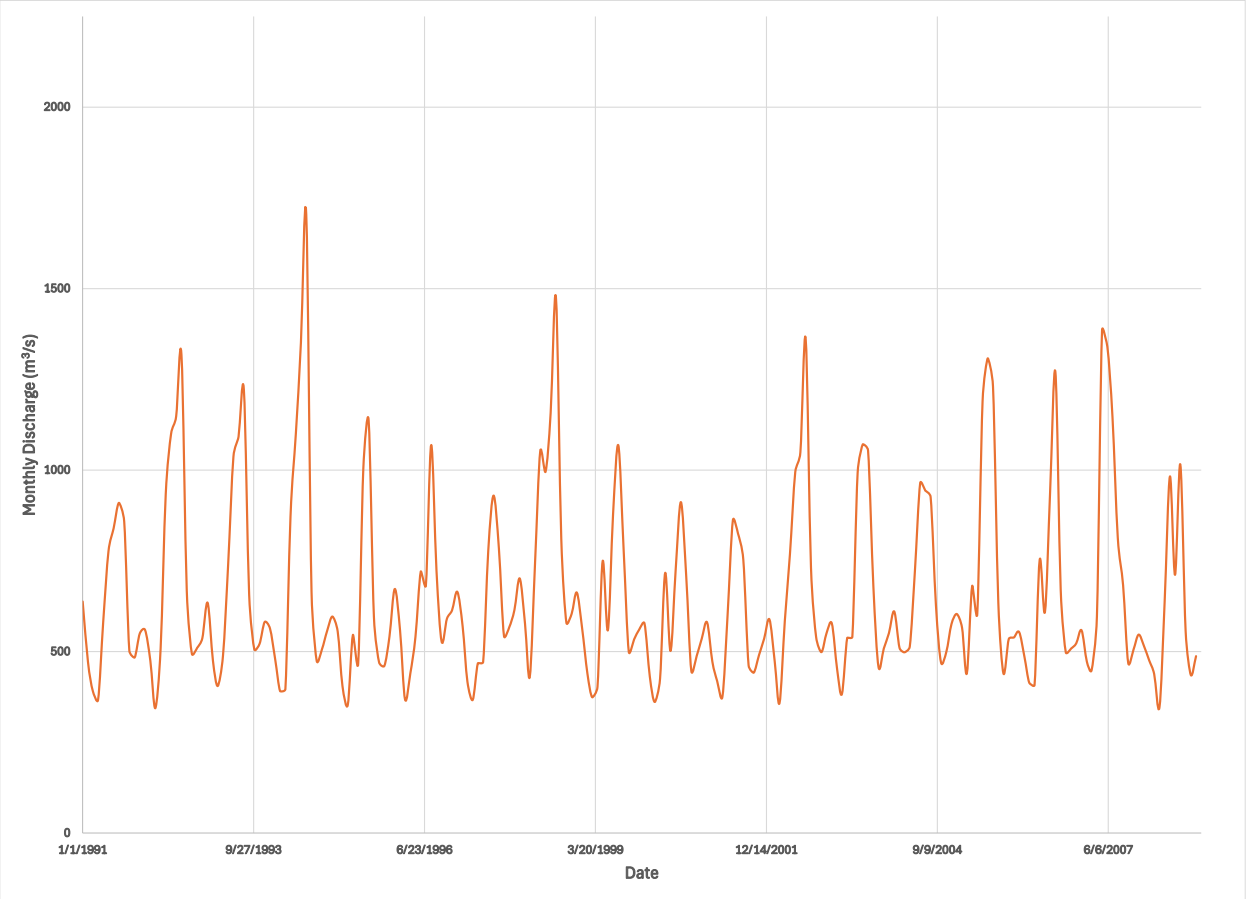


Figure 7-3 - Comparison of simulated and historic average monthly outflow volumes from Nurek Reservoir

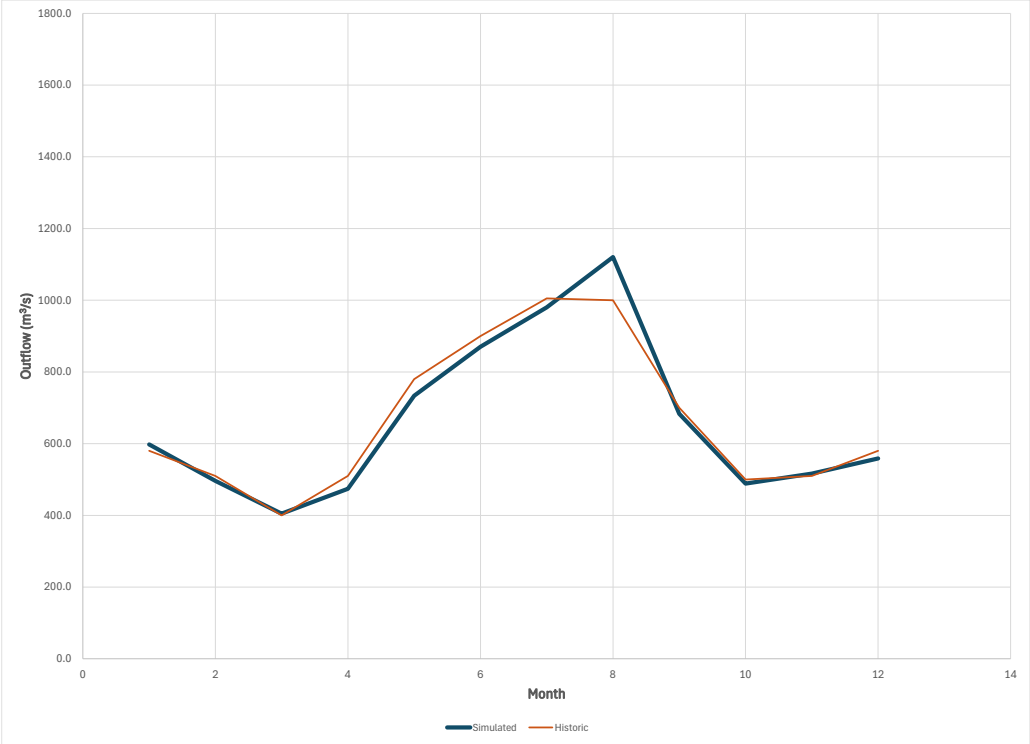
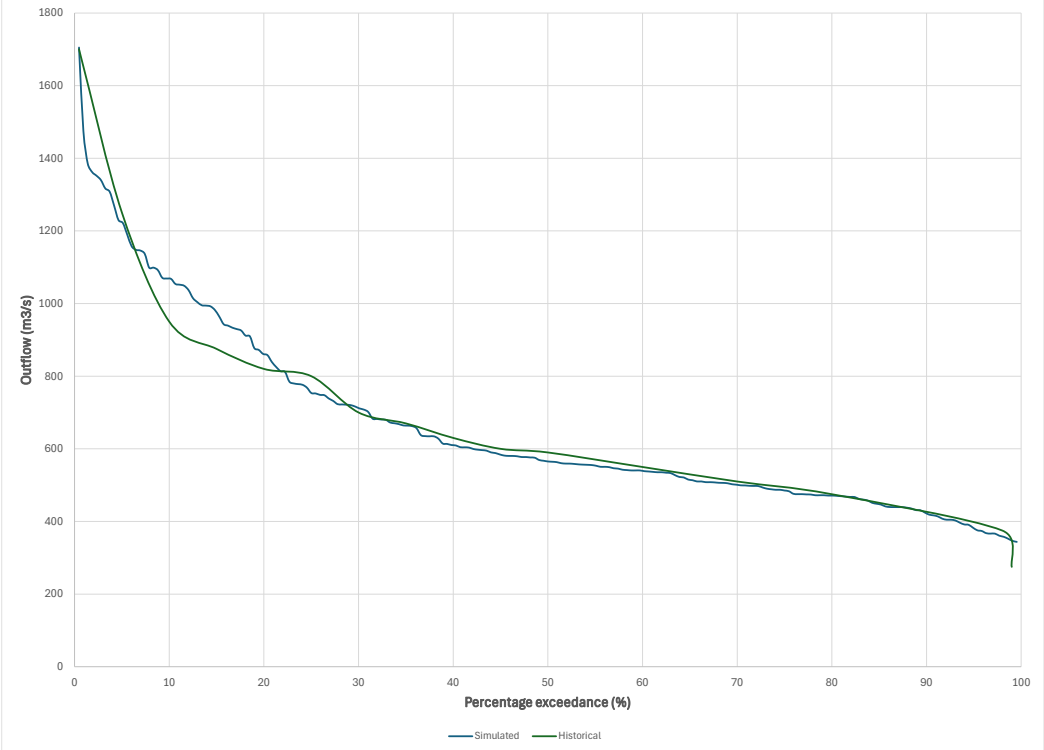


Figure 7-4 - Comparison of flow duration curve of simulated and historic discharges from Nurek Reservoir



8 ROGUN RESERVOIR FILLING

8.1.1. The guiding principle for the impoundment of Rogun reservoir is that the Government of Tajikistan will impound the flows that are otherwise not-used from its annual water share allocation, as per the water allocations to countries regionally agreed each year at ICWC meetings. Historically, the unused water share allocation of Tajikistan has been in average higher than 1.2 km^3/year. Tajikistan will respect at all times the regional water sharing agreements during the impoundment of Rogun reservoir, and will not go beyond its allocated water share. It is expected that in ICWC negotiations each year, TJ will likely get a greater allocation during above-average years (water abundant years) and the unused water share will exceed the historical average; and conversely, during drought years, the unused allocation may be smaller than the historical average. For this reason, the impoundment of Rogun reservoir will depend mainly on the volume of inflows from the Vakhsh River during impoundment years. Given the need to respect the regional water sharing agreements at all times, an exact, fixed impoundment plan is difficult to produce.

8.1.2. Based on the construction progress, an illustrative schedule of reservoir impounding elevations and the volume of water that could be stored in the reservoir at each elevation are listed in **Table 8-1** (Tractebel Engineering S.A./ELC Electroconsult S.P.A., 2024). The dates are based on the optimised dates for the overall implementation programme for dam construction. The dates and elevations listed in **Table 8-1** are the dates at which water can be impounded to that elevation in the reservoir if the construction of the dam embankment and associated infrastructure (flood management structures: diversion tunnels and spillways at different elevations, etc) has progressed sufficiently to allow for the impoundment of water to that elevation. Table 8-1 is tentative based on early planning and it is liable to be revised towards later completion of impoundment. Table 8-1 - Planned tentative impoundment elevations, water volumes that can be stored at the elevations

Date	Impounding Elevation (masl)	Storage Volume (Km^3)
1 Jan 2025	1 075	0.56
15 Oct 2026	1 100	0.86
15 Aug 2028	1 175	2.68
15 June 2032	1 230	6.16
15 Nov 2033	1 290	13.30

8.1.3. The volume of water proposed to be used to fill Rogun Reservoir is the difference between Tajikistan's annual allocation from the Vakhsh River made as per the protocols and that years expected water use by Tajikistan. The allocation (non-vegetation and vegetation), actual water used from the Vakhsh River as given in the annual reports on the SIC ICWC web site (http://sic.icwc-aral.uz/reports_e.htm) are presented in **Table 8-2** and plotted in **Figure 8-1**. The differential between the allocation and actual use is included as well as the annual total streamflow volume (January to December) at Rogun Dam site..

8.1.4. The information shown in **Table 8-2** and **Figure 8-1** reflects the following:

- The lower allocation and actual use in 2012 are due to the data for the non-vegetation water allocation and use was not available on the web site.

- The allocation is fairly constant over the period 2010 to 2023. The allocation has been constant in time because Tajikistan has not been using its full allocation, in wet or dry years. Thus, in the historical period there is no relationship between allocation and VaKhsh river streamflows.
- The use varies over the period as indicated by the varying differential between allocation and actual use. The average differential is 1.33 km^3/yr which is higher than the 1.211 km^3/yr used in the filling assessment undertaken in the TEAS.
- On one hand, the data indicates that the differential between the allocation and actual use, i.e. the unused share available for filling the reservoir, shows a declining trend over the time period analysed. The differential is particularly low in 2022 and 2023. Tajikistan will have to manage the water use to realise the volume required to fill Rogun Reservoir.
- On the other hand, it is well known that a significant part of the flows diverted into canals in Tajikistan return back to the river, and the actual use of the water share is overestimated. Two simple examples are as follows: (i) in winter, the irrigation canals downstream of the cascade are used for the several HPPs existing along the canals but there is no consumptive use and the totality of the water diverted returns to the river; (ii) the conveyance and irrigation efficiency in Tajikistan is low, with numerous return flows to the river. The Ministry of Energy and Water Resources of Tajikistan is making steps to install hydroposts to measure these unaccounted return flows to the river, which are significant.
- As Tajikistan has not used its full allocation, the ICWC-agreed allocation has been constant in time, without any increases during wet years. This is subject to change in future yearly ICWC meeting negotiations given the need to impound Rogun..

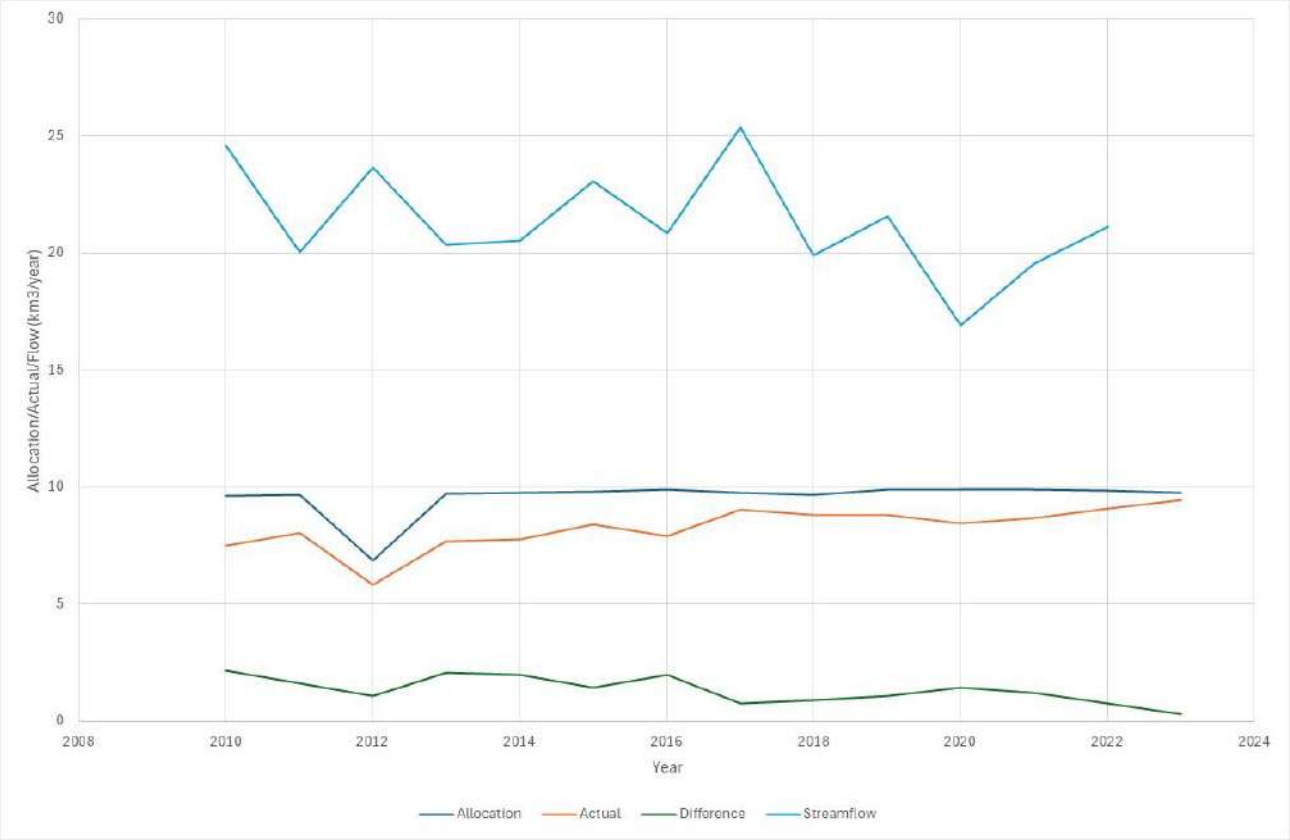
Table 8-2 - Summary of annual allocation, actual use, differential and annual flow volume at Rogun Dam Site

Year	Allocation (km^3)	Actual Use (km^3)	Differential (km^3)	Flow at Rogun Dam (km^3)
2010	9.63	7.48	2.15	24.6
2011	9.67	8.05	1.62	20.0
2012	6.88*	5.82*	1.06	23.7
2013	9.72	7.67	2.05	20.3
2014	9.75	7.79	1.96	20.5
2015	9.82	8.41	1.41	23.1
2016	9.88	7.91	1.97	20.9
2017	9.77	9.03	0.74	25.4
2018	9.67	8.8	0.87	19.9
2019	9.88	8.8	1.08	21.6
2020	9.88	8.46	1.42	16.9

Year	Allocation (km^3)	Actual Use (km^3)	Differential (km^3)	Flow at Rogun Dam (km^3)
2021	9.88	8.69	1.19	19.5
2022	9.86	9.09	0.77	21.1
2023	9.78	9.46	0.32	-
Average	9.58	8.25	1.33	-

*No non-vegetation allocation or use data available for 2012.

Figure 8-1 - Annual allocation, actual use and unused allocation in the Vakhsh River Basin; and streamflow at Rogun Reservoir site.



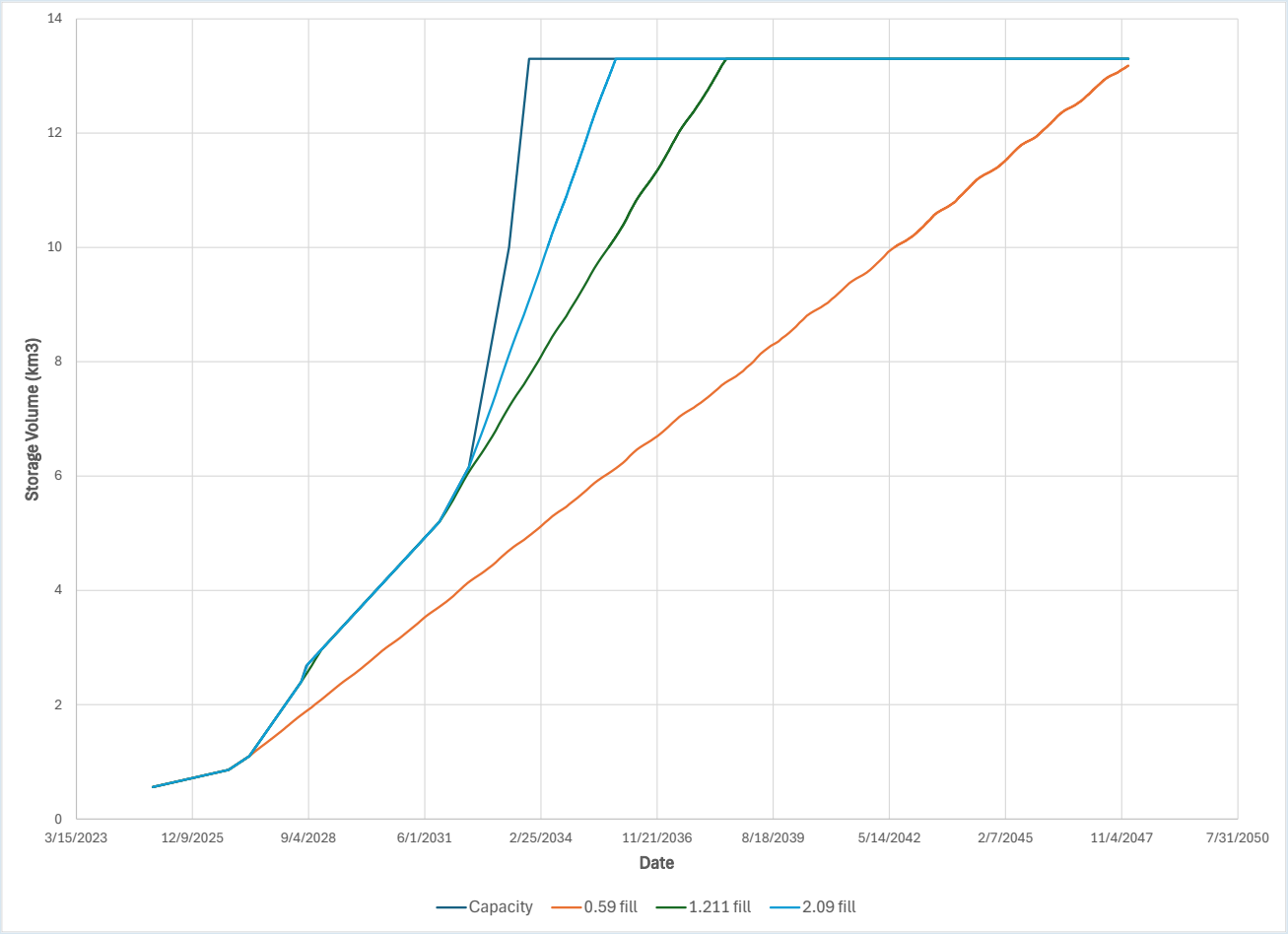
8.1.5. As a sensitivity analysis to assess the impacts of different filling rates, the filling times were estimated for several average differentials, or unused-allocations: a low differential – 0.59 km^{3}/year (5 percentile), the filling rate of 1.211 km^{3}/year (close to the average) used in the TEAS and a high differential 2.09 km^{3}/year (95 percentile). The start water elevation in the reservoir was taken as the 1075 mamsl or 0.56 km^{3} of water that is in storage in the reservoir in January 2025. The balance of the water not used to fill the dam is released downstream to Nurek Reservoir through the turbines and spillways. Nurek Reservoir was operated using the operation rule curve as used in the TEAS and given in **Figure 4-1**.

8.1.6. The simulation model was used to assess:

- The filling times for Rogun Reservoir for the three fill rates.
- The impact of the filling of Rogun Reservoir on the flows in the river reach between Rogun and Nurek reservoirs.
- The impact of the filling of Rogun Reservoir on the releases from Nurek Reservoir.

8.1.7. The simulated trajectories of the water volumes stored in the Rogun Reservoir during filling for the three fill rates are plotted in **Figure 8-2**. The estimated fill dates are by December 2048 (23 years), July 2038 (13 years) and December 2035 (10 years) for the 0.59 km^{3}/yr, 1.211 km^{3}/yr and 2.09 km^{3}/yr respectively.

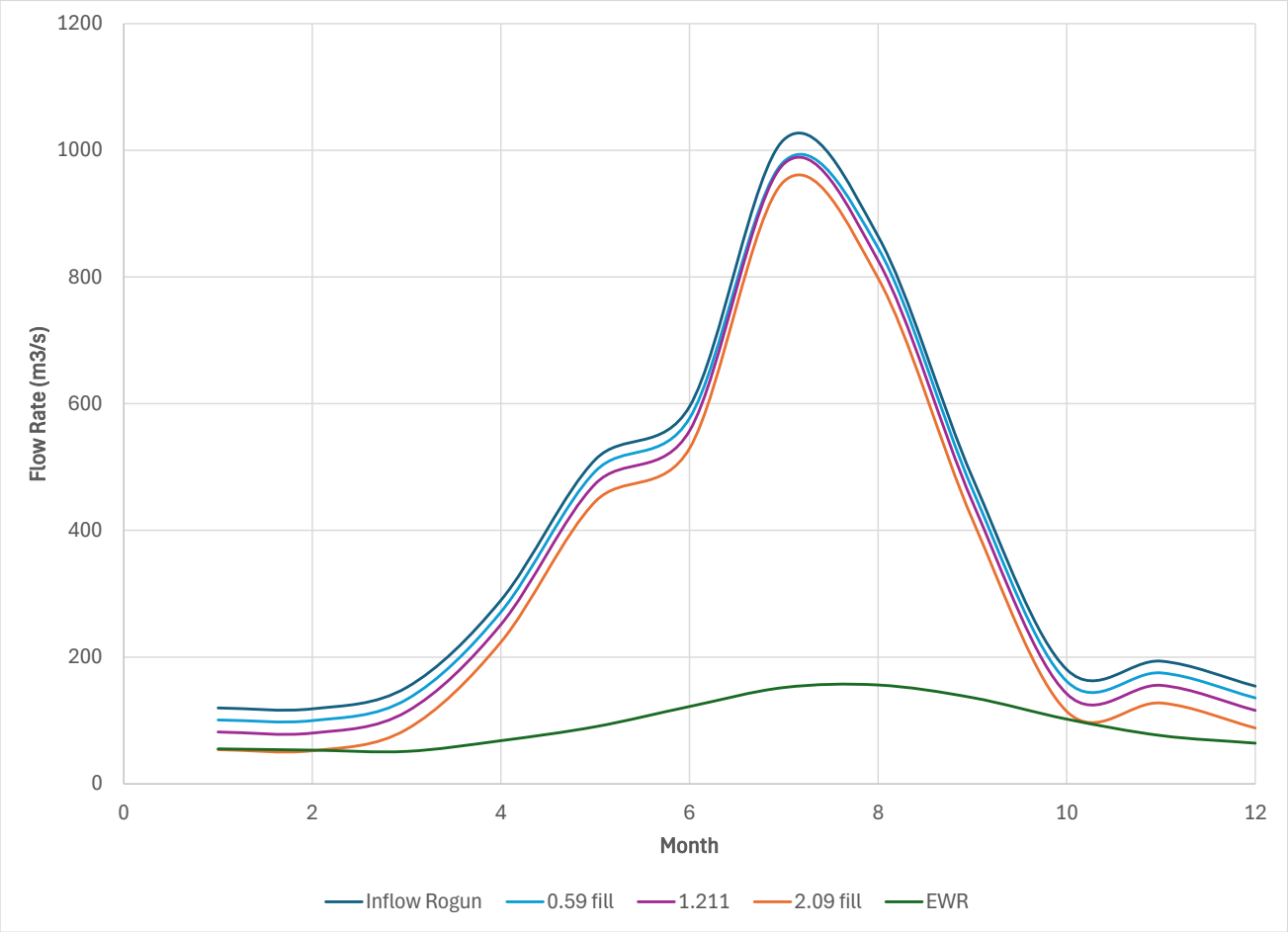
Figure 8-2 - Plot of simulated volumes in storage during filling of Rogun for the three constant filling rates and allowable impoundment as per construction progress.



8.1.8. The water volume available for filling the reservoir is dependent on the differential between the allocation and water use so the actual time to fill will fall between the 23 and 10 years simulated for the low and high fill scenarios. The annual allocation will be calculated based on the protocols and the fill rate will be actively managed by Tajikistan based on the expected use and the allocation.

8.1.9. The model was used to simulate the impact of the different filling rates on the flows discharged from Rogun Reservoir to Nurek. The model was run by time shifting the inflows to Rogun by a year and simulating the flows downstream of Rogun for the three fill rates. The time shifting of the inflows allows for the simulation of the discharges for different inflow sequences to Rogun Reservoir. The inflow volumes exceeding the fill volume were assumed to be released downstream either through the turbines, spillways or flow bypass infrastructure. The minimum downstream flow rate simulated for each month are compared to the minimum inflow rate and the Environmental Water Requirements (EWR) in **Figure 8-3**. The simulations showed that for the three filing rates, the EWR are always met for the reach of the Vakhsh River between Rogun and Nurek Reservoirs.

Figure 8-3 – The minimum simulated flow rates in each month downstream of Rogun for the three fill rates compared to the inflow and EWR flows



8.1.10. The model was applied using the operating rule curve shown in **Figure 4-1** to simulate the flows released from Nurek Reservoir during the filling period for comparison to the flows that would have been released if Rogun Reservoir was not in place. The assessment was done for the inflow sequence with the lowest total volume for the filling duration for the three fill rates. This will give a conservative view of the impact of the filling of Rogun Reservoir on the flows able to be released from Nurek Reservoir. The dates of the selected flow sequences, total runoff volume, average annual total and the minimum annual total over the filling period are listed in Error! Reference source not found..

8.1.11. The percentiles (exceedance percentage) of the releases from Nurek Reservoir with and without Rogun were calculated from the simulation results for the three filing rates. The decrease in the flows due to the filling of Rogun were also calculated and are presented in Error! Reference source not found. together with the percentiles.

8.1.12. The results show the following:

- The volumes that will be released from Nurek are reduced during the filling of Rogun.
- The higher the filling rate the larger the reduction in flows from Nurek Reservoir.
- The percent reduction is the largest for the low flows (95th percentile) during the winter period.

Table 8-3 - Percentiles of simulated releases (m^3/s) from Nurek with and without Rogun for 3 filling rates. (Percentage change shown in brackets)

Filling rates (km^3/yr)	Without Rogun			With Rogun		
	95th percentile	50th percentile	5th percentile	95th percentile	50th percentile	5th percentile
0.59	332	541	1152	313(-5.6%)	526(-2.8%)	1143(-0.7)
1.211	328	532	1125	296(-9.8%)	504(-5.2%)	1110(-1.31%)
2.09	326	522	1124	260(-20.2%)	492(-5.7)	1088(-3.3)

8.1.13. This sensitivity analysis simulations show the order of magnitude of flow reductions below Nurek during the filling period, assuming the impoundment rate is uniform throughout the year. The reduction depends on the filling rate but, if applied uniformly, could significantly affect the 95th percentile low flows for high fill rates. While the discharges from Nurek will be reduced, Tajikistan have agreed not to exceed their allocation in filling the reservoir so on a basin scale, the filling of the reservoir will not affect the flows expected from the Vakhsh River to the downstream river system based on the international agreements. Realistically, most of the impounded volumes are likely to take place during the summer peak flows and when electricity demand is lowest.

9 JOINT OPERATION OF ROGUN AND NUREK

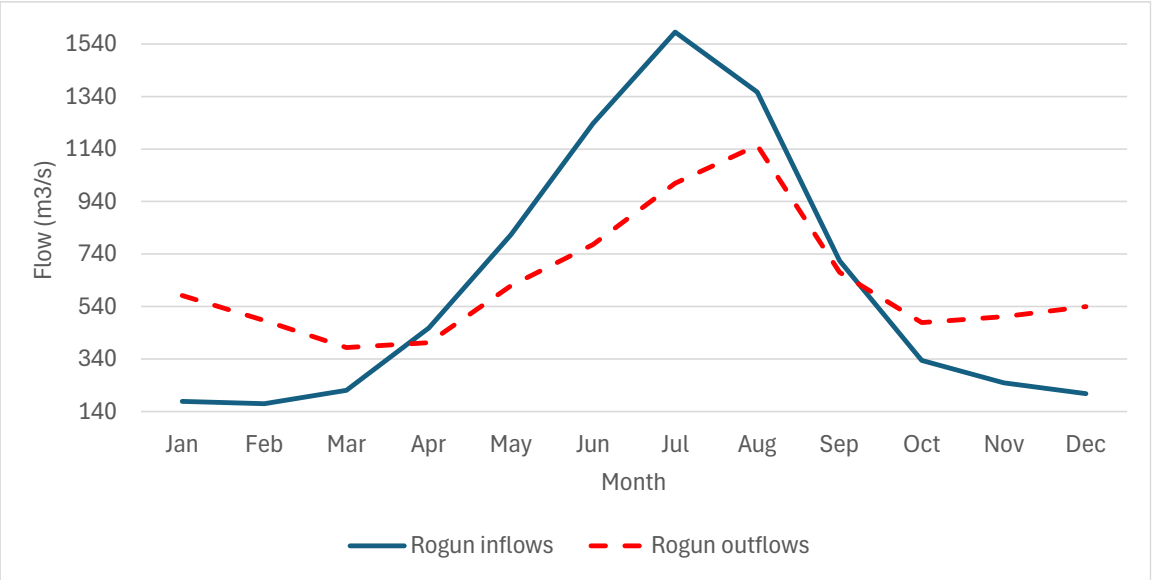
9.1.1. The model was applied to assess the change of flows between Rogun Reservoir and Nurek Reservoir and downstream of Nurek Reservoir after the Rogun Reservoir filling period. The Rogun and Nurek reservoirs are planned to be operated together (OSHPC Barki Tojik, 2013) with Rogun Reservoir providing the regulation and Nurek HPP being operated similar to a run of river HPP. The start volumes in the dams were set at the minimum operating level and the system was simulated from 2025 to 2115. Nurek Reservoir without Rogun Reservoir was also modelled as a base case to simulate the flows downstream of Nurek Reservoir against which to compare the flows downstream of Nurek Reservoir with Rogun Reservoir in place. In the simulations, no allowance was made for maintenance of turbines. It was assumed that the turbines are available all the time.

ASSESSMENT OF FLOW CHANGES BETWEEN ROGUN AND NUREK RESERVOIRS

9.1.2. The simulated flows downstream of Rogun Reservoir are compared to the inflows to assess the changes in flow resulting from Rogun Reservoir HPP. The average monthly inflow and simulated release volumes over the simulation period are plotted in **Figure 9-1**.These changes are not expected to be significantly different under climate change conditions for the next 50 to 100 years, as the main impacts of climate change are expected to be an earlier snowmelt and a shift of the hydrograph towards earlier in the year.

9.1.3. The plot (**Figure 9-1**) shows that the discharges from Rogun Reservoir during the low flow winter months are higher than the natural flows into Rogun Reservoir based on the HPP operating rule. The flows released from Rogun Reservoir during the summer months are reduced as water is stored in the reservoir to maintain the releases during winter required to generate electricity. The overall inflow volume to the reservoir is released but the release pattern is different with flow from the high summer flows stored for release during the winter. The average volume shifted annually from summer to winter was simulated to be 4.2 km^3. This is the current release pattern for Nurek Reservoir with up to 4.5 km^3 shifted from summer to winter. Tajikistan will continue to implement the current operating rules and will not increase the water volume shifted from summer to winter.

Figure 9-1 – Plot of average monthly inflows and outflows from Rogun Reservoir over the simulation period 2025 to 2115

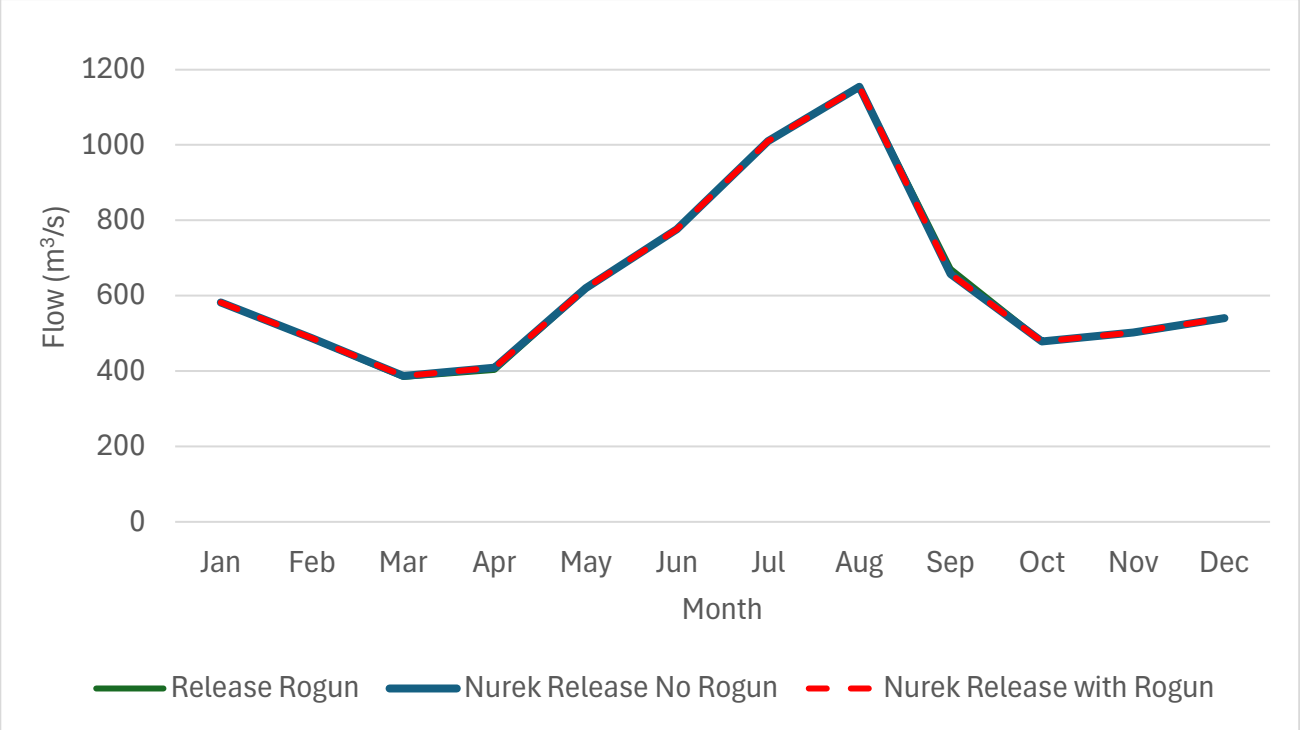


ASSESSMENT OF FLOW CHANGES DOWNSTREAM OF NUREK RESERVOIR

9.1.4. The guiding principle of the operation of the combined Rogun and Nurek reservoirs is that the flow regime below Nurek is not expected to change from the historical period, given that Tajikistan has committed to not shift more than 4.2 km^3/year from summer to winter. This is the amount historically shifted by Nurek operations (emptying itself in winter, and being refilled in summer, by the amount of 4.2 km^3/year). This commitment from Tajikistan is reflected in the minutes of riparian consultations as well as in the financing agreement as per the obligation to comply at all times with the water sharing agreements (which include the national water allocations and the seasonally agreed deliveries) and avoiding significant harm downstream. Thus, after impoundment, the presence and operation of Rogun is likely to be invisible to downstream countries, given that the flow regime downstream of Nurek will not change from the historical period.

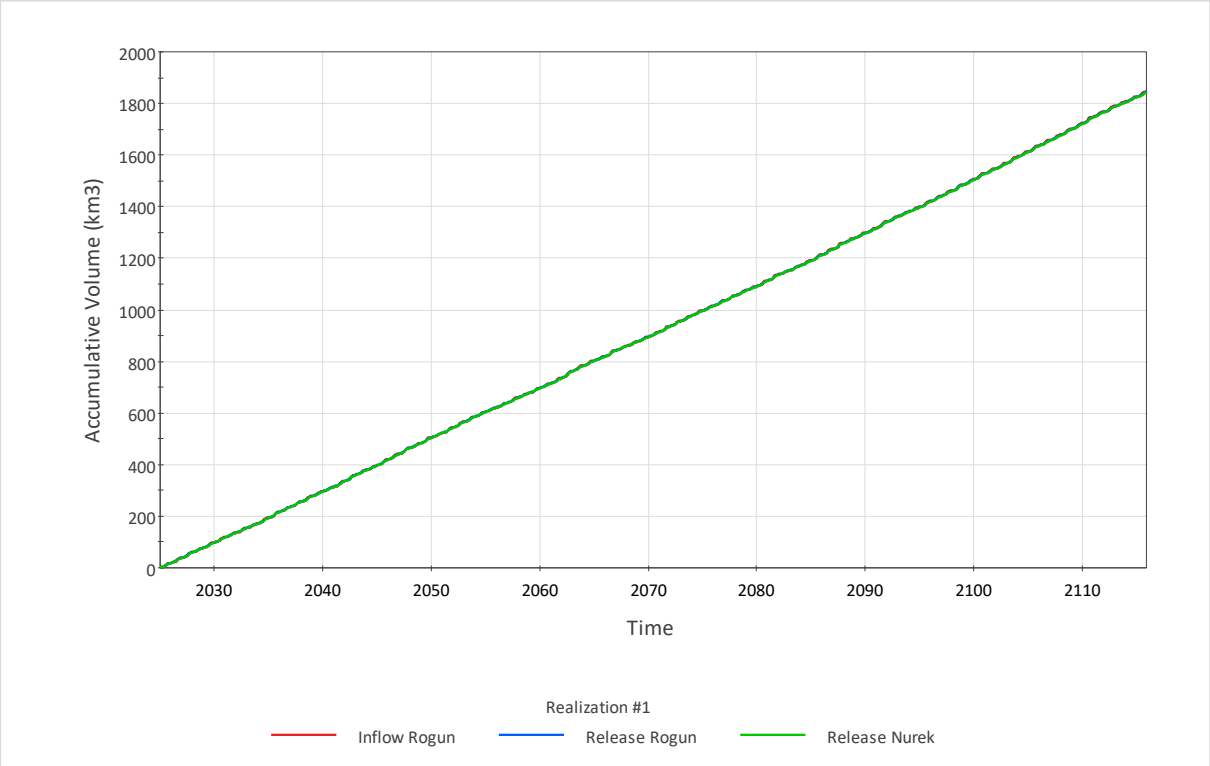
9.1.5. The flows released from Nurek Reservoir without Rogun and with Rogun Reservoir in place were simulated. A plot of the median of the monthly flows for the two cases are compared in **Figure 9-2**. The plot shows that the inflow to Nurek from Rogun is released without any changes in the flow pattern indicating that Nurek is being used as a run of river HPP. The median of the simulated releases from Nurek with and without Rogun Reservoir in place are the same. This is due to the Nurek operating rule curve continuing to be applied to Nurek with releases being made from Rogun to keep Nurek full so that Nurek is operated as a run of river HPP. The simulations show that based on the operating rules, the impact of Rogun on the median flows downstream of Nurek is insignificant.

Figure 9-2 – Median of simulated releases from Nurek Reservoir with and without Rogun Reservoir in place



9.1.6. A plot of the accumulative water volume flowing into Rogun, released from Rogun and released from Nurek is shown in **Figure 9-3**. The plot shows that the total volume of water entering Rogun is released from Nurek over the simulation period.

Figure 9-3 - Plot of accumulative volume flowing into Rogun, released from Rogun and from Nurek Reservoirs



10 CONCLUSIONS

10.1.1. The following conclusions can be made as a result of this study:

- A simulation model was built of the Rogun and Nurek Reservoirs. The model was applied to simulate the Nurek Reservoir releases based on the operating rule curve given in the TEAS, which is designed to ensure Tajikistan meets its obligations under international agreements. The model results compared favourably with those of the TEAS. The model calibration was therefore considered adequate to use in assessing flow changes due to the filling and operation of Rogun Reservoir.
- The filling of Rogun will not be at a constant rate each year, as it will depend on the river flows and the agreed water allocation for each particular year. As a sensitivity analysis, model simulations were performed to assess the filling time of Rogun Reservoir for filling rates of 0.59 km^3/year (low), 1.211 km^3/year (TEAS) and 2.09 km^3/year (high). The estimated time of filling for the three fill rates is 2047 (23 years), 2037 (13 years) and 2034 (10 years) for the low, TEAS and high filling rates respectively. The flows discharged from Rogun Reservoir will be reduced during the filling period but the EWR are still met for all the filling rates simulated.
- The releases from Nurek Reservoir will be reduced during the filling period. The reduction depends on the filling rate. The higher the filling rate the larger the reduction but the shorter the time period. Tajikistan will use the difference between their allocation determined under the international water sharing agreements and the estimated use of the allocation as the fill volume. While the discharges from Nurek will be reduced, Tajikistan have agreed not to exceed their allocation in filling the reservoir so on a basin scale, the filling of the reservoir will not affect the flows expected from the Vakhsh River to the downstream river system based on the international agreements.
- During operations, the flow pattern in the river reach between Rogun and Nurek Reservoirs is changed due to the HPP operating rule. The high summer flows are reduced, and water is stored in Rogun for release during winter. The winter flows will be higher udue to the energy generation requirements. This flow pattern currently downstream of Nurek will continue to be the case with Rogun Reservoir in place.
- The simulations showed that the proposed operation of Nurek and Rogun reservoirs will not impact flows downstream from Nurek. The current discharge pattern will be maintained with the shift of a maximum of 4.5 km^3 of water annually from summer to the winter months.

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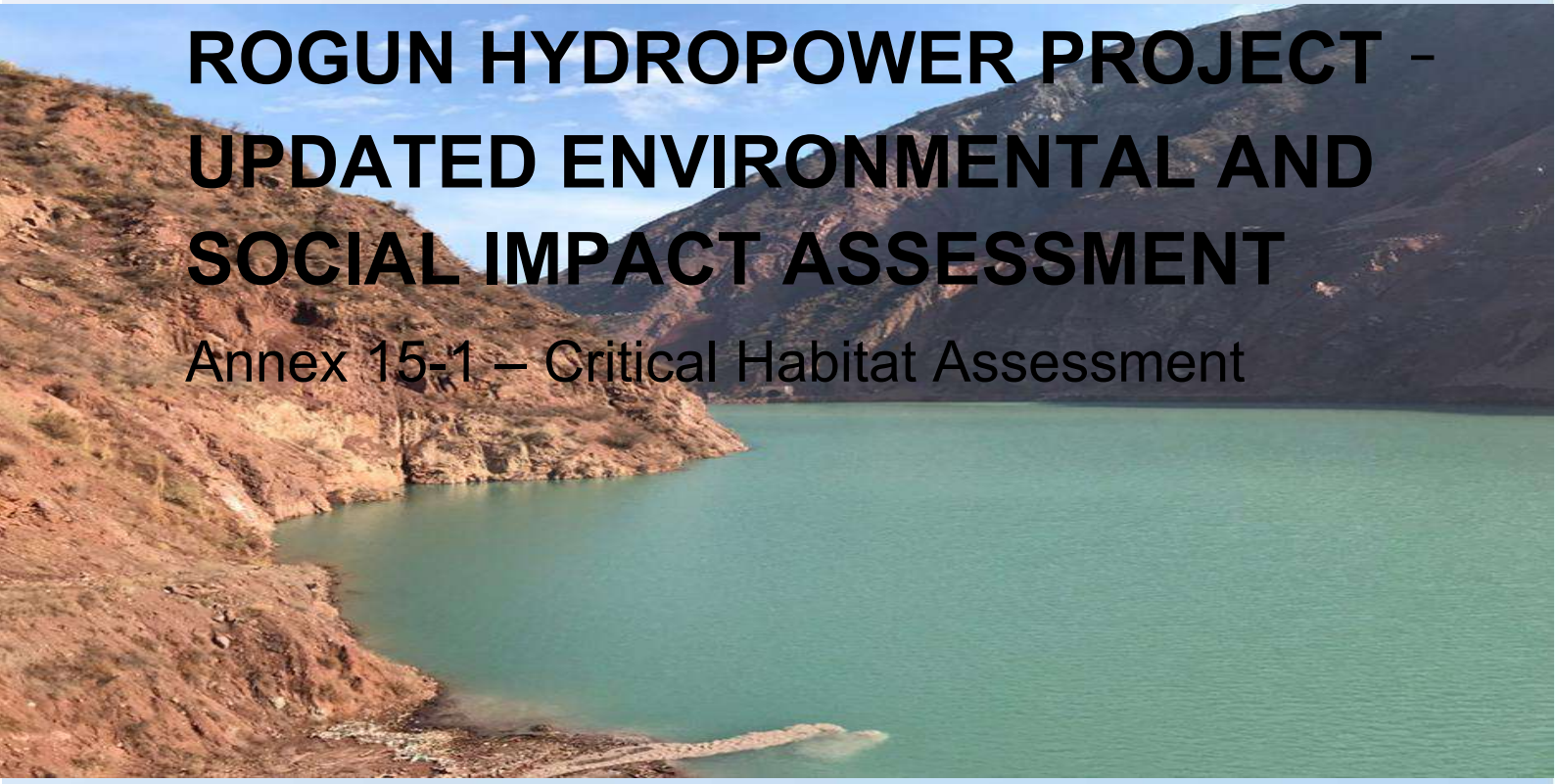
APPENDIX TITLE

PUBLIC

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

Annex 15-1 – Critical Habitat Assessment

MAY 2025

PUBLIC

PUBLIC

PROJECT NUMBER

PROJECT REF

DATE: MAY 2025

QUALITY CONTROL

CONTENTS

1 INTRODUCTION 1

1.2 WORLD BANK ESS6 1
1.3 THE PROJECT 1

2 METHODOLOGY 3

2.1 THE CRITICAL HABITAT ASSESSMENT PROCESS 3
2.2 CRITICAL HABITAT CRITERIA 4
2.3 NATURAL HABITAT IDENTIFICATION 7
2.4 DATA SOURCES 7
2.5 LIMITATIONS 8
2.6 COMPLIANCE WITH ESS6 9

3 CRITICAL HABITAT DETERMINATION 11

3.1 CANDIDATE LIST OF BIODIVERSITY RECEPTORS 11
3.2 SCREENING SUMMARY 33
3.3 SUMMARY 47

4 ESS6 COMPLIANCE REVIEW 48

4.1 INTRODUCTION 48

5 MITIGATION PROPOSALS 52

5.2 CONCLUSIONS 52

6 REFERENCES 53

TABLES

Table 2-1 - Critical Habitat Thresholds 5

Table 2-2- Inventory of Data Sources 7

Table 2-3 - ESS6 Conditions for Working Within Critical Habitat / Natural Habitat 9

Table 3-1 - Critical Habitat Criteria - Screening Factors 11

Table 3-2 - Critical Habitat Screening Table 12

Table 3-3 - Small Amu-Darya shovelnose sturgeon (*Pseudoscaphirhynchus hermanni*) 34

Table 3-4 - Amu Darya Shovelnose Sturgeon (*Pseudoscaphirhynchus kaufmanni*) 36

Table 3-5 - Aral Bulltrout (*Salmo trutta spp aralensis*) 38

Table 3-6 - Aral Barbel (*Luciobarbus brachycephalus*) 40

Table 3-7 - Bulatmai Barbel (*Luciobarbus capito*) 41

Table 3-8 – Egyptian vulture 42

Table 3-9 – Saker Falcon 43

Table 3-10 - Nationally Threatened Plants 44

Table 3-11 - Sarykhosorsky Nature Refuge 46

Table 3-12 - Nurek State Complex Area 47

Table 4-1 – Natural Habitat Compliance Screening 48

Table 4-2 - ESS6 Compliance Review Table 49

Table 5-1 – Mitigation Summary 52

FIGURES

Figure A-1 - EAAA - Aquatic Species 57

Figure A-2 - EAAA - Egyptian Vulture 58

Figure A-3 - EAAA - Notable Flora 59

Figure A-4 - EAAA - *Vitex-agnus castus* 60

Figure A-5 - EAAA - Sarykhosorsky Nature Refuge 61

Figure A-6 - EAAA - Nurek State Complex Area 62

1 INTRODUCTION

1.1.1. This Annex provides an assessment of the nature and extent of Critical Habitat relevant to the Project, together with an assessment of the Project against the requirements of World Bank's Environmental and Social Standard 6 (ESS6). It has the following aims:

- To identify biodiversity that would qualify as Critical Habitat (as defined under ESS6);
- Assess the implications of Critical Habitat on the Project; and
- Outline the mitigation measures required for the Project to progress in line with ESS6.

1.1.2. The report also identifies and defines areas of Natural Habitat, working through a similar process to ensure ongoing Project compliance with World Bank ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

1.2 WORLD BANK ESS6

1.2.1. ESS6 has four specific objectives:

- to protect and conserve biodiversity and habitats;
- to apply the mitigation hierarchy (as set out in ESS1) and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity;
- to promote the sustainable management of living natural resources; and
- to support livelihoods of local communities, including Indigenous Peoples, and inclusive economic development, through the adoption of practices that integrate conservation needs and development priorities.

1.2.2. ESS6 is applied to a project based upon the perceived risks to biodiversity, ecosystem services, and natural resources, which are screened as part of the risks and impacts identification process as set out in ESS1.

1.2.3. Under ESS6, habitats are classified as either Natural or Modified Habitats, based upon the level of human influence that has occurred.

1.2.4. Modified habitats are areas that may contain a large proportion of plant and/or animal species of nonnative origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

1.2.5. 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 eco

1.2.6. Critical Habitats being a subset of either of these habitat types that reflects the most significant biodiversity values.

1.3 THE PROJECT

1.3.1. A full Project description is provided with **Volume 1, Chapter 3** of the ESIA. However, to provide context for the reader, a summary is included as follows.

1.3.2. The Project comprises a partially completed rock-filled dam across the Vakhsh River together with the filling of the reservoir up until the maximum inundation level (i.e. to 1,290 m – hereafter referred to as the 'flooding zone'), along with other Project components such as new roads and stockpiling

areas. Consequently, this Critical Habitat Assessment (CHA) has been conducted within the context of a heavily modified landscape.

1.3.3. The timeline for completion of the Project and flooding of the reservoir to maximum inundation level (1290m) is currently 2038.

2 METHODOLOGY

2.1 THE CRITICAL HABITAT ASSESSMENT PROCESS

2.1.1. The CHA process assesses the importance of a defined area to one or more biodiversity receptors that meet the requirements of ESS6 in terms of Critical Habitat.

2.1.2. Determining the presence of Critical Habitat/Natural Habitat is a process that is explicitly separate from any consideration of a project's impacts, mitigation strategy, etc. The only influence of a project on the CHA process is for identification of the location and extent of the area to be assessed. This is determined by the Project's Area of Influence (AoI).

2.1.3. The AoI is the area over which impacts from the Project could legitimately be expected to occur. This is described fully within **Volume 1, Chapter 15: Biodiversity** of this ESIA.

2.1.4. To assist with the determination of Critical Habitat and Natural Habitat, the guidance described within updated ESS6 Guidance Note 6 has been followed (World Bank, 2018). This has been supplemented through explicit reference to International Finance Corporation (IFC) Performance Standard 6 with regards criteria thresholds for defining Critical Habitat (IFC, 2019).

2.1.5. ESS6 defines Critical Habitat/Natural Habitat as:

- Critical Habitats fall into one (or more) of the following categories:
  a. Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;
  b. Habitat of significant importance to endemic or restricted-range species;
  c. Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;
  d. Highly threatened or unique ecosystems; and
  e. Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

2.1.6. This CHA will also consider the presence of Natural Habitat, which is defined as 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.

2.1.7. Any habitat that triggers one (or more) of the above will result in Critical Habitat/Natural Habitat being classified (as such, features being considered against the above criteria are referred to as potential Critical Habitat or Natural Habitat 'triggers').

2.1.8. ESS6 makes explicit reference to International Finance Corporation's Performance Standard 6 (PS6) to assist in implementing ESS6; as such, the systematic process to undertaking CHA, comprising four steps, is used here to frame this report.

STEP 1 – DEFINE THE STUDY AREA

2.1.9. It is necessary for an appropriately defined area to be assessed for the presence of Critical Habitat and Natural Habitat. IFC PS6 and other similar guidance refers to an 'ecological appropriate area of analysis' (EAAA), which is the wider distribution of a feature or receptor (often at a landscape level)

within which there is connectivity between the ecological process that supports the feature or receptor. The EAAA is used throughout this report as the basis for the application of each of the criteria thresholds to determine Critical Habitat.

2.1.10. Defining an EAAA is an important step in the CHA process as it ensures assessment of an ecologically relevant feature or area, rather than an area influenced only by the project footprint. It also has inherent appreciation of ecological function across an area, and therefore avoids the risk of considering the specific areas in which a Critical Habitat trigger may be present discontinuously or seasonally.

2.1.11. EAAAs should be identified separately for each individual biodiversity receptor being assessed during the CHA process.

STEP 2 – STAKEHOLDER CONSULTATION AND INITIAL DESKTOP REVIEW OF AVAILABLE DATA

2.1.12. Step 2 is a screening process designed to identify features that may trigger Critical Habitat/Natural Habitat. This is done through consultation with relevant stakeholders and a review of data and published literature. At this stage, use of the Integrated Biodiversity Assessment Tool (IBAT) is recommended.

STEP 3 – VERIFICATION OF BIODIVERSITY PRESENT

2.1.13. This includes baseline fieldwork to confirm and engagement with relevant stakeholders/specialists to finalize the list of biodiversity features within the AoI.

STEP 4 – CRITICAL HABITAT DETERMINATION

2.1.14. This comprises quantitative and qualitative screening of confirmed biodiversity elements against critical habitat criteria defined in 2.2.

2.2 CRITICAL HABITAT CRITERIA

2.2.1. Following PS6 guidance, the assessment of each biodiversity receptor against the Critical Habitat criteria makes use of both qualitative and quantitative thresholds and these are detailed in IFC (2019). In the interests of clarity, the alpha-numeric codes reflect PS6 criteria from this point forward.

Table 2-1 - Critical Habitat Thresholds

Criterion	Threshold
1 Threatened species	
Species listed as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU), including consideration of national/reginal lists also.	(a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species). (b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a). (c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species (taken as species listed as EN or CR on the Red Book of Tajikistan).
2 Endemic/range-restricted species	
Species with limited Extent of Occurrence (EOO), as follows: - For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO less than 50,000 square kilometers (km2). - For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km2. - For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to 500 km linear geographic span (i.e., the	(a) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.

Criterion	Threshold
distance between occupied locations furthest apart).	
3 Migratory/congregatory species	
Species for which a significant proportion of the population cyclically and predictably moves from one geographical area to another and/or gathers in large groups on a cyclical or otherwise regular and/ predictable basis.	(a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. (b) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.
4 Threatened habitats	
Habitats that are threatened at a relevant geographical scale	(a) Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. (b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.
5 Supporting functions required to support 1-4	
Habitats that play a significant role in functioning of areas sufficient to support any of the features covered by the above criteria.	Based upon expert opinion.

2.3 NATURAL HABITAT IDENTIFICATION

2.3.1. Classification of Natural Habitats relies upon a more qualitative approach, with areas defined as Natural Habitats being *'…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*.'

2.3.2. Given the more qualitative approach to defining Natural Habitat, the process can include consultation with relevant expert stakeholders. In the absence of quantitative thresholds, definition of Natural Habitat includes all necessary evidence/justification and considers the habitat value in isolation, together with the presence of viable species assemblages dependent on the functioning of that habitat when classifying an area as Natural Habitat.

2.3.3. Natural Habitats will be discussed alongside the CHA findings throughout this report.

2.4 DATA SOURCES

2.4.1. This CHA is based upon a range of data collected specifically to inform this study, as well as existing information collated from a wide range of published literature as detailed in **Table 2-2**. Much of this has been presented within this Environmental and Social Impact Assessment (ESIA), which should be read alongside this report.

Table 2-2- Inventory of Data Sources

Data Source	Relevant Organisations	Details
IBAT Report	IBAT-alliance.org	PS6 and ESS6 Report generated on **25th May 2023.** The report identified a range of potential Critical Habitat triggers and concluded the Project search area was 'likely' to overlap within Critical Habitat. However, the Critical Habitat Assessment (CHA) supported by stakeholder consultation and field data confirmed that the critical habitat is out side the project AoI.
2014 EIA	n/a	The 2014 ESIA was reviewed as part of the overall biodiversity input to this Project, in particular to inform understanding of the biodiversity baseline.
2023 desk study	WSP; In-country biodiversity support team	Various published literature resources were reviewed to inform the overall biodiversity input to the Project.
2023 field survey report - spring	In-country biodiversity support team	Results of the surveys undertaken in April/May 2023.

Data Source	Relevant Organisations	Details
2023 field survey report - autumn	WSP biodiversity specialist In-country biodiversity support team	The CHA has been informed by additional site visits/surveys undertaken in September - November 2023.
Project ESIA	WSP	**Volume 1: Chapter 15** of this ESIA produced for this Project.
Literature review	WSP/ In-country biodiversity support team	A detailed literature review has been undertaken in support of the biodiversity input to the Project (including specifically this CHA). Referenced where used.
e-bird	www.ebird.org	Online resource for global bird records.
IUCN Red List	www.iucnredlist.org	Online resource for species occurrence and global conservation status.
Ad hoc stakeholder consultation/liaison	Flora & Fauna International (FFI); Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Discussions with organisations involved in conservation initiatives across Tajikistan.

EXPERT STAKEHOLDER ENGAGEMENT

2.4.2. A vital part of the CHA process is engagement with, and ongoing involvement of, relevant external experts. There are limited active biodiversity organisations operating in Tajikistan (e.g., there is no national Birdlife International partner organisation); however, the survey team involved in data collection comprises esteemed academics and those with abundant experience of Tajik biodiversity.

2.5 LIMITATIONS

2.5.1. There are areas of the AoI that are difficult to survey because access is challenging and or the health and safety of field researchers could be compromised. Consequently, for some terrestrial species groups, most notably bats, the level of survey effort has been lower than would be expected to fully align with Good International Industry Practice (GIIP). To appropriately address this limitation, a precautionary approach has been taken to the assessment in places and this is referenced accordingly.

2.5.2. With regards the aquatic biodiversity baseline, there were significant constraints to completing 'traditional' survey effort within the Project AoI as described above. To address this, eDNA analysis was incorporated into the study design.

2.6 COMPLIANCE WITH ESS6

2.6.1. The principles of ESS6 seek to avoid impacts to biodiversity, and in particular impacts to biodiversity of high value. It is recognised that in some circumstances, development may be appropriate within such areas, although only when supported by robust justification, sufficient mitigation, and reasoned assessment.

2.6.2. Upon determination of Critical Habitat and Natural Habitat, it is necessary to review the Project compliance with ESS6. For projects potentially adversely affecting such features, ESS6 has several explicit conditions, all of which need to be met to demonstrate project compliance. These conditions are listed within **Table 2-3**.

2.6.3. Due consideration has also been given to other relevant Lender standards, in particular European Investment Bank (EIB) Standard 4 – Biodiversity and Ecosystems. Critical Habitats are similarly assessed as per ESS6, although the inclusion of IUCN VU species is at a slightly lower level, with 'significant concentrations' of such species being required to trigger Critical Habitat, rather than just those for which losses may result in the change of IUCN Red List classification (as explicitly the case for ESS6). Standard 4 classifies 'high-value biodiversity', which can be assumed to align with Natural Habitats as per ESS6. On this basis, no material distinction between applicable Lender standards is made within this CHA unless otherwise stated.

Table 2-3 - ESS6 Conditions for Working Within Critical Habitat / Natural Habitat

Critical Habitat – Conditions	Natural Habitat – Conditions
No other viable alternatives within the region exist for development of the project in habitats of lesser biodiversity value.	There are no technically and financially feasible alternatives.
All due process required under international obligations or national law that is a prerequisite to a country granting approval for project activities in or adjacent to a critical habitat has been complied with.	-
The potential adverse impacts, or likelihood of such, on the habitat will not lead to measurable net reduction or negative change in those biodiversity values for which the critical habitat was designated.	-
The project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered, or restricted-range species, over a reasonable time period.	-
The project will not involve significant conversion or significant degradation of critical habitats. In circumstances where the project involves new or	-

Critical Habitat – Conditions	Natural Habitat – Conditions
renewed forestry or agricultural plantations, it will not convert or degrade any critical habitat.	
The project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.	Appropriate mitigation measures are put in place, in accordance with the mitigation hierarchy, to achieve no net loss and, where feasible, preferably a net gain of biodiversity over the long term. When residual impacts remain despite best efforts to avoid, minimise and mitigate impacts, and where appropriate and supported by relevant stakeholders, mitigation measures may include biodiversity offsets adhering to the principle of "like-for-like or better."
A robust and appropriately designed, long-term biodiversity monitoring and evaluation program aimed at assessing the status of the critical habitat is integrated into the Borrower's management program.	-

3 CRITICAL HABITAT DETERMINATION

3.1 CANDIDATE LIST OF BIODIVERSITY RECEPTORS

3.1.1. This CHA focusses on biodiversity receptors identified during the baseline data collection process as present/potentially present within the AoI, with sources summarised in **Table 2-2**, which are considered to have the potential to trigger Critical Habitat or Natural Habitat. Receptors were screened against the various Critical Habitat criteria, in consideration of the following factors as per **Table 3-1**.

3.1.2. These biodiversity receptors identified in **Table 2-2** are listed in **Table 3-2** together with the reason for their inclusion or exclusion. An assessment of Critical Habitat against each of the 'screened in' candidate receptors is provided in **Section 4**.

Table 3-1 - Critical Habitat Criteria - Screening Factors

Critical Habitat Criteria	Factors considered
Threatened species	All species of IUCN Red List VU or higher screened in. All TRB[1] species listed as EN or CR screened in.
Endemic/range-restricted species	Any species listed within the IBAT report as being endemic or range-restricted Endemic/range-restricted species as listed within other published literature (such as TRB)
Migratory/Congregatory species	All migratory birds were considered Fish were screened against Convention on the Conservation of Migratory Species of Wild Animals (www.cms.int)
Threatened habitats	All habitats were considered for their scarcity, mainly derived through the ESIA risk screening process; those which displayed 'Natural habitat' characteristics were screened in. Any protected area and internationally recognised area were screened in.
Evolutionary processes	Any areas as flagged through desk study, consultation with stakeholders, etc.

[1] Red Book of Tajikistan: Committee for Environmental Protection. 2017. The Red Book of Tajikistan Second Edition. Volume 1: Flora.

Table 3-2 - Critical Habitat Screening Table

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
FLORA										
Tulip sp.	*Tulipa orithyioides*	IBAT		X				Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously). Its habitat preferences are generally those dominated by stone/gravels at an altitude above that of the Project (GBIF, 2023). No mention in accepted flora lists for the country (e.g. Nowak & Nobis 2020).	-	-
Tulip sp.	*Tulipa praestans*	TRB					TRB CR	Screened in: Identified from the desk study as potentially present within the AoI, and a small population confirmed during the 2023 surveys.	1c	-
Allium sp.	*Allium stipitatum*	TRB					TRB EN	Screened in: Identified from the desk study as potentially present within the AoI.	1c	-
Allium sp.	*Allium rosenbachianum*	DS/FS						Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously). Its habitat preferences are	-	-

[2] Includes migratory species, TRB status.

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								shaded habitats (including cliffs and wooded areas) and north-facing limestone slopes, at an altitude predominately above that of the Project (GBIF, 2023).		
Allium sp.	*Allium suworowii*	DS/FS						Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously). Its habitat preferences are varied but it is not tolerant of grazing pressures. It is more often found at altitude above that of the Project (TRB).	-	-
Orchid sp.	*Juno nicolai*	TRB					TRB EN	Screened in: Identified from the desk study as potentially present within the AoI, and a small population confirmed during the 2023 surveys.	1c	-
Crocus sp.	*Crocus korolkowii*	TRB					TRB EN	Screened in: Identified from the desk study as potentially present within the AoI, and a small population confirmed during the 2023 surveys.	1c	-
Fritillary sp.	*Fritillaria eduardii*	TRB					TRB CR	Screened in: Identified from the desk study as potentially present within the AoI, and a small population confirmed during the 2023 surveys.	1c	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Fennel sp.	*Ferula tadshikorum*	DS/FS					TRB EN	Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously). Closest known records are c. 2.5km north, with some records from near Nurek also (GBIF, 2024). Listed as Least Concern (LC) within Nowak & Nobis (2020).	-	-
Bellflower sp.	*Ostrowskia magnifica*	DS/FS					TRB CR	Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously); closest known records are c. 3.5km north of the AoI and it prefers sparsely forested areas with open grassland habitat at an altitude generally above that of the Project (i.e. 1200-2300m). Listed as Least Concern (LC) within Nowak & Nobis (2020).	-	-
Iris sp.	*Iris hoogiana*	DS/FS					TRB EN	Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously). Its habitat preferences are grassy slopes on well-drained soils at an altitude above that of the Project (GBIF, 2024, TRB). Listed as Least Concern (LC) within Nowak & Nobis (2020).	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Tulip sp.	*Tulipa korolkowii*	DS/FS					TRB EN	Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously), with closest known record being c. 2km north of the AoI. Its habitat preferences are generally grassy areas of gravelly slopes (GBIF, 2023, TRB); any such areas have been heavily impacted by grazing across the AoI, reducing suitability here.	-	-
Anemone sp.	*Anemone bucharica*	DS/FS					TRB EN	Screened out: None known from Project AoI, from either desk or field study exercises (both during 2023 and previously). It is susceptible to grazing pressures (TRB) and so likely much reduced presence within the Vakhsh River valley on this basis. Listed as Least Concern (LC) within Nowak & Nobis (2020).	-	-
Chaste Tree	*Vitex agnus-castus*	TRB					TRB CR	Screened in: Identified from the desk study as potentially present within the AoI, and a small population confirmed during the 2023 surveys.	1c	-
MAMMALS										

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Least weasel	*Mustela nivalis*	DS/FS					TRB EN	Screened out: Widespread species across Tajikistan with a hugely varied habitat tolerance. Two records obtained during 2023 desk/field studies, with no indication of any importance of the AoI to this species, especially when considering its widespread distribution.	-	-
Tiger	*Panthera tigris*	IBAT		X			TRB EX	Screened out: The Caspian tiger is an extinct sub-species previously present within the region.	-	-
Snow leopard	*Panthera uncia*	DS		X			TRB EN	Screened out: No known presence across the AoI, and habitat preferences (in particular altitude at which this species lives) is outside of the AoI. Desk study records obtained from c. 2.5km south-east of the AoI.	-	-
HERPTILES										
Asian tortoise	*Testudo horsfieldii*	DS			X			Screened out: Not recorded during surveys, although habitat is considered broadly suitable for the species given its wide habitat tolerances and its presence cannot be ruled out. However, given its stable global (and Tajikistan) population and the small population size across the AoI, there is no possibility of impacts resulting in a	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								change in IUCN Red List status as would be required under Criterion 1b.		
Tajikistan even-fingered gecko	*Alsophylax tadjikiensis*	IBAT	X				TRB EN	Screened out: Records for this species only exist for the south-west of Tajikistan (CEP 2017), beyond the Project AoI.	-	-
Central Asian pond frog	*Pelophylax terentievi*	IBAT				RR		Screened out: Whilst little is known about this species, it is not thought to be rare (AmphibiaWeb, 2000) and was not recorded during 2023 field surveys, or from the eDNA samples. The closest known records are from Obigarm, in puddles/swamp habitat near hot springs.	-	-
Orange-tailed skink	*Eumeces schneiderii*						TRB EN	Screened out: Recorded outside of the AoI during 2023 field surveys and has a preference for areas with dense vegetation (mostly lacking across the AoI). Whilst potentially present, more suitable areas exist elsewhere in the country (and the TRB notes several protected areas as being key for this species), with no indication of particular importance for this species within the AoI.	-	-
Tartar sand boa	*Eryx tataricus*						TRB EN	Screened out: Recorded twice during 2023 surveys, both outside of the AoI.	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								Some suitable habitat is present across the AoI (the species has a diverse habitat tolerance), but no indication that the AoI offers conditions that would support a significant population of this species.		
INVERTEBRATES										
Mollusc	*Armiger schamaricus*	IBAT				RR		Screened out: Not known from vicinity of the Project (closest records are from approximately 50km to the east), although known to be data deficient. Habitat preference is permanent lake features and so limited habitat suitability within AoI.	-	-
Mollusc	*Polypylis almaatina*	IBAT				RR		Screened out: Not known from vicinity of the Project, with the closest confirmed record being east of Almaty in Kazakhstan. Furthermore, the habitat preference of the genus is known to comprise still and slow-moving waterbodies, which are absent from the AoI.	-	-
Darvaz grasshopper	*Chorthippus darvazicus*	IBAT				RR		Screened out: The species is restricted to an c. 30km south-east of the Project and therefore outwith the AoI (Hochkirch, *et.al.*, 2019). Furthermore, the habitat preferences (subalpine	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								meadows and grasslands with *Artemisia* sp.) were not recorded during baseline studies.		
BIRDS										
White-headed duck	*Oxyura leucocephala*	IBAT		X				Screened out: there have been no confirmed records of this species in Tajikistan for over 50 years (based on reporting in Li Zuo Wei & Mundkur, 2003).	-	-
Common pochard	*Aythya ferina*	FS			x			Screened out: A total of 37 birds were observed during surveys in October and November 2023, with no other records from the baseline studies. The species is a passage visitor to the region and have no particular association with the AoI (i.e. given the broad front migration that occurs here, and in accordance with emerging guidance of categorising airspace as Critical Habitat (IFC 2024)), and given the small numbers recorded (within the context of a global population of 760,000 individuals (Birdlife, 2021)) there is no possibility of impacts resulting in a change in IUCN Red List status as would be required under Criterion 1b..	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Turtle dove	*Streptopelia turtur*	DS			x			Screened out: Not recorded during 2023 surveys, and although likely considered present in low numbers, there is no reasonable possibility of this being at numbers that would impact the conservation status at a global level (the current population is listed at 12,800,00 individuals (IUCN, 2019)).	-	-
Pallas's fish eagle	*Haliaeetus leucoryphus*	IBAT		X				Screened out: No known records from Project AoI. Habitat here is sub-optimal, with species having a close association with wetland and mature forest habitats.	-	-
Egyptian vulture	*Neophron percnopterus*	IBAT, TRB		X			TRB EN	Screened in: Summer visitor to the region (including Project AoI); recorded during 2023 surveys (two individuals in spring and c. 15 during autumn surveys). The Tajikistan population is thought to number <30 pairs in total (CEP, 2017), although no nest sites/breeding territories identified within the AoI. On this basis, there is the possibility that the AoI supports an important concentration of this Tajik Red Book EN species. With regards the global population, the lower range estimate population for the	1c	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								species is 12400 individuals (BirdLife International, 2021), which would require an EAAA population of c.62 birds in order to trigger Critical Habitat under criterion 1a. Given the aforementioned national population number, together with baseline information for this species, this is not considered likely and therefore is screened out against that criterion.		
Saker falcon	*Falco cherrug*	IBAT, TRB		X			TRB EN	Screened in: Summer visitor to the region (including Project AoI); recorded during 2023 surveys (two individuals). The lower range global population estimate is 12200 individuals, while the Tajikistan population is thought to number up to 30 pairs in total (CEP 2017) (c. 0.25%). On this basis, there is no possibility of the population within the Project AoI reaching the required level of 0.5%; however it is included given the possibility that the AoI supports an important concentration of this Tajik Red Book EN species.	1c	-
Sociable lapwing	*Vanellus gregarius*	IBAT	X					Screened out: No confirmed presence within Project AoI, and limited information on numbers throughout Tajikistan in general (i.e. it is absent from the Red Book of Tajikistan). It is a passage migrant to the wider region.	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Short-toed snake eagle	*Circaetus gallicus*	DS					TRB EN	Screened out: No records from field surveys in 2023 (or 2014) although given the species' varied habitat tolerances and likely foraging range of >10km (based on review of information for proxy species of eagle such as golden eagle), it is unlikely the AoI supports a significant population of this species. Additionally, the species is mainly tree-nesting, and such nesting resource is very limited across the AoI.	-	-
Osprey	*Pandion haliaetus*	DS						Screened out: Only known breeding population of this species is at Drumkul Lake c. 250km south-east of the AoI (TRB), with no records obtained during surveys in 2014 and 2023. Potential presence cross the AoI will be as a passage migrant only.	-	-
Ibisbill	*Ibidorhyncha struthersii*	FS						Screened out: No records of this species were obtained from within the AoI, although a pair was observed during eDNA sampling within the Sangikar tributary (a known breeding location for this species). The species is associated with higher altitude mountain watercourses (above 1600m) where it breeds on stable islands, and therefore outside of the AoI in terms of habitats that would support significant numbers of this species (if any at all).	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Brown-headed gull	*Chroicocephalus brunnicephalus*	FS					TRB EN	Screened out: Three birds were observed during surveys in November 2023, with no other records from the baseline studies. The species is a passage visitor to the region and have no particular association with the AoI (i.e. given the broad front migration that occurs here, and in accordance with emerging guidance of categorising airspace as Critical Habitat (IFC 2024)).	-	-
Himalayan sparrowhawk	*Accipiter nisus melanoschistus*	FS						Screened out: A single bird was observed during field surveys in autumn 2023, and the population across the AoI is considered to be very small (probably as part of ranging birds outside of their core foraging range). The species is a bird of higher altitudes than the AoI (typically 1800-2000m), and the woodland cover is high.	-	-
Bearded vulture	*Gypaetus barbatus*	DS/FS					TRB EN	Screened out: Several individual records made during 2023 surveys, two of which were of birds within (above) the AoI. The species breeds at high altitude and has extensive home ranges, influenced by the presence of large predators (the feeding remains of which the species feeds on). No suitable breeding habitat exists within	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								the AOI, and foraging opportunities are very limited.		
Steppe eagle	*Aquila nipalensis*	IBAT		X				Screened out: No confirmed presence within Project AoI, and limited information on numbers throughout Tajikistan in general (i.e. it is absent from the Red Book of Tajikistan). It is a passage migrant to the wider region, not observed during surveys in spring and autumn 2023.	-	-
FISH										
Small Amu-Darya shovelnose sturgeon	*Pseudoscaphirhynchus hermanni*	IBAT, TRB	X			X	TRB EN	Screened in: Initially screened out as the Project AoI falls outside of the mapped geographic extant (resident) as well as the 'possibly extinct' range for the species, but based on its conservation status (CR) has been included for further assessment as a precautionary approach at the request of stakeholders.	1a	-
Amu Darya shovelnose sturgeon	*Pseudoscaphirhynchus kaufmanni*	IBAT, TRB	X			X	TRB CR	Screened in: Initially screened out as the Project AoI falls outside of the mapped geographic extant (resident) as well as the 'possibly extinct' range for the species but based on its conservation status (CR) has been included for further assessment as a	1a	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								precautionary approach at the request of stakeholders.		
Aral Bulltrout (Aral Sea and Amu Darya River stock)	*Salmo trutta spp aralensis*	IUCN, TRB	X				TRB EN	Screened in: The Aral Sea and Amu Darya River stock a subspecies of Salmo trutta has been designated an Endangered status in the Red Book of Tajikistan (2017), and Critically Endangered by the IUCN (Birstein 2000).	1a / 1c	-
Chu sharpray	*Capoetobrama kuschakewitschi*	IBAT, TRB		X			TRB EN	Screened out: Known from the lower reaches of three major rivers: the Chu River (Kazakhstan) to the region of Frunze, the Syr Darya (up to KaraDarya at Balykchi) and Amu Darya (up to Panj), including Zeravshan Rivers (Mamilov and Karimov, 2020). Known to be locally abundant in the lower reaches of the Vaksh River but its distribution does not extend up the River. The Project AoI falls outside of the mapped geographic extant (resident) as well as the 'possibly extinct' range for the species. EOO = 275,206 km^2.	-	-
Aral Barbel	*Luciobarbus brachycephalus*	IUCN, TRB		X			TRB VU	Screened in: Occurs within the Aral basin and is known to migrate up larger tributaries. Currently, the	1b	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								species is known to occurs in a few reservoirs in the Amu Darya and Syr Darya (tributaries to the Aral). The EAAAs falls outside of the mapped extant.		
Bulatmai Barbel	*Luciobarbus capito*	IUCN, TRB			X		TRB VU	Screened in: Occurs within the Caspian and Aral basins. Migrates up larger tributaries for spawning, including the Amu Darya, Syr Darya (tributaries to the Aral). The EAAAs falls outside of the mapped extant.	1b	-
Common Carp	*Cyprinus carpio*	IUCN			X			Screened out: *Cyprinus carpio* inhabits slow-flowing and still waters, such as lowland rivers and large, well vegetated lakes. Within its native range the species is thought to be abundant. This species has been introduced in all types of waterbodies and is found globally.	-	-
Silver Carp	*Hypophthalmichthys molitrix*	IUCN					IUCN NT	Screened out: 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.	-	-
Amu-Darya trout	*Salmo trutta oxianus*	GBIF, TRB				X	TRB VU	Screened out: Endemic subspecies that occurs in the upper reaches of the	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								Amu Darya and in its tributaries, the Kafirnigan and Surkhandarya rivers (FEOW, 2019). The species has also been confirmed within the Vakhsh River and the Rogun Project Area (ESIA, 2014). Introduced into Kyrgyzstan in the 1970s, is known to occur in the Chu River basin, Kara Darya, Talas and Naryn systems (FAO, 2013). The known global range is greater than 500 km linear geographic span (i.e., the distance between occupied locations furthest), and the EAAAs would not hold ≥10% of the global population size or ≥10 reproductive units.		
Turkestan Catfish	*Glyptosternon reticulatum*	TRB					TRB VU	Screened out: The Turkestan Catfish (Small Turkistan sheatfish) has been designated a Vulnerable status in the Red Book of Tajikistan (2017), and a status of Least Concern for The IUCN Red List of Threatened Species in 2020. The Extent of Occurrence (EOO) is estimated to be 860,000 km², and it is expected to occur in more than 2,000 km of rivers and many more than 10 subpopulations. The upstream and downstream EAAAs (to be	-	-

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								conservative) are approximately 2,071km^2. Therefore the EAAAs are not expected to contain an important concentration (~0.2%).		
Sattar snowtrout	*Schizothorax fedtschenkoi*	IBAT				RR		Screened out: None known from Vakhsh River Drainage. Endemic to Zeravshan River drainage in Uzbekistan and Tajikistan (Karimov, 2020).	-	-
Pike asp	*Aspiolucius esocinus*	IUCN, TRB		X			TRB CR	Screened out: Regionally endemic and previously widespread in the Syr and Amu Darya drainages. Recorded in low numbers in the downstream parts of Vakhsh River and is not known to extend upstream into the Project AoI (Karimov, 2020). The EAAAs falls outside of the mapped geographic extant (resident) as well as the 'possibly extinct' range for the species. EOO = 22,000 km^2.	-	-
PROTECTED AREAS and HABITATS										

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Protected areas	Komarou Nature Refuge	IBAT / literature review					IV[3]	Screened out: The Kamarovsky Nature Refuge is located c. 10km to the north of the eastern end of the Project. There are no effect pathways identified between this site and the AoI and so it is scoped out of further assessment.	-	-
	Sarykhosorsky Nature Refuge	IBAT / literature review					IV[3]	Screened in: Potentially outside of the Project AOI, but precautionarily screened in because of changes to the flowregime of the Vakhsh River between Rogun and Nurek.	4	-
	Nurek State Complex Area	IBAT / literature review					IV[3]	Screened in: Potentially affected by changes to the flow regime of the Vakhsh River between Rogun and Nurek.	4	-
	Romit Nature Refuge	IBAT / literature review					1a[3]	Screened out: The Romit Nature Refuge is located c. 50km to the west of the Project. Given the distance, this site is considered outwith the AoI and is screened out on this basis.	-	-

[3] IUCN Management Category – as per: Dudley, N. (Editor) (2008). Guidelines for Applying Protected Area Management Categories. Accessed at: https://portals.iucn.org/library/sites/library/files/documents/pag-021.pdf

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
	Tigrovaya Balka Nature Reserve (and World Heritage Site)	IBAT / literature review					IUCN management category 1a (as per Dudley, 2008)	Screened out: The Tigrovaya Balka is c. 170km downstream of the Project. There will be no downstream impacts arising from the Project that extend downstream of the Nurek dam, and therefore there is no potential effect pathway on the Tigrovaya Balka protected area. See the Transboundary Cumulative Impact Assessment (CIA) produced for the Project, which states: '*.There will be no additional* (to Nurek) *negative effect of Rogun HPP on Tigrovaya Balka. This means that a negative impact of Rogun HPP, or a cumulative impact of Rogun in combination with the Vakhsh cascade, can be excluded.'* (Zwahlen, 2024 draft). See also **Volume 1, Chapter 12 (Water)** and **Chapter 24 (CIA)** of this ESIA. This is screened out on this basis.	-	-
Floodplain habitats	DS/FS	-						Screened out: Recorded at various locations across the Project AoI, with the largest extents near Nurobod and Komsomalabad. This habitat varies in composition within the AoI, with most floodplain habitats being modified through ongoing human influence. This has including settlements having been	-	Yes

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
								established in such areas, and ongoing grazing pressure removing any natural vegetation structure and composition. Two exceptions to this are close to the confluence of the Vakhsh and Obikhingou rivers (within both channels). Within the Vakhsh channel it appears that a relatively new floodplain habitat has been formed through geomorphological changes. This area has not experienced the same human influence and so supports a more natural habitat type. There has been no notable flora or fauna (i.e., those that might trigger Critical Habitat) identified as being reliant upon these habitat features, and they are therefore not considered to qualify for further consideration as Critical Habitat; however, given their relatively unmodified nature and the disproportionately important role in sustaining native plant and animal biodiversity that floodplains play, this habitat type is currently screened in as Natural Habitat. Additional survey work undertaken in September/October 2023 has corroborated this conclusion, with a plant species assemblage that, although not of significant diversity, is characteristic of the region's natural floodplain habitats.		

Biodiversity Value	Scientific Name	Screening source	IUCN CR	IUCN EN	IUCN VU	Endemic / RR	Other Listing[2]	Screening Comments	CH	NH
Juniperus sp. woodland	DS/FS	-						Screened out: The woodland habitat within the AoI aligns with mesophilic broad-leaved woodland in which *J. seravschanica* is a common tree species. These woodlands tend to be at altitudes of above 1500m and so the examples mapped within the AoI are at the lower limit of this. These woodlands exhibit signs of human influence in places, where grazing animals have reduced the sward and will likely have affected tree regeneration and resulted in preferential spread of those species unpalatable to livestock; however, the overall composition appears to be broadly natural and will still be functioning as a naïve woodland habitat. While not of sufficient biodiversity value to trigger Critical Habitat (i.e., the EAAA for this habitat within the AoI is not considered to support any sufficiently rare/sensitive flora or fauna, nor is this habitat included on the IUCN Red List of threatened habitats), it is still considered to be Natural Habitat as per ESS6.	-	Yes

3.2 SCREENING SUMMARY

3.2.1. The above screening exercise identified 15 biodiversity values that will require close monitoringand continued discussion with the academics and stakeholders:

- Egyptian vulture
- Saker falcon
- *Allium stipitatum*
- *Juno Nicolai*
- *Crocus korolkowii*
- *Fritillaria eduardii*
- *Tulipa praestans*
- *Vitex agnus-castus*
- Small Amu-Darya Shovelnose Sturgeon
- Amu Darya Shovelnose Sturgeon
- Aral Barbel
- Bulatmai Barbel
- Aral Bulltrout
- Protected areas (Nurek State Complex Area and Sarykhosorsky Nature Refuge)

3.2.2. The following biodiversity values have been confirmed as meeting the requirements for Natural Habitat classification (see **Figure 15A1**):

- Floodplain habitats
- Mesophilic broad-leaved woodland with *J. seravschanica*

DETERMINING THE EAAA

3.2.3. Determining the EAAA varies depending on the biodiversity receptor. In the case of protected areas and those species associated with these areas, the EAAA extends to the protected area boundary. For other species/habitats, the extent of the EAAA has been influenced by factors such as known range or distribution, where available, prevailing habitat types and land uses and with the application of expert opinion where considered appropriate. In some instances, a necessarily broad and conservative EAAA has been estimated.

3.2.4. For terrestrial ecology, the EAAA varies by receptor group and so is presented where relevant throughout the assessment section and illustrated on figures within **Appendix A**.

3.2.5. From an aquatic biodiversity perspective, two distinct EAAAs have been defined based on connectivity within the Vakhsh River system. The first EAAA (downstream) comprising the Nurek Reservoir and the reach of river between the Nurek Reservoir and Rogun Dam, while the second EAAA (upstream) compromises the Vakhsh River upstream of the Rogun Dam to Damburacha, which is approximately 100 km upstream from full supply level at an elevation of 500 m above FSL. These are illustrated on figures within **Appendix A**.

3.2.6. The EAAAs are also described within the **Volume 1, Chapter 15: Biodiversity** of this ESIA, the EAAA for each biodiversity receptor is summarized in the following assessment tables (**Table 3-3** to **Table 3-12**). The EAAA figures referenced in the tables are included in **Appendix A.**

CRITERION 1 – THREATENED SPECIES

3.2.7. Thirteen biodiversity values that potentially trigger Critical Habitat under Criterion 1 have been identified for the Project.

Table 3-3 - Small Amu-Darya shovelnose sturgeon (*Pseudoscaphirhynchus hermanni*)

Factor	Description
Species Conservation Status	**IUCN Critically Endangered** (A2c) **Tajikistan Red Book Endangered**
Species EAAA	This species is very rare and endemic to the middle (about 600 km river length) and lower (about 300 km river length) reaches of the Amu Darya River drainage (Mugue & Karimov, 2022a). Reported to occur downstream of the Vakhsh and Panj rivers and lakes of Tigrovaya Balka Nature Reserve (TRB). The **Project AoI** falls **outside** of the mapped geographic extant (resident) as well as the 'possibly extinct' range for the species (Mugue & Karimov, 2022a). The EAAA for this species includes the mapped distribution as per Nedoluzhko, *et al* (2020) and the IUCN mapped geographic extant (resident) as well as the 'possibly extinct' range for the species.
Population Estimate in EAAA	Unknown. This species was regarded as rare in the 1940s (Berg 1948) and is regarded as very rare today (Mugue & Karimov, 2022a). During 1995-2005, 60 specimens of Small Amu Darya Shovelnose Sturgeon were caught by the Turkmen researcher Vladimir Sal'nikov in the middle section of Amu Darya River (Tashrabat-Astanababa) in Lebap Province of Turkmenistan (Mugue & Karimov, 2022a). Two specimens of this species were caught in 2014–2015 in Amu Darya River in Khanka area, Khorezm Province of Uzbekistan by a group of Russian and Uzbek ichthyologists (Mugue & Karimov, 2022a). There are no records of *Pseudoscaphirhynchus hermanni* occurring or historically having occurred within either the Project AoI or upper reaches of the Vakhsh River.
Global Population and Trend[25]	Decreasing. Decline due to the construction of dams, and the reduced discharge in the lower part of the Amu Darya River.
Assessment	This species is being considered under criterion 1a, given their IUCN CR status. This species is **not** known to be **present within the Project AoI** or upper Vakhsh River, nor does its 'possibly extinct' range overlap these areas. The species is only found in the middle Amu Darya and has been extirpated from the Aral Sea and lower Amu Darya (as per Sheraliev. *et.al*., 2021 and Mugue, 2022). With the construction of the Nurek Reservoir and other downstream dams, migration into the Project AoI would not be possible.

Factor	Description
	The species is rheophilic, occurs exclusively in fast-running turbulent current turbid waters (Mugue & Karimov, 2022a). Not detected in eDNA samples collected in October 2023. Based on the presumable extant of this species which is downstream of the Nurek Reservoir (Vakhsh HPP cascade), neither the Project AOI or the upper Vakhsh River are expected to support a globally important concentrations (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species) of *Pseudoscaphirhynchus hermanni,* and therefore **no Critical Habitat under Criterion 1a for *Pseudoscaphirhynchus hermanni* is considered to be present upstream on the Nurek Reservoir.**

Table 3-4 - Amu Darya Shovelnose Sturgeon (*Pseudoscaphirhynchus kaufmanni*)

Factor	Description
Species Conservation Status	**IUCN Critically Endangered** (A2c) **Tajikistan Red Book Critically Endangered**
Species EAAA	This species is endemic to the Amu Darya River drainage where historically it occurred along all of the river from the upper reaches (Pyandzh River) to the delta. the species is still present are the tributaries to the Amu Darya e.g. the lower section of Vakhsh River, the lower section of Surkhan Darya River and the middle and lower reaches of the Amu Darya itself, from the confluence of the Vaksh River to Uzbekistan and Turkmenistan (Mugue & Karimov, 2022b). The Project AoI falls outside of the mapped geographic extant (resident) as well as the 'possibly extinct' range for the species (Mugue & Karimov, 2022b). The EAAA for this species includes the mapped distribution as per Nedoluzhko, *et al* (2020) and the IUCN mapped geographic extant (resident) as well as the 'possibly extinct' range for the species.
Population Estimate in EAAA	Unknown. There are no records of *Pseudoscaphirhynchus hermanni* occurring or historically having occurred within either the 'downstream' or 'upstream' the EAAAs (Project AoI or upper reaches of the Vakhsh River).
Global Population and Trend	Decreasing. Since the mid-1960s, a continuous decline of the species started and it is now relatively rare. But it continues to reproduce in the Amu Darya River and in the lower section of Vakhsh River, however, the rate of reproduction of the population is uncertain. The catches and by-catches of this species between 2009–2017 from the lower and middle sections of the river and the lower section of Vakhsh River (Tadjikistan), indicate that this species is still extant in almost all of its distribution (Mugue & Karimov, 2022b and Berg, 1948).
Assessment	This species is being considered under criterion 1a, given their IUCN CR status. This species is **not** known to be **present within either of the EAAAs (Project AoI or upper Vakhsh River**), nor does its 'possibly extinct' range overlap either of the EAAAs. The species is endemic to the Amu Darya (Turkmenistan and Uzbekistan) and occurs from the Pyandzh (near Faizabad-kala) to the mouth, inclusive of the lower section of Vakhsh River (Reshetnikov and Shakirova, 1993 and Mugue and Karimov, 2022). With the construction of the Nurek Reservoir and other downstream dams, migration into the Project AoI would not be possible. The species occurs in the turbid waters of rivers with fast flowing turbulent current, with sandy or rock-gravel substrates at depths of up to two meters in highly turbulent, turbid water at flow velocities of 0.4 to 1.9m/s (Salnikov et al. 2004, Kuhajda et al. 2007). Not detected in eDNA samples collected in October 2023.

Factor	Description
	Based on the presumable extant of this species which is downstream of the Nurek Reservoir (Vakhsh HPP cascade), neither of the EAAAs are expected to support a globally important concentrations (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species) of *Pseudoscaphirhynchus kaufmanni,* and therefore **no Critical Habitat under Criterion 1a for *Pseudoscaphirhynchus kaufmanni* is considered to be present upstream on the Nurek Reservoir.**

Table 3-5 - Aral Bulltrout (*Salmo trutta spp aralensis*)

Factor	Description
Species Conservation Status	**IUCN Critically Endangered** (A2c) **Tajikistan Red Book Endangered**
Species EAAA	The EAAA for this species includes both the 'downstream' and 'upstream' EAAAs, which incorporates the Vakhsh River drainage upstream of the Nurek Reservoir and Rogun Dam. See **Appendix A: Figure 15A2.**
Population Estimate in EAAA	Unknown. The most recent IUCN assessment (2000) that identifies this species as subspecies does not describe range or population (Birstein, 2000). The TRB (2017) states that this species inhabits the Aral Sea and the Amu Darya River Basin and is reportedly found very rarely in the Kofarnihon and Vakhsh rivers and Nurek Reservoir. From 1974 until 1994 the Aral Bulltrout was mostly caught in the Nurek Reservoir. A rare, but relatively stable population within the Nurek Reservoir is mentioned in the TRB (2017), indicating that similar to the Aral Sea, the species persists in lectic habitats. Artaev *et.al* (2025), does not recognise *Salmo trutta spp aralensis* as a species currently present within Tajikistan, stating that "*Salmo aralensis*" (synonym) was extinct as a consequence of the collapse of the Aral Sea Basin ecosystem. Schöffmann (2001), notes that the anadromous trout of Lake Aral *Salmo trutta aralensis* was notified as extinct since the 1970s. Mitrofanov and Mamilov (2015), note that the Aral Trout (*Salmo trutta aralensis*), is an endemic subspecies of the widespread Brown Trout, *Salmo trutta*, and that it most likely no longer occurs within the Amu Darya. Dr. Nadir Shamilevich Mamilov from the Al-Farabi Kazakh National University indicated that they do not have any relevant information regarding *Salmo trutta ssp. aralensis* (the Aral Sea and Amu Darya River stock) during the last 40 years (Personal communication 2024). One specimen was reportedly caught in 2004 by the Kazakh Fishery Research Institute in the Syr Darya delta, and a second oral report from lower reaches of the Syr Darya River has been reported through the Kazakh Centre of Fisheries and Aquaculture. These are the most current anecdotal records available.
Global Population and Trend[25]	Unspecified, widely regarded as extinct.
Assessment	This subspecies is being considered under criterion 1a and 1c, given their IUCN CR status and given they are listed nationally or regionally as EN (Red Book of Tajikistan).

Factor	Description
	Due to limited information on the species' estimated extent of occurrence (EOO) or population, we rely on available literature and subject matter experts. Originally endemic to the Aral Sea and its affluent river mouths, the Amu Darya and Syr Darya Rivers, this species is now widely considered extinct. Historical records from the Nurek Reservoir (1974 to 1994) likely represented a non-viable population that could not migrate downstream to the lower Amu Darya and Aral Sea, leading to its eventual disappearance. **Based on the weighted evidence, *Salmo trutta aralensis* is considered extirpated from the Amu Darya drainage as a consequence of the disappearance of the Aral Sea and habitat alterations (overfishing, damming and channel management, extraction of water for irrigation, and water pollution). Therefore, no Critical Habitat for *Salmo trutta aralensis* has been identified within the Project EAAA.**

Table 3-6 - Aral Barbel (*Luciobarbus brachycephalus*)

Factor	Description
Species Conservation Status	**IUCN Endangered** (A2cd) **Tajikistan Red Book Vulnerable**
Species EAAA	The EAAA for this species includes both the 'downstream' and 'upstream' EAAAs, which incorporates the Vakhsh River drainage upstream of the Nurek Reservoir and Rogun Dam. See **Appendix A: Figure 15A2.**
Population Estimate in EAAA	Unknown. Present within the Aral basin (extirpated in the sea - due to salinity, only survives in the reservoirs of its tributaries), Chu drainage and southern and western Caspian Sea. Known to migrate up larger tributaries of western and southern coasts: Terek, Samur, Kura, lower Aras. Rarely in lower Volga (up to Volgograd) and Ural (Freyhof & Kottelat, 2008a). The IUCN mapped geographic extant (resident) as well as the 'possibly extinct' range for the species does not overlap with the EAAA (Ford 2024a).
Global Population and Trend	Decreasing as a large part of his species' range (estimated 20%), the Aral Sea, has disappeared due to intensive water abstraction leading to increased salinity levels. Currently, the species only occurs in a few reservoirs in the Amu Darya and Syr Darya (tributaries to the Aral), and Karakum Canal (where it is invasive) where its status is unknown (Freyhof & Kottelat, 2008a). In the western Caspian Sea, the landlocked population (in the Kura river) is thought be stable, and the anadromous population has declined, due to the lack of spawning sites and poaching, but it is still frequent in the southern Caspian tributaries in Azerbaijan and Iran (Freyhof & Kottelat, 2008a). Overall, there is a continuing to decline due to expanding hydropower development and strong ecological impacts on Caspian and Aral Sea basins. It is suspected that the total population has declined by at least 30% in the past 30 years (Freyhof & Kottelat, 2008a).
Assessment	This species is being considered under criterion 1b, given their IUCN EN status. The primary habitat for *L. brachycephalus* is at sea, at depths of up to 25 m and in rivers, in deep stretches with gravel or stone bottom. Based on the habitat preferences and know distribution downstream, it is unlikely that either of the EAAAs would support a population large enough that their loss would result in the Red List status changing to Endangered (based on IUCN, 2019). Not detected in eDNA samples collected in October 2023. **The EAAAs are therefore not considered of sufficient value for it to qualify as Critical Habitat under Criterion 1b for Aral Barbel.**

Table 3-7 - Bulatmai Barbel (*Luciobarbus capito*)

Factor	Description
Species Conservation Status	**IUCN Vulnerable** (A2cd) **Tajikistan Red Book Vulnerable**
Species EAAA	The EAAA for this species includes both the 'downstream' and 'upstream' EAAAs, which incorporates the Vakhsh River drainage upstream of the Nurek Reservoir and Rogun Dam. See **Appendix A: Figure 15A2.**
Population Estimate in EAAA	Unknown. Present within the Caspian basin, for spawning migrates up larger tributaries of western and southern coasts, from Volga southward to Atrek (Iran). Was always very rare in Volga. Aral basin, in Amu Darya, Syr Darya and Chu drainages, extirpated in the Aral Sea (Freyhof & Kottelat, 2008b). The IUCN mapped geographic extant (resident) range for the species does not overlap with the EAAA (Ford 2024b).
Global Population and Trend[25]	Decreasing. Declined sharply due to damming in the 1950's and 1960's in the Caspian Sea. In the Aral Sea the species declined due to the shrinking (increased salinity) of the Aral sea (started in 1970s to present) and damming of its tributaries (1950's to 1970's) (Freyhof & Kottelat, 2008b). It is suspected that the total population has declined by at least 30% in the past 30 years (Freyhof & Kottelat, 2008b).
Assessment	This species is being considered under criterion 1b, given their IUCN VU status. Lives at sea, mostly close to shores. Forages also in estuaries. Spawns in lowland streams and rivers on sand-gravel bottom, usually in strong current (Freyhof & Kottelat, 2008b). Based on the habitat preferences and know distribution downstream, along with the fact that *L. capito* is semi- anadromous but rarely landlocked in reservoirs, it is unlikely that either of the EAAAs would support a population large enough that their loss would result in the Red List status changing to Endangered (based on IUCN, 2019 and Fricke, 2024). Not detected in eDNA samples collected in October 2023. **The EAAAs are therefore not considered of sufficient value for it to qualify as Critical Habitat under Criterion 1b for Bulatmai Barbel.**

Table 3-8 – Egyptian vulture

Factor	Description
Species Conservation Status	**IUCN Endangered** (A2abcde, 3bcde, 4abcde) **Tajikistan Red Book Endangered**
Species EAAA	The EAAA for this species is assumed crudely to extend across the Vakhsh valley within the Project AoI and for an additional 10km (breeding birds are considered to forage up to 10km from nest sites – VCF, 2019). See **Appendix A: Figure 15A3**
Population Estimate in EAAA	Unknown. No confirmed nest sites/occupied territories.
National Population and Trend[25]	Stable. No more than 30 pairs considered present within Tajikistan, with greater numbers present as passage migrants.
Assessment	This species is being considered under criterion 1c, given their Tajikistan Red Book EN status. The species mainly occupies territories with valley and cliff features but will forage across a wide range of habitats, including those close to human habitation (the species will readily make use of dump sites for foraging). No nest sites were identified within the AoI and it is considered likely that birds observed during spring and autumn survey visits were passage individuals rather than those occupying territories (the species is generally solitary/in pairs during the breeding season, so the group of birds recorded in autumn 2023 would certainly reinforce this suggestion). The Project AoI does not contain habitat/features that appear of any increased importance to the species. Based on the assumption regarding recorded birds being passage individuals, the EAAA is not considered to be of any explicit importance that would trigger classification as Critical Habitat. **The EAAA is therefore not considered of sufficient value for it to qualify as Critical Habitat under Criterion 1c for Egyptian vulture.**

Table 3-9 – Saker Falcon

Factor	Description
Species Conservation Status	**IUCN Endangered** (A2bcde, 3bcde, 4bcde) **Tajikistan Red Book Endangered**
Species EAAA	The EAAA for this species is assumed crudely to extend across the Vakhsh valley within the Project AoI within the same distance as Egyptian vulture above (when considering a proxy species (*Falco peregrinus*) breeding birds are considered to regularly forage within 5km from nest sites (White *et al.* 2002) VCF, 2019, but have been recorded up to 18km (SNH, 2018)). See **Appendix A: Figure 15A3.**
Population Estimate in EAAA	Unknown. No confirmed nest sites/occupied territories.
National Population and Trend[25]	Declining. No more than 30 pairs considered present within Tajikistan, with greater numbers present as passage migrants.
Assessment	This species is being considered under criterion 1c, given their Tajikistan Red Book EN status. The species mainly occupies territories with valley and cliff features and nests in rock crevices. No nest sites were identified within the AoI and it is considered likely that the two birds observed (during spring 2023) were passage individuals rather than those occupying territories given that no further observations were made. The Project AoI does not appear to contain habitat/features that appear of any increased importance to the species, with more extensive suitable features considered likely to be prevalent across the wider areas and at higher altitudes (in particular, stable cliff crevices). Based on the assumption regarding recorded birds being passage individuals or those prospecting new territories, the EAAA is not considered to be of any significant importance that would trigger classification as Critical Habitat. **The EAAA is therefore not considered of sufficient value for it to qualify as Critical Habitat under Criterion 1c for saker falcon.**

Table 3-10 - Nationally Threatened Plants

Factor	Description
Species Conservation Status	TRB EN/CR
Species EAAA	The EAAAs for these species includes a broad band of habitat that continues the sub-optimal conditions recorded from within the flooding zone, together with the juniper woodland recorded. See **Appendix A: Figure 15A4.**
Population Estimate in EAAA	*Allium stipitatum:* Unknown, although despite being listed as EN within the TRB, it was classified as Least Concern (LC) in Nowak & Nobis (2020) and has a fairly wide distribution within Tajikistan. Only sparsely recorded from the literature review; none recorded during 2023 surveys and the species is thought to prefer habitats at an elevation of >1200m asl (Norooziyan *et al.* 2018). Assumed small population.
	Juno nicolai: Unknown, although despite being listed as EN within the TRB, it was classified as Least Concern (LC) in Nowak & Nobis (2020). Only sparsely recorded from the literature review; with a single small population recorded from 2023 surveys, with the habitat across the AoI generally sub-optimal (the species prefers mixed xerophilous scrub/forests and steppe habitats). Assumed small population, and the more extensive distribution is further west, south and east (as per Nowak & Nobis (2020).
	Crocus korolkowii: Unknown, although despite being listed as EN within the TRB, it was classified as Least Concern (LC) in Nowak & Nobis (2020), and the mapped distribution extends across west and south Tajikistan. Only sparsely recorded from the literature review; with plants recorded during 2023 surveys around the villages of Rog, Sichirog and Hakimi. Sub-optimal habitat present across the AoI due to habitat modification (the species prefers alpine meadows and a more heterogenous community). Assumed small population.
	Fritillaria eduardii: Unknown, although despite being listed as EN within the TRB, it was classified as Least Concern (LC) in Nowak & Nobis (2020). Only sparsely recorded from the literature review; single record of this species during 2023 surveys, with habitats generally sub-optimal (the species grows beneath xerophilous woodland and shrubs at a height of >1200m. Assumed small population.
	Tulipa praestans: Unknown, although despite being listed as EN within the TRB, it was classified as Least Concern (LC) in Nowak & Nobis (2020). Only sparsely recorded from the literature review; with a single stand recorded during 2023 surveys, and the habitat is suboptimal across the AoI, with the species preference being woodland and xerophilous shrubs on stony slopes. Assumed small population.
	Vitex agnus-castus: Unknown, although despite being listed as EN within the TRB, it was classified as Least Concern (LC) in Nowak & Nobis (2020), and has a mapped distribution from across Tajikistan. Only sparsely recorded from

Factor	Description
	the literature review with a single small population recorded during 2023 surveys. Given its relatively large size and conspicuous nature is considered likely to be absent across much of the AoI, with those present comprising widely scattered individual plants/small groups of plants.
Global Population and Trend (TRB, 2017)	*Allium stipitatum:* This species is endemic to Central Asia, with records from Tajikistan, Turkestan, Kyrgystah, Uzbekistan and Afghanistan. It is considered to be rare and declining, although thought to be LC in Tajikistan.
	Juno nicolai: This species is known from Tajikistan, Uzbekistan and Afghanistan. It is considered to be rare and declining, largely due to is collection by people for its flowers. Listed as LC in Tajikistan.
	Crocus korolkowii: This species is endemic to Central Asia, with records from Tajikistan, Kazakhstan and Uzbekistan. It is considered to be rare and declining, largely due to its continued collection for its flowers. Listed as LC in Tajikistan.
	Fritillaria eduardii: This species is endemic to Central Asia, with records from Tajikistan and northern Afghanistan. It is considered to be rare and declining, largely due to its continued collection for its flowers and its bulb as a food source. Listed as LC in Tajikistan.
	Tulipa praestans: Endemic to Tajikistan, this species has declined massively due to collection for its flowers and bulbs and also widespread habitat loss to agriculture. Listed as LC in Tajikistan.
	Vitex agnus-castus: The species has a relatively widespread distribution, including Central Asia and west into the Mediterranean region. It is readily used for firewood as well as its pharmaceutical properties and has declined significantly as a result of this and general habitat loss. Listed as LC in Tajikistan.
Assessment	These plants have been screened in for consideration under criterion 1c '…areas containing important concentrations of a nationally or regionally listed EN or CR species.' However, there is no indication that the EAAAs comprise any notably important areas for these species with only limited field survey records in 2023 (with no records described from 2014, besides from the literature review), and recent distribution mapping does not infer any increased importance/value of the Vakhsh River valley to any of these plants. There are no reliable population estimates for any of the above species, and most have been included on a precautionary basis. The most recent population trend review for these species (from Nowak & Nobis 2020) has all species classified as LC. As per the text above, the habitats present within the AoI are generally sub-optimal, with the prevailing legacy of modification across the AoI likely to have significantly reduced the populations and habitat suitability for these species. In addition, all of these species are traditionally collected, for various uses, and so this will have contributed to the decline. **The EAAA is therefore not considered of sufficient value for it to qualify as Critical Habitat under Criterion 1a for nationally threatened plants.**

CRITERION 2 - ENDEMIC/RANGE-RESTRICTED SPECIES

3.2.8. No biodiversity values triggering Critical Habitat under Criterion 2 were identified for the Project.

CRITERION 3 - MIGRATORY/CONGREGATORY SPECIES

3.2.9. No biodiversity values triggering Critical Habitat under Criterion 3 were identified for the Project.

CRITERION 4 - THREATENED ECOSYSTEMS

3.2.10. Two biodiversity values potentially triggering Critical Habitat under Criterion 4 have been identified for the Project.

Table 3-11 - Sarykhosorsky Nature Refuge

Factor	Description
Designation	Nature Refuge (IUCN management category IV)
Receptor EAAA	Nature Refuge boundary See **Appendix A: Figure 15A5**
Summary description	There is limited information on the management objectives of this Nature Refuge; however, it is known to support mountain forest ecosystems including fruit and nut trees, which align with habitats elsewhere within the Vakhsh River valley. The site is subject to management activities to restore forest ecosystems (including fruit and nut forests) and agroforestry. It also includes sites of recreational and cultural significance.
Assessment	The Sarykhosorsky Nature Refuge is not supported by any specific management plan, and so details regarding the baseline conditions at the site are limited. However, it is known that forest habitats, including fruit and nut trees are present and exploited to some extent by local communities. Additionally, forestry management takes place there and FFI (and previously UNDP) are involved on capacity building with regards ongoing forest protection, agroforestry and conservation (FFI, 2016). Additionally, the reserve provides recreational and cultural resources and so does not have a purely conservation focus. The IUCN management category for the site is IV, and so not at a level that would automatically qualify this site as Critical Habitat. The reserve extends across elevations of 1200-1600m. Given the likely lack of ecosystems of sufficient conservation value, and history of human influence in the reserve, together with the absence of any management plan for the site, the Sarykhosorsky Nature Refuge is **not classified as Critical Habitat under Criteria 4 for highly threatened or unique ecosystems.**

Table 3-12 - Nurek State Complex Area

Factor	Description
Designation	Nature Refuge (IUCN management category IV)
Receptor EAAA	Nature Refuge boundary See **Appendix A: Figure 15A6**
Summary description	The Nurek State Complex Area was created to protect local juniper and other forest types, and therefore provide suitable habitat for species of wildlife found within this area.
Assessment	The Nurek State Complex Area is not supported by any specific management plan, and so details regarding the baseline conditions at the site are limited. However, it is known that the main goal of the reserve's designation was to preserve mountain ecosystems, juniper forests and other forest types, and to offset effects caused by the Nurek Reservoir on these ecosystems, and further study their evolution. The IUCN management category for the site is IV, and so not at a level that would automatically qualify this site as Critical Habitat. From in-person discussions with stakeholders, it appears that a component of the Management Area is to provide a game hunting resource, with gamebirds released periodically into the site, which suggest some limitation to the conservation objectives of the site. Given the similar habitats within the Vakhsh River valley (such as juniper woodland), which do not qualify as Critical Habitat, it is reasonable to assume that this protected area does not support highly threatened or unique ecosystems. Additionally, for qualification under criterion 4, it would be expected that a management plan would be in place (especially for a site that has been designated since 1984) The Nurek State Complex Area is therefore **not considered of sufficient value for it to qualify as Critical Habitat under Criteria 4 for highly threatened or unique ecosystems.**

CRITERION 5 - KEY ECOLOGICAL FUNCTIONS

3.2.11. No biodiversity values triggering Critical Habitat under Criterion 5 have been identified for the Project.

3.3 SUMMARY

CRITICAL HABITAT

3.3.1. In summary, based on our current understanding of the Project AoI and information gathered through available literature and in field investigations, together with application of the precautionary principle, there are **no** biodiversity features that are considered to trigger Critical Habitat for the associated EAAA.

NATURAL HABITAT

3.3.2. The following biodiversity values are considered to trigger Natural Habitat for the associated EAAAs:

- Floodplain habitats
- Mesophilic broad-leaved woodland with *J. seravschanica*

4 ESS6 COMPLIANCE REVIEW

4.1 INTRODUCTION

4.1.1. Upon completion of the CHA it is necessary to review Project compliance against the requirements of ESS6. This has been done with the assessment outcome derived from the Project ESIA and should be read in conjunction with that report. The assessment requirements of ESS6 are explicitly detailed within Section B1.2 and discussed individually below in terms of Project compliance.

4.1.2. As per the requirements of ESS6, this process applies to all areas of Critical Habitat in which Project activities where potential adverse effects impacts exist. In terms of Natural Habitat, this compliance review only applies where '…significant, adverse and irreversible…' impacts have been identified.

4.1.3. **Table 4-1** summarises this position for each Natural Habitat Feature that was derived from the assessment within **Volume 1, Chapter 15: Biodiversity** of this ESIA.

Table 4-1 – Natural Habitat Compliance Screening

Natural Habitat	Assessment Conclusion[4]
Floodplain	Approximately 77 ha lost; Major habitat loss effect (significant)
Juniper woodland	Approximately 185 ha lost; Major habitat loss effect (significant)

4.1.4. The compliance review is detailed within **Table 4-2** and any mitigation required to achieve compliance is described. Note that these compliance criteria apply where adverse impacts (to Critical Habitats/Natural Habitats) are identified.

[4] Impact of greatest significance listed, in the absence of any mitigation.

Table 4-2 - ESS6 Compliance Review Table

ESS6 Compliance Criteria	Supporting Information	Outcome	Further Actions
No viable alternative / no technically or economically feasible alternative.	**Volume 1, Chapter 4** of this ESIA for full details.	Compliant	No further actions
All due process required under international obligations or national law that is a prerequisite to a country granting approval for project activities in or adjacent to a Critical Habitat has been complied with.	Permitted. **Volume 1: Chapter 1** of this ESIA.	Compliant	No further actions
The potential adverse impacts, or likelihood of such, on the habitat will not lead to measurable net reduction or negative change in those biodiversity values for which the Critical Habitat was designated.	n/a for Critical Habitat. Full impact assessment of these below values is included within **Volume 1, Chapter 15** of this ESIA. A high-level summary is included here. **Critical Habitat** None present. **Natural Habitat** **Floodplains** A total of approximately 75ha of Natural Habitat floodplain will be lost because of the flooding. This represents all of	Compliant on the basis that successful mitigation is implemented.	Specific actions presented within: **Volume 3, A4: Biodiversity Management Plan** (**BMP**) **Volume 3. A5: No Net Loss Framework (NNLF**).

ESS6 Compliance Criteria	Supporting Information	Outcome	Further Actions
	this habitat within the AoI and is therefore a significant effect. **Juniper woodland** A total of approximately 185ha of Natural Habitat floodplain habitat will be lost because of the flooding and associated tree clearance. This represents over 50% of the habitat across its EAAA and is therefore a significant effect.		
The project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered, or range-restricted species, over a reasonable time period.	None expected.	Compliant	No further actions
The project will not involve significant conversion or significant degradation of Critical Habitats. In circumstances where the project involves new or renewed forestry or agricultural plantations, it will not convert or degrade any Critical Habitat.	None expected.	Compliant	No further actions
The project's mitigation strategy will be designed to achieve net gains of those	n/a for Critical Habitat.	Compliant	No further actions

ESS6 Compliance Criteria	Supporting Information	Outcome	Further Actions
biodiversity values for which the Critical Habitat was designated.	For Natural Habitat a NNLF has been developed to demonstrate how the Project will achieve NNL for Natural Habitat biodiversity values.		
A robust and appropriately designed, long-term biodiversity monitoring and evaluation program aimed at assessing the status of the critical habitat is integrated into the Borrower's management program.	n/a for Critical Habitat. For Natural Habitat a NNLF has been developed to demonstrate how the Project will achieve NNL for Natural Habitat biodiversity values, and this includes monitoring information.	Compliant	No further actions

5 MITIGATION PROPOSALS

5.1.1. Several bespoke and generic mitigation measures are described within this ESIA to minimise impacts to biodiversity receptors so that the significance of residual impact is negligible or minor. With regards Natural Habitat, the requirement for mitigation extends to ensuring no net loss.

5.1.2. Details regarding these measures is presented within the **Volume 3, A4: BMP** and **Volume 3, A5: NNLF** for the Project and summarised in **Table 5-1**.

Table 5-1 – Mitigation Summary

Receptor and Effect	Mitigation
Floodplain habitat	A no net loss management plan was developed to mitigate the impct on this natural habitat.
Juniper woodland habitat	A no net loss management plan was developed to mitigate the impct on this natural habitat.

5.1.3. In addition to the above, it is expected that complementary mitigation proposals that will be delivered through separate technical specialists will also contribute to the overall mitigation of effects to the above receptors (note that any such benefits will be supplementary to the dedicated mitigation required for these effects). In particular, this will comprise tree/vegetation planting around the Project and flooding zone for the purposes of landscaping and soil stabilisation. Further information in this regard can be found in **Volume 1, Chapter 12: Soils & Geology** and **Volume 1, Chapter 14: Landscape & Visual** of this ESIA.

5.2 CONCLUSIONS

5.2.1. This CHA has concluded that **there are no areas of Critical Habitat within the Project AoI**.

5.2.2. Two Natural Habitat features (floodplain and juniper woodland habitat) have been identified, both of which will be subject to significant adverse effects in the absence of mitigation.

5.2.3. In order for the Project to be compliant with the requirements of ESS6 and other similar Lender standard), a series of mitigation measures have been recommended that will be delivered through a Project Biodiversity Management Plan and, in the case of Natural Habitat, an No Net Loss Framework, the latter with specific aims to achieve a No Net Loss for floodplain and juniper woodland habitats, thereby achieving a key aspect of ESS6 compliance.

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Appendix A

FIGURES

Figure A-1 - EAAA - Aquatic Species

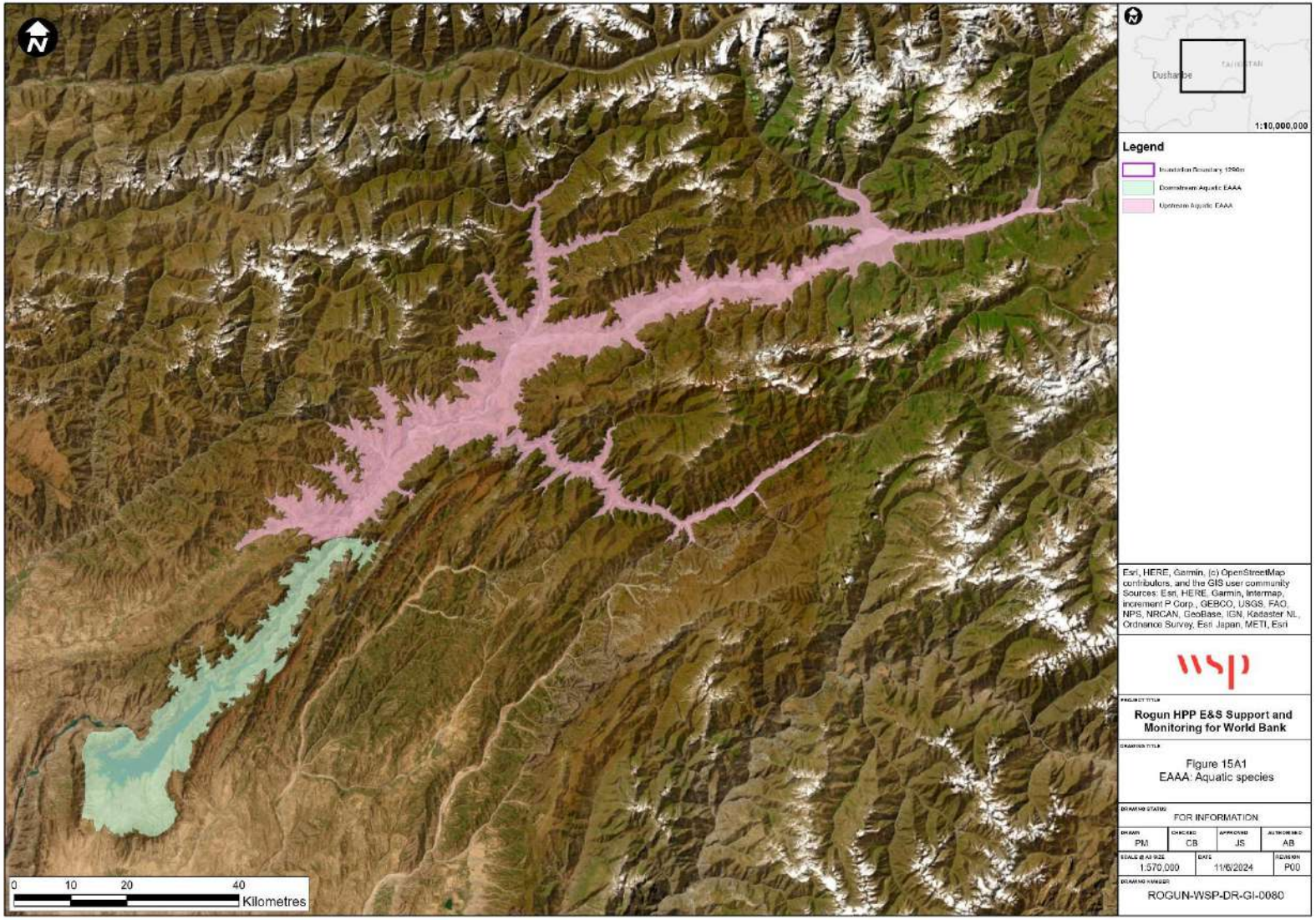


Figure A-2 - EAAA - Egyptian Vulture

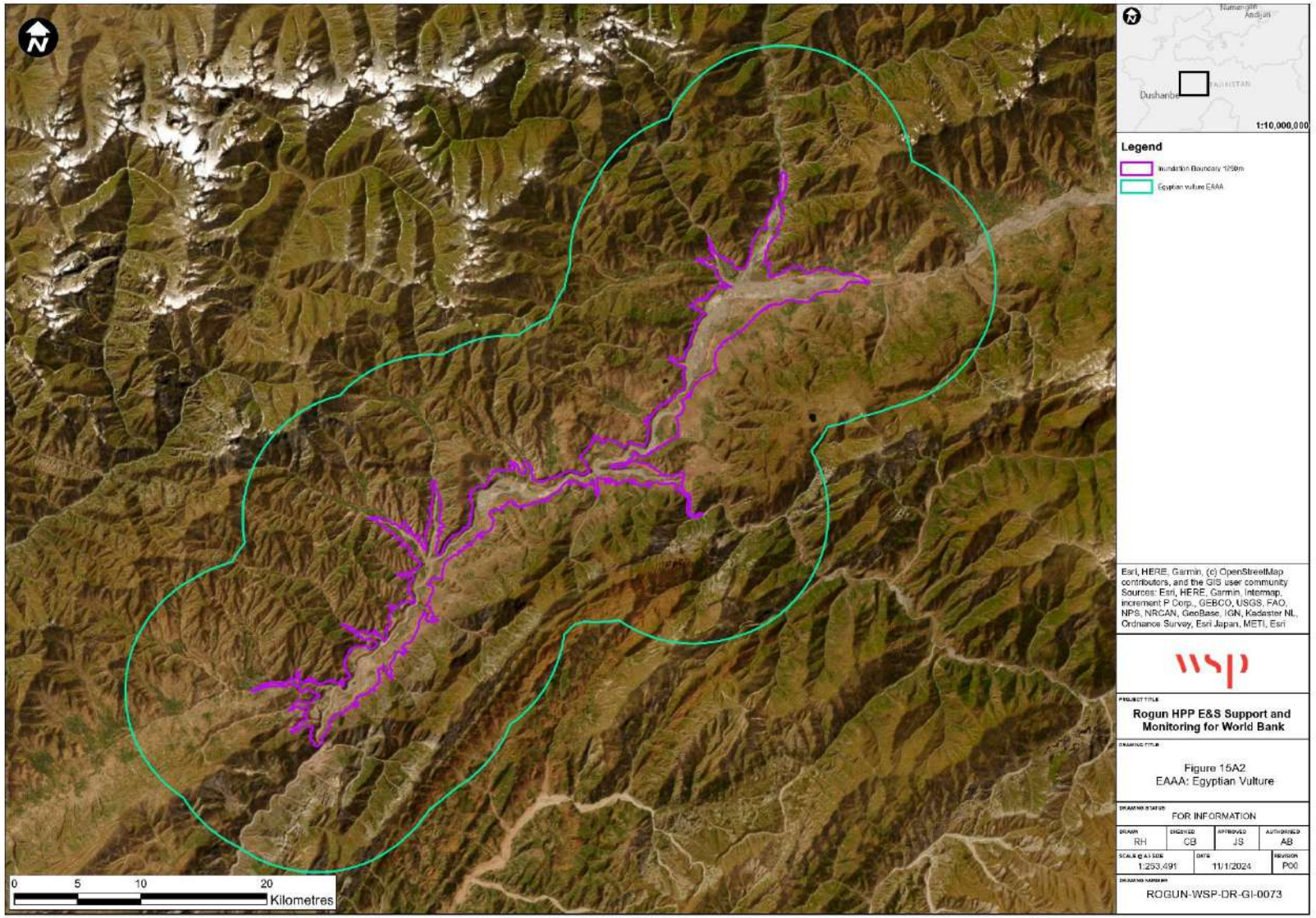


Figure A-3 - EAAA - Notable Flora

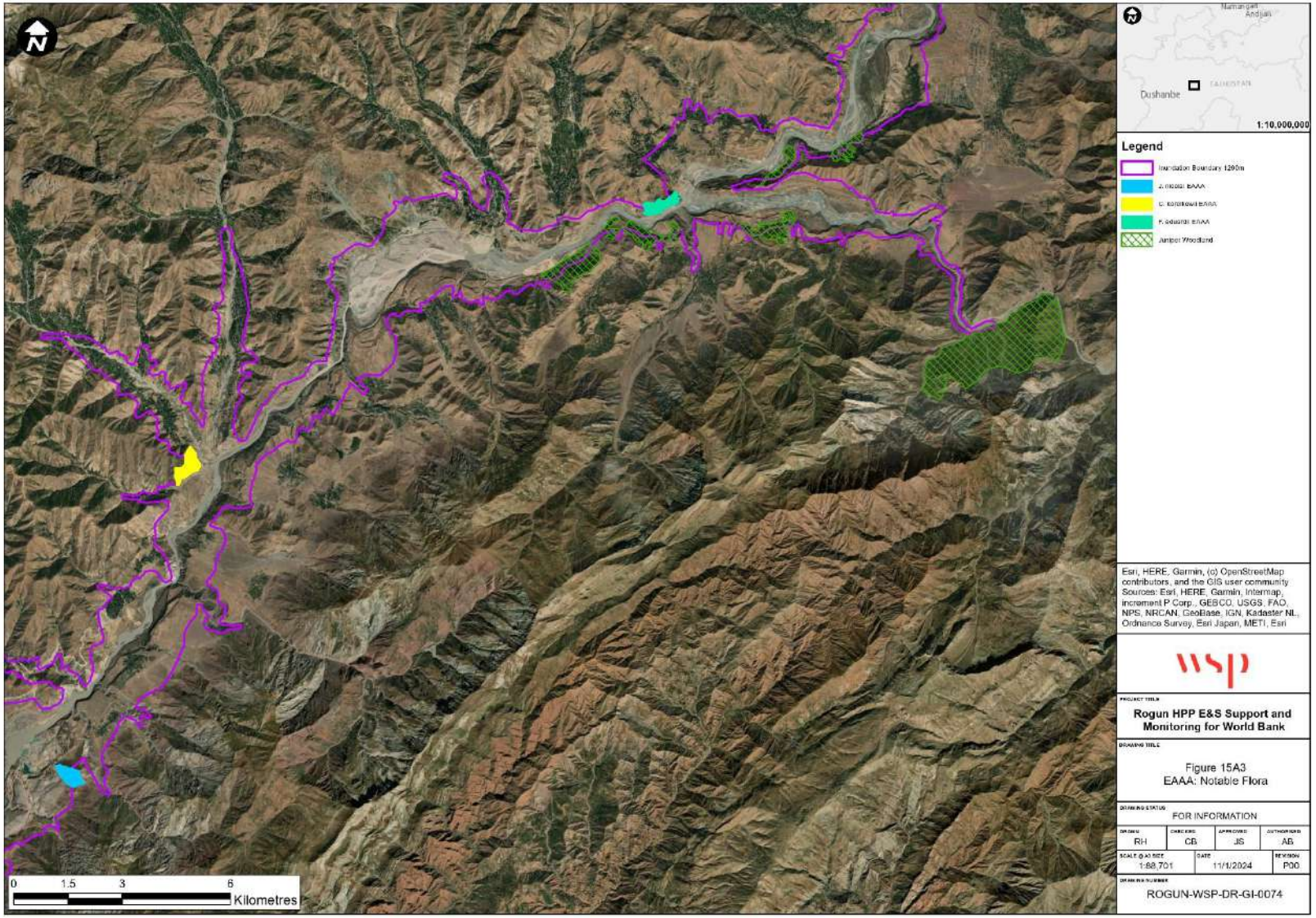


Figure A-4 - EAAA - *Vitex-agnus castus*

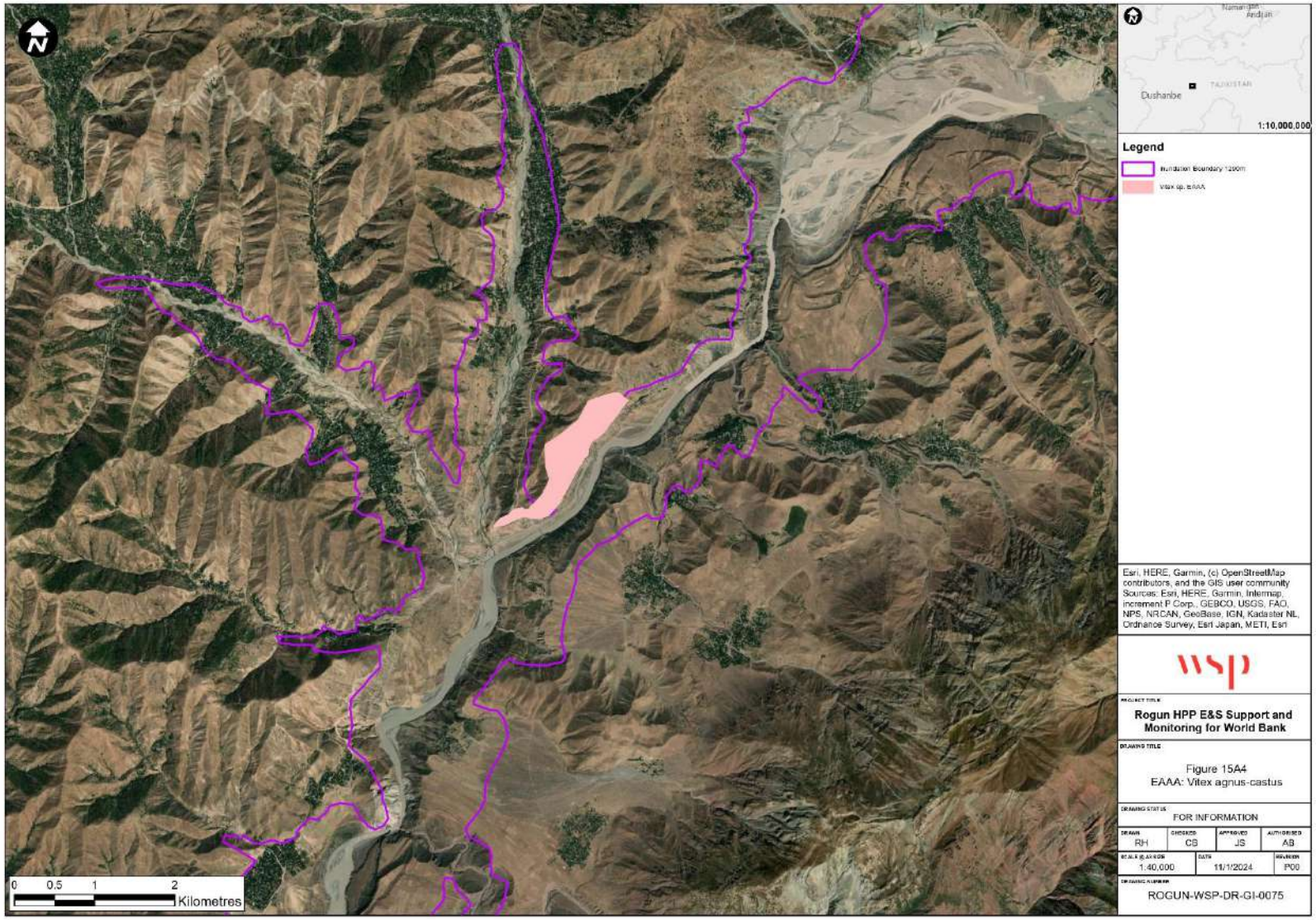


Figure A-5 - EAAA - Sarykhosorsky Nature Refuge

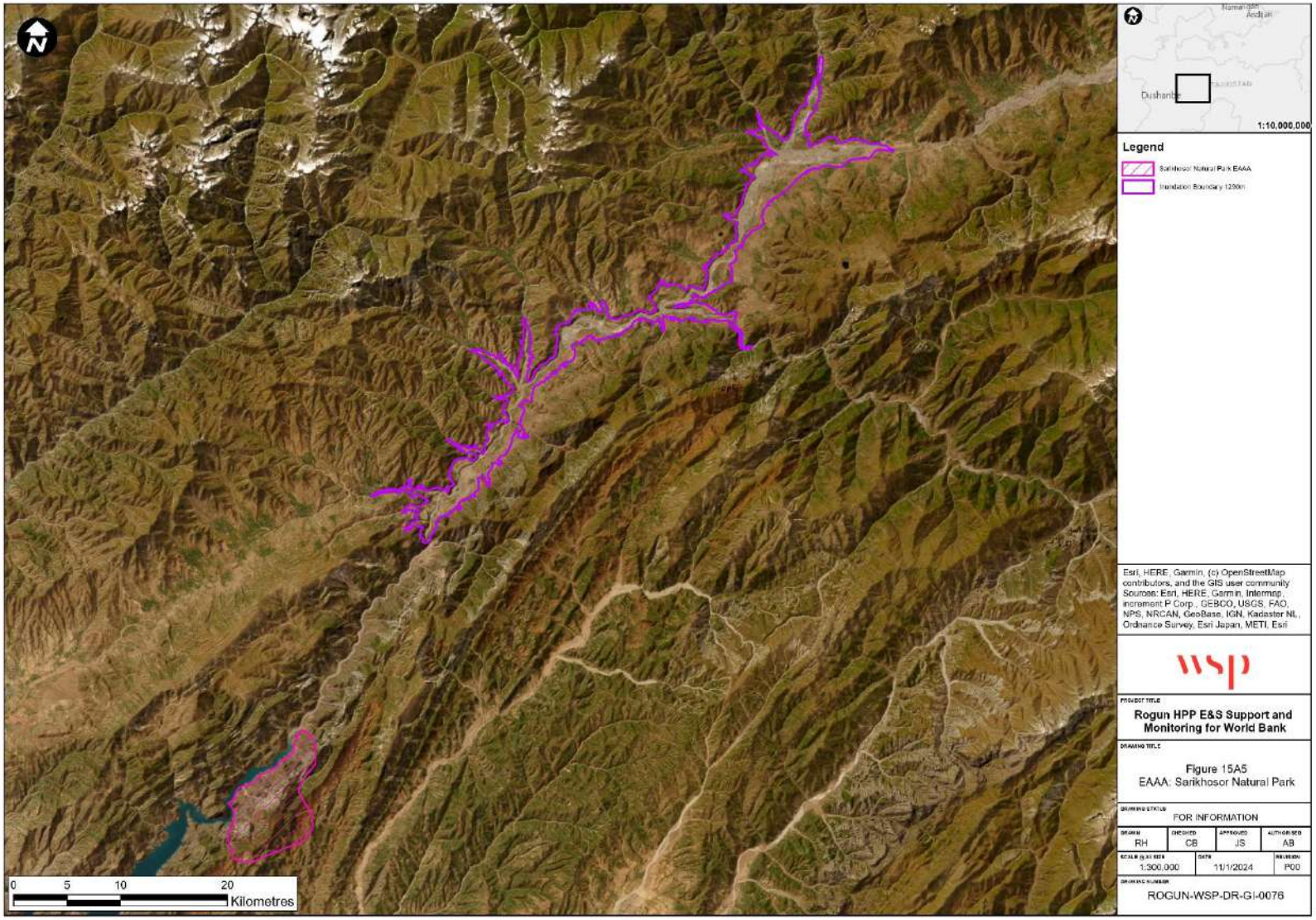
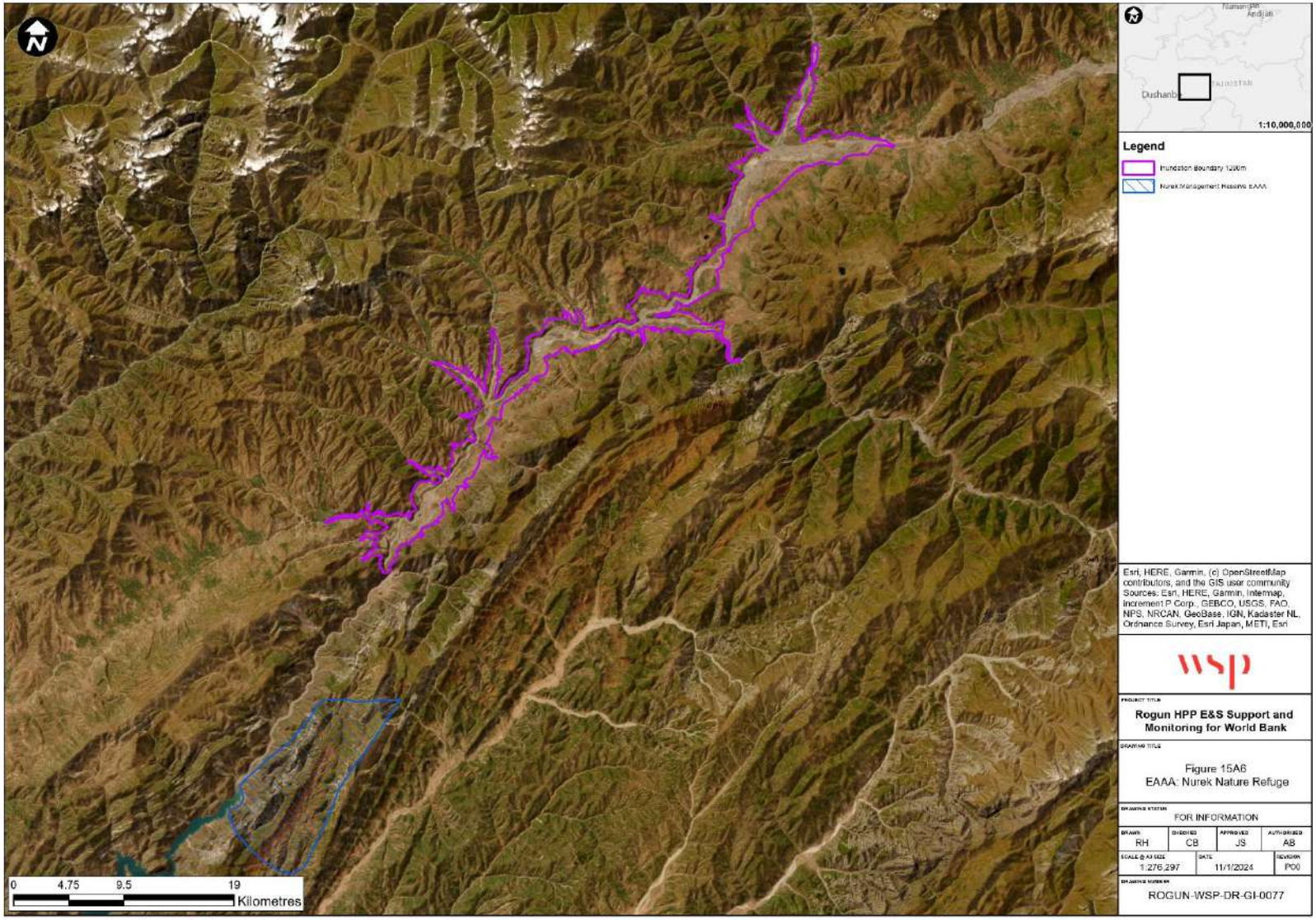


Figure A-6 - EAAA - Nurek State Complex Area



PUBLIC

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 2, Annex 17-1: Gender Assessment



PROJECT REF
JUNE 2025

PUBLIC

PUBLIC

PROJECT NUMBER

PROJECT REF

DATE: JUNE 2025

CONTENTS

KEY DEFINITIONS 6

17 GENDER ASSESSMENT 8

17.1 PURPOSE 8
17.2 SCOPE OF THE GENDER ASSESSMENT AND GENDER ACTION PLAN 8
17.3 KEY COMPONENTS OF GBV AND GENDER EQUALITY 9
17.4 APPLICABLE STANDARDS AND GUIDELINES 11
17.5 PROJECT CONTEXT 22
17.6 METHODOLOGY 25
17.7 BASELINE 29
17.8 NATIONAL LAW, GAPS AND CURRENT DEVELOPMENTS 62
17.9 KEY FINDINGS FROM THE KEY INFORMANT INTERVIEWS 72
17.10 INTERNAL CAPACITY AND MECHANISMS 77
17.11 GENDER SAFETY AND PROJECT DESIGN 82
17.12 IMPACT ASSESSMENT 82
17.13 PARTNERSHIP OPPORTUNITIES 111

APPENDIX A –RELEVANT OCCUPATIONS WHERE THE USE OF WOMEN'S LABOR IS PROHIBITED 113

APPENDIX B – GBV/SEA/SH- RELATED SERVICE PROVIDERS BY DISTRICT 121

DEPARTMENTS OF WOMEN AND FAMILY AFFAIRS (CWFA AT DISTRICT LEVEL) 121
REHABILITATION ROOMS FOR GBV SURVIVORS (UNDER THE MINISTRY OF HEALTH AND SOCIAL PROTECTION) 121
POLICE DEPARTMENTS 122
LEGAL AID CENTERS (UNDER THE MINISTRY OF JUSTICE) 122
NATIONAL HELPLINE FOR SUPPORTING GBV SURVIVORS 123
WOMEN RESOURCE CENTERS FUNDED BY OSCE 124

NON-GOVERNMENTAL ORGANIZATIONS (NGO) **124**

TABLES

Table 17-1 - Key International Conventions signed or ratified by Tajikistan. 12

Table 17-2 - Summary of International Standards Pertaining to Gender 14

Table 17-3 – Breakdown of Rogun workers by job type, gender and expat status as of July 2023 23

Table 17-4 - List of Women-only Focus Group Discussions 27

Table 17-5 - Summary of Relevant National Legislation 29

Table 17-6 - Summary of Key National Policies and Strategies 34

Table 17-7 - Key National GBV Service Providers and Roles and Responsibilities 37

Table 17-8 – Assessment of GBV/SEA/SH survivor services available in Project affected areas 43

Table 17-9 – Female education and literacy data from household survey 58

Table 17-10 – Source of income by gender – data from household survey 61

Table 17-11 - National Laws and Gaps Compared to International Standards 63

Table 17-12 - Summary of Key Informant Interviews 72

Table 17-13 - Key findings from women FGDs 76

Table 17-14 – Impact significance matrix 84

Table 17-15 - Construction-phase Gender-related Risks and Impacts 86

FIGURES

Figure 17-1 - Risk Areas for GBV in Investment Operations 10

Figure 17-2 - The location of construction camps and facilities relative to Rogun town 24

Figure 17-3 - Women's Toilets at a Workers' Camp Site within the Construction Zone 79

Figure 17-1 - Risk Areas for GBV in Investment Operations 10

Figure 17-2 - The location of construction camps and facilities relative to Rogun town 24

Figure 17-3 - Women's Toilets at a Workers' Camp Site within the Construction Zone 79

Figure 17-1 - Risk Areas for GBV in Investment Operations 10
Figure 17-2 - The location of construction camps and facilities relative to Rogun town 24
Figure 17-3 - Women's Toilets at a Workers' Camp Site within the Construction Zone 79

KEY DEFINITIONS

Definitions	
Economic Violence	Any act or behavior which causes economic harm to an individual. Economic violence can take the form of, for example: property damage; restricting access to financial resources; controlling access to health care, employment, education, including agricultural resources; not complying with economic responsibilities such as alimony; excluding from financial decision-making; discriminatory traditional laws or practices relating to property rights and use of communal land.[1]
Gender-Based Violence (GBV)	Umbrella term for violence and harassment directed at persons because of their sex or gender or affecting persons of a particular sex or gender disproportionately, and includes sexual harassment.[2]
Gender Equality	The equal rights, responsibilities and opportunities of women and men and girls and boys.
Gender Mainstreaming	Mainstreaming involves ensuring that attention is given to the goal of gender equality and that gender perspectives are central to all activities.
Grievance Redress Mechanism	A Grievance Redress Mechanism is an avenue for individuals and communities to submit complaints and for these to be addressed.
Intimate Partner Violence	Behavior by an intimate partner or former partner that causes physical, sexual, economic, and/or psychological harm.
Non-discrimination	Refers to the practice of treating all people equally (e.g., based on gender, race, ethnicity, religions, disability, etc.)
Sexual Abuse	The actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions. All sexual activity with children (as defined by the UN Convention on the Rights of the Child as any person under the age of 18) is sexual abuse, regardless of the age of maturity or consent locally. Mistaken understanding of the age of a child is not a defense.[3]
Sexual Exploitation	Any actual or attempted abuse of a position of vulnerability, differential power or trust for sexual purposes, including profiting monetarily, socially or politically from the sexual exploitation of another.[4]

[1] EIGE (2017) Glossary of definitions of rape, femicide and intimate partner violence. https://eige.europa.eu/publications/glossarydefinitions-rape-femicide-and-intimate-partner-violence
[2] ILO (2019) Convention No. 190 and Recommendation No. 206 — Convention Concerning the Elimination of Violence and Harassment in the World of Work. https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---relconf/documents/meetingdocument/wcms_711570.pdf
[3] United Nations Secretariat (2003) United Nations Secretary-General's bulletin ST/SGB/2003/13. https://www.refworld.org/ docid/451bb6764.html
[4] Ibid

Definitions	
Sexual Harassment	Any form of unwanted verbal, non-verbal or physical conduct of a sexual nature with the purpose or effect of violating the dignity of a person, in particular when creating an intimidating, hostile, degrading, humiliating or offensive environment.[5]
Sexual Assault	The Tajikistan Criminal Code covers “sexual assault, includes aggravated, abusive and wrongful intentional sexual contact which may be characterized by use of force, threats, intimidation, abuse of authority or when the victim does not or cannot consent.” Verbal, non-verbal or cyber harassment are not currently covered by the Criminal Code.
Survivor	A person who has experienced GBV and survived. The terms "victim" and "survivor" are often used interchangeably. "Survivor" is the term generally preferred in the psychological and social support sectors.
Victim	A person who has experienced GBV. "Victim" is a term more often used in the legal and medical sectors.
Violence and Harassment	A range of unacceptable behaviors and practices, or threats thereof, whether a single occurrence or repeated, that aim at, result in, or are likely to result in physical, psychological, sexual or economic harm, and includes gender-based violence and harassment.[6]
Rape	Sexual penetration, whether vaginal, anal or oral, through the use of object or body parts, without consent, using force, coercion or by taking advantage of the vulnerability of the victim.[7]

[5] Ibid
[6] ILO (2019) Convention No. 190 and Recommendation No. 206 — Convention Concerning the Elimination of Violence and Harassment in the World of Work. https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---relconf/documents/meetingdocument/wcms_711570.pdf
[7] EIGE (2017) Glossary of definitions of rape, femicide and intimate partner violence. https://eige.europa.eu/publications/glossarydefinitions-rape-femicide-and-intimate-partner-violence

17 GENDER ASSESSMENT

17.1 PURPOSE

17.1.1. As part of the environmental and social impact assessment for the Project, WSP has been commissioned to develop a Gender Assessment and a Gender Action Plan.

17.1.2. The development of this Gender Assessment and the subsequent Gender Action Plan was financed through the TA grant for the Rogun HPP. These are new studies not previously undertaken as part of the scope of works undertaken in 2014 but now included to comply with the World Bank Environmental and Social Framework (2018) and its commitment to closing gender gaps globally for lasting impact in tackling poverty and driving sustainable economic growth that benefits all.

17.1.3. The key objectives of the Gender Assessment are to identify and assess the key gender related risks and impacts related to the Project, as well as the opportunities that it presents to women. The Gender Assessment explores:

- Identify, assess and analyze gender and gender-based violence (GBV), Sexual Exploitation and Abuse (SEA) / Sexual Harassment (SH) risks and impacts as well as opportunities to promote gender equality and opportunities for women.
- Gaps between the national legislation and policy context and international standards.
- Partnership opportunities that can be leveraged to more effectively prevent and address GBV/SEA/SH and develop opportunities for women.
- Key mitigation measure and actions that can be adopted to prevent and mitigate gender-related risks and impacts and promote gender equality and opportunities for women.

17.2 SCOPE OF THE GENDER ASSESSMENT AND GENDER ACTION PLAN

17.2.1. This technical annex comprises a Gender Assessment that assesses the national and local baseline with respect to gender, identifies gaps between national legislation and international standards and assesses gender-related risks and impacts as well as key opportunities for women in relation to the project. A Gender Action Plan, informed by findings from the Gender Assessment, presents specific actions and measures to address GBV/SEA/SH risks at or near the Project and / or resettlement sites, identify challenges and restrictions in gender equality and mainstreaming, and finally to propose economic and social opportunities for women and girls affected by the Project.

17.2.2. The Gender Assessment consists of the following sections:

- Introduction: Including objectives and scope, a description of the key components of GBV/SEA/SH and gender equality, and an overview of applicable international standards and requirements.
- Methodology: Including desktop assessment and collection of primary data.
- Project description: A full Project description can be found in **Volume 1, Chapter 3: Project Description** of this ESIA. This section highlights key aspects pertinent to gender including workforce, accommodation and transport.
- Baseline: Including national legislation, national policy context, national and local socio-economic context in relation to gender and national and local gender referral pathways.
- National Law, gaps and current developments.

- Findings from the gender surveys: Including Key Informant Interviews and Focus Group Discussions.
- Internal Capacity and Mechanisms –Reviewing current policies, procedures and reporting mechanisms relating to GBV/SEA/SH and gender equality.
- Gender safety and project design.
- Risk and Impact Assessment.
- Partnership opportunities.

17.2.3. This Gender Action Plan is appended and includes measures to:

- Addressing GBV/SEA/SH risks at or near the Project site.
- Addressing GBV/SEA/SH risks at or near resettlement sites.
- Developing economic and social opportunities for women and girls PAPs.
- Creating greater opportunities for women as workers/employees at the Project site.
- Create an enabling environment for better economic opportunities for affected people and for women and girls.

17.3 KEY COMPONENTS OF GBV AND GENDER EQUALITY

17.3.1. This section provides detailed definitions of gender-based violence (GBV), Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH) and gender equality and mainstreaming.

Gender-Based Violence (GBV)

17.3.2. GBV is an umbrella term "for any harmful act that is perpetrated against a person's will and that is based on socially ascribed gender differences", including "physical, mental, sexual harm or suffering; threats of such acts; and coercion and other deprivations of liberty, whether occurring in public or in private life"[8].

17.3.3. GBV is rooted in gender inequality and unequal distribution of power – considering whether an act of violence reflects or reinforces unequal power relations between men and women can help identify whether it constitutes GBV.

17.3.4. Perpetrators in relation to the Project may include Project staff, contractors or individuals within Project affected communities.

17.3.5. Many forms of GBV are criminal acts in national laws although this will differ between countries. In Tajikistan, laws exist that prohibit domestic violence (the National Law on the Prevention of Violence in the Family (2013), which prohibits reviews physical, psychological, sexual and economic violence in the framework of family), but it is not criminalized as a standalone offence. See Table 17-5 and Section 17.8 for further details of relevant national laws.

[8] World Bank (2020) 'Good Practice Note: Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works', https://thedocs.worldbank.org/en/doc/741681582580194727-0290022020/original/ESFGoodPracticeNoteonGBVinMajorCivilWorksv2.pdf

Sexual Exploitation and Abuse and Sexual Harassment

17.3.6. Sexual Exploitation and Abuse and Sexual Harassment are types of GBV.

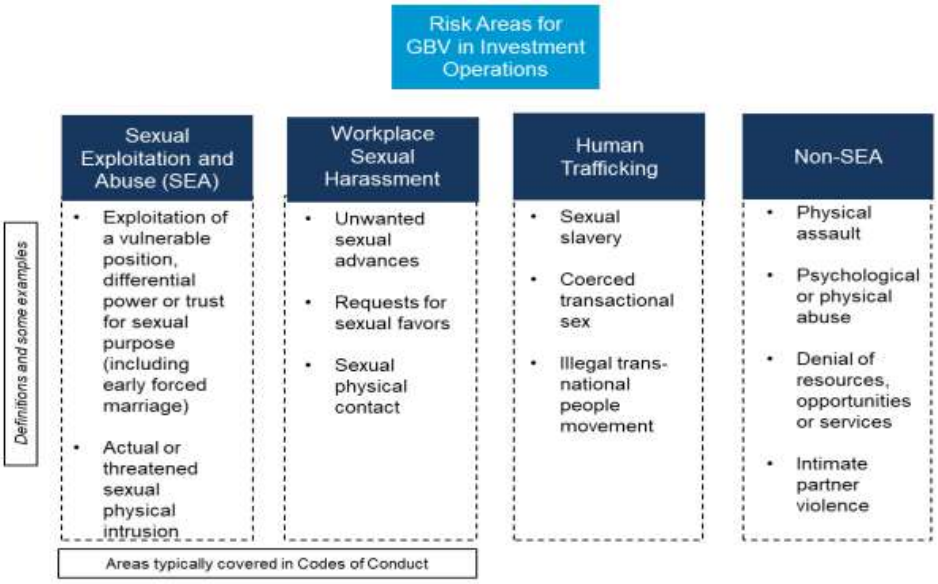
17.3.7. Sexual Exploitation and Abuse (SEA) refers to 'Any actual or attempted abuse of a position of vulnerability, differential power, or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another' (sexual exploitation) and 'Actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions' (sexual abuse)[9].

17.3.8. Sexual harassment refers to 'Any unwelcome sexual advance, request for sexual favor, verbal or physical conduct or gesture of a sexual nature, or any other behavior of a sexual nature that might reasonably be expected or be perceived to cause offense or humiliation to another, when such conduct interferes with work, is made a condition of employment or creates an intimidating, hostile or offensive work environment'[9].

17.3.9. SEA occurs against a beneficiary or member of the community. SH occurs between personnel/staff and involves any unwelcome sexual advance or unwanted verbal or physical conduct of a sexual nature.

17.3.10. Figure 17-1**Figure 17-1** shows the four broad categories of GBV that the World Bank identifies as being most likely to be exacerbated by World Bank-financed IPF involving major civil works.

Figure 17-1 - Risk Areas for GBV in Investment Operations



[9] World Bank (2019) 'Good Practice Note – Addressing SEA/SH in IPF Involving Major Civil Works'

Source: World Bank, 2020, 'Good Practice Note: Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works'[10].

17.3.11. In Tajikistan, national law prohibits sexual harassment and workplace harassment (Law on Equality and Elimination of All Forms of Discrimination 2022, Article 6).

Gender equality and mainstreaming

Gender Equality

17.3.12. Gender equality is defined by the United Nations (UN) as referring to "the equal rights, responsibilities and opportunities of women and men and girls and boys"[11]. This is not to say that women and men will become the same, but that women's and men's rights, responsibilities and opportunities will be equal and not dependent on whether a person is born male or female. It is important to note that to achieve gender equality, men and boys should be fully engaged in addition to women and girls.

Gender Mainstreaming

17.3.13. Gender Mainstreaming is a strategy used to promote the achievement of gender equality. Mainstreaming involves ensuring that attention is given to the goal of gender equality and that gender perspectives are central to all activities (in this instance related to the Project) including policy development, research, advocacy / dialogue, legislation, resource allocation, and planning, implementation and monitoring of programs and projects[12]. It is about taking systematic account of the differences between the conditions, situations and needs of women and men in all community policies and actions[13].

17.4 APPLICABLE STANDARDS AND GUIDELINES

International Gender-Related requirements

17.4.1. Gender is a key component of the Sustainable Development Goals (SDGs) and has been set out in Goal 5, to "Achieve gender equality and empower all women and girls".

17.4.2. The Constitution of the Republic of Tajikistan recognizes international law as a component of the national legal system. Tajikistan is a signatory to a number of international human rights treaties as listed in **Table 17-1**, with commitments to equality for all reflected in national laws. However, while a sound national legal framework is in place to support gender equality, it should be noted Tajikistan has not implemented many of the laws and international agreements to which it is party[14]. This

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[10] World Bank (2020) 'Good Practice Note: Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works', https://thedocs.worldbank.org/en/doc/741681582580194727-0290022020/original/ESFGoodPracticeNoteonGBVinMajorCivilWorksv2.pdf

[11] United Nations (2020), Gender Concepts and Definitions. Available at: https://www.un.org/womenwatch/osagi/conceptsandefinitions.htm.

[12] United Nations (2020), Gender Mainstreaming. Available at: https://www.un.org/womenwatch/osagi/gendermainstreaming.htm.

[13] UNICEF (2020) https://gdc.unicef.org/resource/gender-impact-assessment-gender-mainstreaming-toolkit.

[14] The World Bank (2017), 'Tajikistan Risk and Resilience Assessment', file:///C:/Users/UKEJB009/Downloads/Tajikistan-Risk-and-resilience-assessment.pdf

includes the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) which requires states to take action to prevent and prohibit discrimination on the basis of sex. CEDAW states that family violence may be considered a violation of the convention and calls on states to combat domestic violence. However, reports conclude that in Tajikistan the response to family violence and services available do not meet international standards (which call for a survivor-centered response to DV that prioritizes the survivor's security and wellbeing) inadequate support is provided to survivors of GBV[15].

Table 17-1 - Key International Conventions signed or ratified by Tajikistan.

International Convention / Requirements	Brief Description
Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), 1979	The Convention explicitly defines discrimination against women and sets up an agenda for national action to end such discrimination. The Convention targets culture and tradition as influential forces shaping gender roles and family relations, and it is the first human rights treaty to affirm the reproductive rights of women. It calls for implementation of laws on domestic violence, for provision of services to protect and support survivors, and training of state officials, including judicial and law enforcement personnel, to properly enforce these measures. It recommends the establishment of support services for survivors of domestic violence, including in rural or isolated areas. Tajikistan ratified the CEDAW convention in 1993 and its Optional Protocol to the Convention on the Elimination of All Forms of Discrimination against Women in 2014. With this, Tajikistan committed to end all forms of violence against women, take measures to combat violence against women and provide support to victims from violence against women[16].
CEDAW General Recommendation No. 19: Violence against women, 1992	The Convention in Article 1 defines discrimination against women. The definition of discrimination includes gender-based violence, that is, violence that is directed against a woman because she is a woman or that affects women disproportionately. It includes acts that inflict physical, mental or sexual harm or suffering, threats of such acts, coercion and other deprivations of liberty[17].
International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families	This convention is a United Nations multilateral treaty governing the protection of migrant workers and families. Tajikistan ratified the Convention in 2002.
Convention concerning Equal Remuneration for Men and Women	Tajikistan has ratified all fundamental ILO Conventions including Convention No. 100. The Convention concerning Equal Remuneration for Men and Women Workers for Work of Equal Value, or Equal Remuneration Convention is the

[15] Human Rights Watch (2019), 'Violence with every step'
[16] United Nations Tajikistan, https://tajikistan.un.org/en/103928-analysis-amendments-law-prevention-violence-family-align-those-cedaw-concluding-observations
[17] UN,1992. Available at : https://www.refworld.org/docid/52d920c54.html

International Convention / Requirements	Brief Description
Workers for Work of Equal Value, 1951 (International Labor Organization (ILO), Convention No. 100)	100th International Labor Organization Convention and the principal one aimed at equal remuneration for work of equal value for men and women.
International Covenant on Economic, Social and Cultural Rights 1966	This international human rights treaty includes a commitment to 'the equal right of men and women to the enjoyment of all economic, social and cultural rights set forth in the present Covenant' (Article 3) and 'Fair wages and equal remuneration for work of equal value without distinction of any kind, in particular women being guaranteed conditions of work not inferior to those enjoyed by men, with equal pay for equal work' (Article 7). Tajikistan ratified the Covenant in 1999.
Beijing Declaration and Platform for Action (UN) 1995	This UN resolution is described by UN Women as 'the most progressive blueprint ever for advancing women's rights'[18]. It is a global policy framework and blueprint for action and aims to support gender equality and the human rights of women and girls, everywhere. It was adopted by Tajikistan in 1998.
International Labor Organization (ILO)	Tajikistan has ratified all fundamental ILO Conventions including Convention No. 100. The Convention concerning Equal Remuneration for Men and Women Workers for Work of Equal Value, or Equal Remuneration Convention is the 100th International Labor Organization Convention and the principal one aimed at equal remuneration for work of equal value for men and women.
2030 Sustainable Development Agenda	The Agenda is a plan of action for people, planet and prosperity which came into force in 2016 – focused on eradicating poverty, securing peace and delivering worldwide sustainability and resilience through 17 Sustainable Development Goals and 169 targets. Goal 5 'Gender Equality' seeks to end all discrimination and violence and provide equal rights to economic resources among its targets. Tajikistan approved and adopted the 2030 Sustainable Development Agenda for implementation.

International Lender Standards – Gender Aspects

17.4.3. **Table 17-2** below describes the key aspects of international lender standards (including World Bank, European Investment Bank (EIB), Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB) and the Islamic Development Bank (IsDB) pertaining to gender including non-discrimination and equality and gender-based violence and harassment.

[18] UN Women (2015) https://www.unwomen.org/en/digital-library/publications/2015/01/beijing-declaration.

Table 17-2 - Summary of International Standards Pertaining to Gender[19]

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	EIB Environmental and Social Standards (2022)	ADB Safeguard Policy Statement (2009)	AIIB ESP and ESF (2022)
Assessment of gender risks, opportunities and mitigation	**ESS1:** Identify 'disadvantaged or vulnerable' groups, mitigate disproportionate impacts and ensure benefits are shared (gender not explicitly mentioned).	**Standard 7:** Promote gender equality as a basic human right crucial for sustainable development, by ensuring that the gender specific impacts, vulnerabilities and barriers are considered and addressed… and by promoting the equal ability to access and utilize the benefits and opportunities. Standard 7 identifies that 'gender-based discrimination affects all societies and cuts across all other types of discrimination, often exacerbating vulnerability, exclusion, and/or marginalization' and that 'discrimination, entrenched social and gender roles and attitudes, gender-based violence and lack of access to decision-making can weaken the resilience of (women) and render	**Safeguard requirement 1:** **G**ender aspects included in the E(S)IA.	**ESS1:** Identify any potentially adverse gender-specific risks and impacts of the Project that have a disproportionate impact on one gender compared to another, consider how the Project's risks and impacts may increase such gender-specific risks and impacts and develop mitigation measures to reduce these. Collect, at an appropriate level of detail, and use gender-disaggregated baseline data and analysis, and consider enhancing the design of the Project to promote equality of opportunity and women's socioeconomic empowerment.'

[19] IsDB is not included in this table as detailed standards have not yet been completed.
[20] Paraphrased for brevity and clarity.

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	EIB Environmental and Social Standards (2022)	ADB Safeguard Policy Statement (2009)	AIIB ESP and ESF (2022)
		them disproportionally vulnerable to adverse Project impacts'.		
Stakeholder engagement and consultation	**ESS10:** Project information will be disclosed, taking into account any specific needs of groups that may be differentially or disproportionately affected or have specific information needs, such as women.	**Standard 2:** [stakeholder] engagement shall be gender responsive and inclusive, devoid of discrimination and take into account, if necessary, the different needs of and potential barriers facing the various stakeholders to ensure their equitable participation.	'Meaningful consultation' defined as 'gender inclusive and responsive'.	**ESS1:** 'Meaningful consultation is gender sensitive, inclusive, accessible, responsive and tailored to the needs of vulnerable groups'.
Grievance management	**ESS10:** Requirement to establish a grievance mechanism to receive and facilitate resolution of concerns and grievances of project-affected parties. **ESS 2:** Requirement to establish a separate grievance mechanism for workers.	**Standard 8:** A workplace GRM mechanism, including provision for anonymous and sensitive grievances, to be developed. **Standard 2:** A community grievance mechanism will be developed which is 'gender inclusive and responsive and address potential access barriers to men and women'.	**Safeguard requirement 1:** The borrower/client will establish a GRM that is 'gender responsive, culturally appropriate, and… readily accessible to all segments of the affected people.'	**ESP:** The Project GRM… address affected people's concerns and complaints promptly, including gender-related concerns and complaints relating to GBV, using an understandable and transparent process that is gender sensitive, culturally appropriate and readily accessible to all affected people. **ESS1:** Workers' GRM to be responsive to gender-related concerns.
Involuntary resettlement	**ESS5:** Specific measures to be implemented as necessary so that women's preferences,	**Standard 6:** Pay attention to the specific gender dimensions of involuntary resettlement, especially	**Safeguard requirement 2:** During the identification of the impacts of resettlement	**ESS2:** Requires identification of gender-related risks and differential impacts, gender-

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	**EIB Environmental and Social Standards (2022)**	**ADB Safeguard Policy Statement (2009)**	**AIIB ESP and ESF (2022)**
	perspectives and interests are considered in all aspects of the resettlement process. Measures should be taken to ensure women gain security of tenure and receive due compensation on equal terms to men.	regarding stakeholder engagement, the census, valuations, payment of compensation and livelihood restoration. The promoter shall put in place specific measures as necessary so that women's perspectives and interests are considered in all aspects of resettlement planning and implementation. The promoter shall consider feasible measures for women to gain security of tenure and receive cash or in-kind compensation on equal terms as men.'	and resettlement planning, and implementation, the borrower/client will pay adequate attention to gender concerns, including specific measures addressing the need of female headed households, gender-inclusive consultation, information disclosure, and grievance mechanisms, to ensure that both men and women receive adequate and appropriate compensation for their lost property and resettlement assistance, if required, as well as assistance to restore and improve their incomes and living standards.	differentiated sources of livelihoods, including informal ones and the establishment of a gender-sensitive GRM as well as equal provision for women to gain security of tenure when determining compensation and entitlements.
Workplace opportunities and non-discrimination	ESS2 'Labor and Working Conditions' include to 'promote the fair treatment, non-discrimination and equal opportunity of project workers' and 'to protect project workers, including vulnerable workers such as women…as appropriate'. ESS2 requires that 'the employment of project workers	**Standard 8**: labor management policies and procedures 'shall be non-discriminatory and shall observe equal opportunities' and must 'set out measures to prevent and address gender discrimination (and) ensure that human resources and career progression decisions are not	N/A	**ESS1:** assessment of 'any discrimination toward groups or individuals in providing access to development resources and Project benefits, particularly toward vulnerable groups. As necessary, incorporate measures to mitigate any such discrimination.

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	EIB Environmental and Social Standards (2022)	ADB Safeguard Policy Statement (2009)	AIIB ESP and ESF (2022)
	will be based on the principle of equal opportunity and fair treatment, and there will be no discrimination with respect to any aspects of the employment relationship, such as recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, or disciplinary practices.' ESS2 states that where national law is inconsistent with these requirements, the Project must seek to carry out Project activities in a manner that is consistent with the requirements to the extent possible.	affected by gender and/or the reproductive role of women'.		
Workplace health and safety (inc. GBV)	**ESS2:** The Borrower will provide appropriate measures of protection and assistance to address the vulnerabilities of Project workers, including specific groups of workers, such as women. Management procedures should 'set out measures to prevent and address harassment,	**Standard 8: Re**quires 'measures, including workplace policies and an appropriate mechanism, to effectively prevent and address any form of violence and harassment, bullying, intimidation, and exploitation, including any form of gender-based violence and harassment.	N/A	**ESS1:** Manage risks of Project-related GBV to… Project workers. Take measures to address any form of GBV and harassment, bullying, intimidation, and/or exploitation under the Project, and adopt specific measures to avoid or mitigate these risks, including

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	EIB Environmental and Social Standards (2022)	ADB Safeguard Policy Statement (2009)	AIIB ESP and ESF (2022)
	intimidation and/or exploitation'. Where national law is inconsistent with these requirements, the Project must seek to carry out Project activities in a manner that is consistent with the requirements to the extent possible.	**Standard 9:** Identify, assess and manage risks to the health and safety of project-affected people and communities, (including to project-related gender-based violence risks including sexual harassment, exploitation and abuse) during the life cycle of the project.' Special note is made of the importance of safeguards in worker accommodation to manage risks of gender-based violence.		providing for confidential, culturally appropriate channels for reporting incidents and providing support to GBV survivors.
Community health and safety (inc. GBV)	**ESS4:** Measures to protect population from transmissible diseases to take into account 'higher sensitivity of vulnerable groups,' with a focus on risk arising from labor influx. Risks associated with security personnel to be assessed and all personnel to be screened for past abuses.	**Standard 9:** Identify, assess and manage risks to the health and safety of project-affected people and communities, (including to project-related gender-based violence risks including sexual. harassment, exploitation and abuse) during the life cycle of the project.	N/A	**ESS1:** If… there are risks of retaliation against relevant Project stakeholders or gender-based violence (GBV) or other threats to the safety of Project-affected people under the Project, additional measures may be required to minimize such risks…. adopt specific measures to avoid or mitigate these risks, including providing for confidential, culturally appropriate channels for reporting incidents and providing support to GBV survivors.

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	EIB Environmental and Social Standards (2022)	ADB Safeguard Policy Statement (2009)	AIIB ESP and ESF (2022)
Natural resources and ecosystem services	N/A	**Standard 4:** A gender-sensitive approach [to the ecosystem services assessment] should be taken, where feasible, acknowledging that men and women may place different values on ecosystems, and derive different benefits from them. The EIA/ESIA shall… examine any impacts on the ability of female and male beneficiaries to utilise [ecosystem] services.	N/A	**ESS1:** Understand that gender risks and impacts are 'closely linked with physical and biological conditions.' **ESS1:** Take gender into account regarding land ownership and customary rights to natural resources.
Climate change	N/A	**Standard 5:** the promotor shall consider gender aspects of the climate change (GHG and physical climate risk) assessment as appropriate.	N/A	N/A
Non-binary, gender non-conforming, and LGBT+ people	**ESS1:** Requirements that environmental and social assessment to take into account…social risks and impacts, including (i) threats to human security through the escalation of personal, communal or inter-state conflict, crime or violence; (ii) risks that project impacts fall disproportionately on individuals and groups who, because of their particular	**Standard 2:** The [community grievance] gender inclusive and responsive and address potential access barriers to… non-binary or gender non-conforming persons'.	N/A	N/A

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	EIB Environmental and Social Standards (2022)	ADB Safeguard Policy Statement (2009)	AIIB ESP and ESF (2022)
	circumstances, may be disadvantaged or vulnerable; (iii) any prejudice or discrimination toward individuals or groups in providing access to development resources and project benefits, particularly in the case of those who may be disadvantaged or vulnerable; (iv) negative economic and social impacts relating to the involuntary taking of land or restrictions on land use; (v) risks or impacts associated with land and natural resource tenure and use , including (as relevant) potential project impacts on local land use patterns and tenurial arrangements, land access and availability, food security and land values, and any corresponding risks related to conflict or contestation over land and natural resources; (vi) impacts on the health, safety and well-being of workers and project-affected communities; and (vii) risks to cultural heritage.			
Monitoring and evaluation	N/A	**Standard 1:** The ESMP should include 'Procedures to… evaluate the effectiveness of the mitigation and/or	N/A	**ESS1:** ESMP to include gender related KPIs

Topic Area	Applicable Lenders' Standards[20]			
	World Bank Environmental and Social Framework (ESF) (2018)	EIB Environmental and Social Standards (2022)	ADB Safeguard Policy Statement (2009)	AIIB ESP and ESF (2022)
		compensatory/ remedial measures, including appropriate qualitative and quantitative indicators disaggregated by sex. age and any other relevant socio-economic characteristics, wherever possible).		

17.5 PROJECT CONTEXT

17.5.1. This section highlights key workforce related aspects pertinent to this gender assessment. A detailed Project description can be found in **Volume 1, Chapter 3: Project Description** of this ESIA, and further details about the workforce is presented in **Volume 1, Chapter 7 Environmental and Social Baseline** and **Volume 2, Annex 7.1: Baseline Conditions Report**.

Project structure and stakeholders

17.5.2. Four institutions, directly under the Government of Tajikistan, are responsible for, or involved in, planning and implementation of the Project:

- Rogun Open Joint Stock Company (JSC) – oversees the implementation of the Project, including tendering, selection of contractors, and supervision of the Employer's Representative (the consortium of Tractebel and ELC Electroconsult S.p.A, hereafter referred to as Tractebel).
- "Barki Tojik" Open Stock Holding Company (OSHC) - the national energy company of the Republic of Tajikistan, not directly involved in Project implementation but is responsible for managing contracts for assessment and detailed design studies.
- Project Management Group for Energy Facilities Construction under the President of Republic of Tajikistan (PMG) - responsible for managing Project development during the feasibility and detailed design phase together with the coordination of all parties involved in the process.
- State Enterprise, Directorate of Flooding Zone (DFZ) – responsible for resettlement planning and implementation of affected population; arranging new resettlement sites and constructing public infrastructure and facilities in new resettlement sites.

17.5.3. For further details of the Project structure and key stakeholders please see **Volume 1, Chapter 3: Project Description** of this ESIA.

Project workforce

17.5.4. Workforce statistics as of October 2024 show that there are approximately 17,198 workers engaged by 49 contractors working on the Project.

17.5.5. As of 2023, when a full Labor Audit was completed, an analysis of the workforce found that;

- Approximately 94 percent are Tajik and 6 percent expat (non-Tajik).
- Approximately 95 percent are male, and 5 percent are female.
- Approximately 82 percent are shift workers and 18 percent are technical workers.Approximately 82 percent are shift workers and 18 percent are technical workers.

17.5.6. It is expected that the workforce will generally reflect these proportions as the number of workers on the Project fluctuates throughout the construction period.

17.5.7. A common trend that can be observed across all the different contractors working in the construction activities of the Project is that women are present in a limited number for domestic types of work, such as cleaning, preparing food for workers and washing dishes. In addition to domestic types of work, there is also 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.

Table 17-3 – Breakdown of Rogun workers by job type, gender and expat status as of July 2023

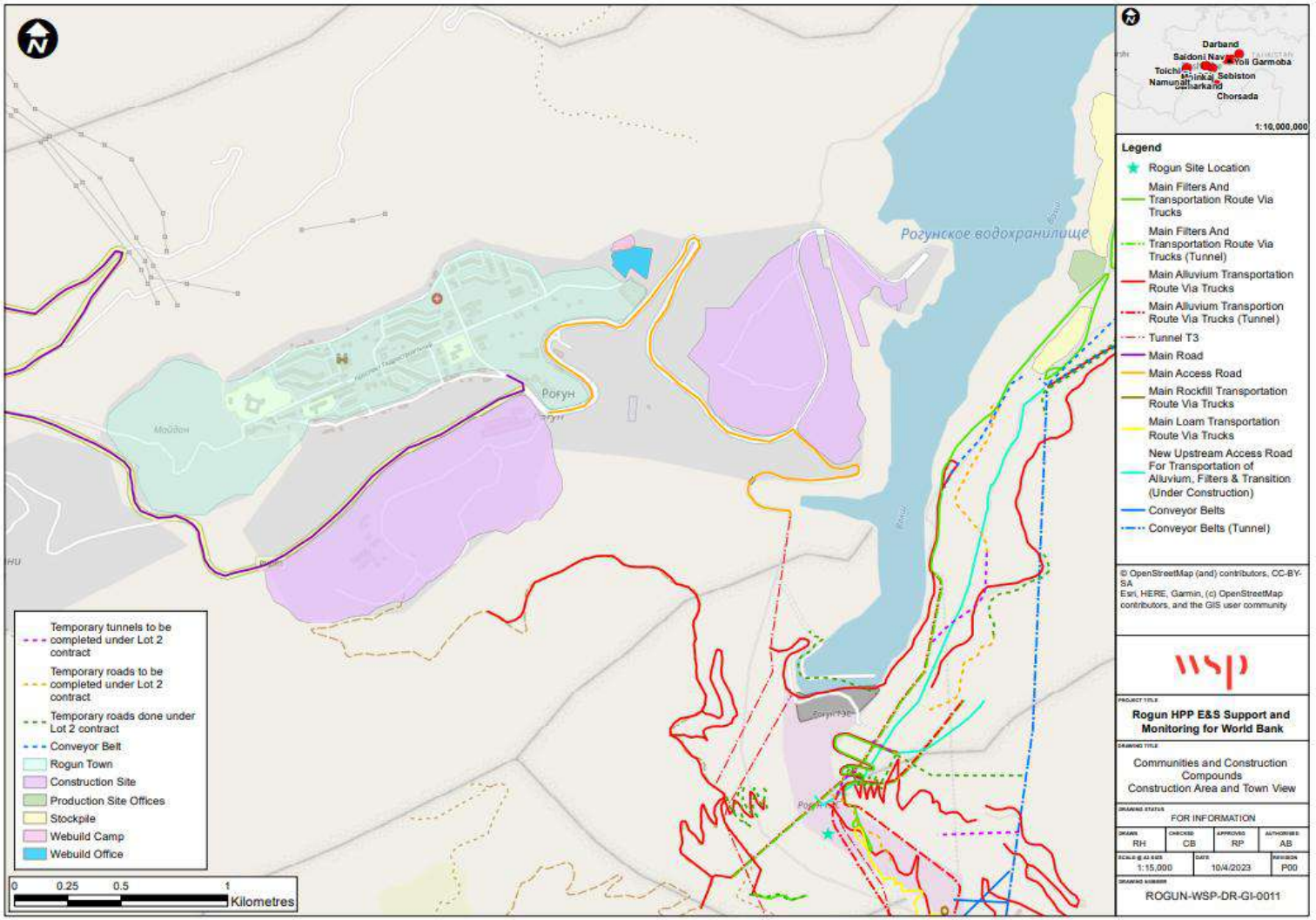
No.	Description	No. workers (total)	% workers (total)	No. women	% women in category
Number of technical engineering employees and workers by gender					
1.1	Technical engineering employees	2 683	*18*	156	*6*
1.2	Workers	12 052	*82*	590	*5*
	Total:	14 735	*100*	746	-
Number of local and expat employees by gender					
2.1	Local	13 828	*94*	731	*5*
2.2	Expats	907	*6*	15	*2*
	Total:	14 735	*100*	746	-

17.5.8. Approximately 17,000 people are currently (October 2024) engaged for construction activities with peak employment likely to reach 20,000 people during the late 2020s. Of current workers, approximately 2,800 are office workers, made up of administrative, manager and support workers (cleaners, canteens, shops) who work shifts from 8am to 5pm, approximately 14,000 workers work 12-hour shifts in construction, on a 15 day on/off schedule with some night shifts (depending on the work programme and individual contractors). Each shift includes 1-hour for lunch.

WORKFORCE ACCOMMODATION

17.5.9. The Labor Audit found that most (approximately 75-80 percent as of 2021) of the non-local workers are accommodated in dormitories and other quarters provided by employers. Most other workers reside in Rogun City (approximately two kilometers uphill from the main worker accommodation area) in company or self-arranged accommodations. The location of current construction camps and facilities relative to residential areas is shown in **Figure 17-2**.

Figure 17-2 - The location of construction camps and facilities relative to Rogun town



17.5.10. Most of the contractor accommodation is comprised of single male and female dormitories. Worker facilities were inspected as part of the Labor Audit (2023), where it was found that most international contractors provided exceptional facilities for international workers, including clean and well-designed apartments, hygienic canteens and kitchens, safe transportation (cars and buses). However, there were areas of non-compliance, including some toilets and sanitary facilities being unsanitary or out of use. Inequalities were noted between male and female facilities within some worker accommodation camps, including examples where single shower facilities are shared by men and women, and an example where women's toilet facilities lacked appropriate sanitary provisions. PMG and OJSC have since worked with Contractors to ensure women have adequate sanitary facilities.

WORKFORCE TRANSPORTATION

17.5.11. Most contractors have their own buses used to transport workers from designated pick-up locations and transport them from their onsite accommodation or Rogun town and take them to and from the construction site.

17.5.12. During the Labor Audit undertaken in 2023, workers – including female workers - were observed attempting to flag down passing vehicles to secure a lift from the construction site. Some contractors reported adding extra bus drop off points in response to worker grievances relating to transportation. Additionally, transport back to home districts following 15-day workers shifts is often promised but not provided. These issues with transportation leave female workers particularly vulnerable, and PMG has worked to ensure women are safely transported to the project site.

17.6 METHODOLOGY

17.6.1. The following section builds on the principles that have guided the overall ESIA Methodology (refer to **Volume 1, Chapter 5: Impact Assessment Methodology** of this ESIA). This Gender Assessment and Gender Action Plan has been undertaken according to the methodology described in this section.

17.6.2. A local gender specialist was engaged to support the delivery of this assessment, providing valuable local knowledge and on-the-ground intelligence regarding the experience of women within Tajikistan and Project affected communities, including GBV/SEA/SH risks and the management of these, the challenges and the opportunities in relation to gender equality and participation in Project opportunities. At a high level, the local gender specialist's scope of work included:

- Interpretation and elaboration of national legislation and policies;
- Insights on lived experience and challenges of women in Tajikistan and rural areas; and
- Support delivering the women's Focus Group Discussions including inputting to planning and the development of the questionnaire, advice and support to M Vector enumerators and in-person support delivering a number of the FGDs.

VALUED COMPONENTS

17.6.3. This Gender Assessment focuses on women and girls within Project affected communities.

BASELINE DATA COLLECTION

Desktop Assessment of Country-specific Gender Related Reports and Data

17.6.4. A comprehensive desktop assessment of available reports and data relevant to the national, local and project-related socio-economic context and gender aspects including the following:

National legislation, strategies and policies; and
Country-specific gender reports and data such as those published by international lenders and institutions.

Review Project Policies, Procedures and Management Plans

17.6.5. A review of existing procedures, policies and management plans for the Project was undertaken along with a detailed gap analysis in relation to gender mainstreaming and inclusion of GBV/SEA/SH aspects. Previous Project-specific environmental and social assessments such as the Environmental and Social Impact Assessment (2014) were also reviewed.

Household Survey

17.6.6. A household survey was undertaken in August 2023 by local Tajikistan market research firm M-Vector to inform the updated social and environmental studies. The socio-economic household survey was carried out using a semi-structured questionnaire, targeting Project affected communities including those within the Project area and those within resettled communities. The affected communities were briefed beforehand by DFZ and the local authorities to ensure that they understand the purpose of the survey and the importance of giving honest answers.

17.6.7. The household survey collected sex-disaggregated data from 900 households across the districts of Rogun, Nurobod and Faizobod (those impacted by resettlement) and contributes to an understanding of the local demographics, lives and livelihoods of Project affected persons and communities.

Focus Group Discussions

17.6.8. In June and August 2023, 18 women-only focus group discussions were held within the resettled, to-be-resettled and host communities. The focus groups were delivered by the women facilitators of the local research company M-Vector, with some of the women-only focus groups supported by the local gender specialist engaged by WSP.

17.6.9. The women-only focus group discussions were held within those within relocation zones and resettled communities. A range of participants were targeted as far as possible including:

- Women of different ages;
- Women with a disability / functional difficulty;
- Women head of households / de-facto head of households;
- Women with differing care responsibilities;
- Women in employment / seeking employment and women not in employment;
- Localities – women based in different localities / for different lengths of time; and
- Women based within host communities.

17.6.10. Women were asked about:

- Their awareness of the project;
- Their daily lives, routines and responsibilities including their roles within their households, roles within their communities, employment (formal and informal), use of resources, care responsibilities, dependents;
- What impacts or opportunities they believe resettlement may offer / has offered;
- How the Project has impacted them, including any safety concerns;
- Their participation in decision-making;
- Their control over assets;
- Their awareness of grievance mechanisms / where to turn if they have concerns.

17.6.11. Table 17-4 below lists the women's focus group discussions undertaken. There were an average of eight women participating in each focus group and a total of 18 women's focus group discussions completed.

Table 17-4 - List of Women-only Focus Group Discussions

District	Jamoat / Village	Host Communities	Resettled Communities	To be Resettled Communities
Rogun	Sicharogh jamoat	1		
	Saidoni Nav	1	1	
	Yoli Garmoba	1	1	
	Lughuri Poyon			1
Nurobod	Makhallai No. 5	1	1	
	Makhallai No. 7	1	1	
	Roghuni poyon			1
	Hakimi			1
	Mehrobod			1
Faizobod	Buston	1		
Rasht	Navobod town			1
	N. Makhsum			1
	B. Rahimzoda			1
	Qal'ai Surkh			1

Key Informant Interviews and Meetings

17.6.12. During March 2023 a number of interviews and meetings were held with women NGOs, UN Women and Tajikistan's Committee of Women and Family Affairs (COWFA) to ask about their roles and

activities within the region as well as women working on the the Project to ask about their experiences and working conditions. In July 2023, representatives from service providers based within the impacted districts to better understand their roles and responsibilities and how they supported women including survivors of GBV. A list of interviewees is provided below.

- NGO “Gender Development”
- Local gender specialist – Viloyat Mirzoeva
- NGO “Madina”
- UN Women
- Committee of Women and Family Affairs (CWFA)
- Woman nurse employed at the Project on-site medical center
- Women workers at Vakhsh Sokhtmon accommodation
- Women workers at TGEM accommodation
- Women workers at Rogun JSC accommodation
- Department of Women and Family Affairs (DWFA) (Rogun and Nurobod districts)
- Department of Labor and Employment of Population (DLEP) (Rogun and Nurobod districts)
- Police department (Rogun)
- NGO “Zanoni Komyob”
- NGO “Nihol”

Constraints

17.6.13. Limited data is available including sex-disaggregated local socio-economic data to provide insights into the experience and lives of women at the local district level and within the Project affected communities.

17.6.14. The engagement of a local gender specialist and delivery of primary research methods within the Project affected communities, including the women-only focus group discussions and gathering of sex disaggregated data through the household survey, are designed to gather valuable insights in the absence of existing data.

IMPACT ASSESSMENT METHODOLOGY

17.6.15. The key steps of the methodology adopted for the gender assessment include:

- Description of the existing gender aspects of the social environment at the national and local level based on qualitative and quantitative data sources.
- Undertake gender-focused surveying and engagement activities (including key informant interviews and women-only focus group discussions).
- Review the outcomes of the engagement along with the desktop research to determine key gender-related social impacts, issues and opportunities that should be considered in the assessment.

- Reviewing relevant technical assessments (for example Labor Audit Report) to identify gender implications of social and socio-economic impacts identified.
- Assess the level or significance of gender-related impacts considering the Applicable Standards and professional judgement. The magnitude of impacts is determined by considering the size of the affect population, duration, reversibility, and geographic extent of an impact, as per the Socio-Economic Magnitude Criteria described in **Volume 1, Chapter 17: Socio-economics** of this ESIA.
- Determine mitigation and management strategies which specifically relate to each impact. Management strategies are based on the mitigation hierarchy of avoiding, minimising, mitigating, and offsetting impacts and maximizing potential benefits.
- The assessment methodology aligns with international standards including The World Bank ESS1 which calls for a risk-based, outcomes-focused tailored, and proportionate approach to Project risks and impacts.
- Development of a Gender Action Plan that identifies actions to manage GBV/SEA/SH risks and impacts and enhance social and economic opportunities for women.

17.7 BASELINE

17.7.1. This section describes key national laws, policies and strategies, and socio-economic conditions as they relate to gender equality in Tajikistan and the local project-affected districts.

NATIONAL LEGISLATION

17.7.2. Legislation of Tajikistan is fairly gender progressive, but there is still significant gap between the laws and their implementation and enforcement. Since the 90s, after gaining independence, the Government of Tajikistan (GoT) started taking measures to promote gender equality and increase women's representation in all spheres of society. The first step toward it was ratifying the "Convention on the Elimination of All Forms of Discrimination against Women" (CEDAW) in 1993 despite the ongoing civil war in the country. Henceforth, numerous laws, national programs and strategies for improving the status of women in society were adopted.

17.7.3. The Committee of Women and Family Affairs (CWFA) is a central executive body that was established to overview and implement the state policy to protect the rights and interests of women and the family and oversee and coordinate gender programs and activities run by international and local non-governmental organizations (NGOs).

17.7.4. **Table 17-5** below provides an overview of the key requirements under national legislation relating to gender aspects in Tajikistan. This provides an understanding of the legislative framework that the Project is operating in with regards to gender and context around the rights of women and laws that govern their protection, rights and equal access to opportunities.

Table 17-5 - Summary of Relevant National Legislation

Key aspect/s	National Law / Article/s	Content
Gender equality & equal rights	The Constitutions of the Republic of Tajikistan	Adopted by the Government of Tajikistan in 1994. Article 17 states that: All are equal before the law and the courts. The state guarantees the rights and freedoms of every person regardless of nationality, race, sex, language, religious beliefs, political persuasion,

Key aspect/s	National Law / Article/s	Content
Marriage & polygamy		social status, knowledge, and property. Men and women have the same rights. According to the Article 33, men and women of marriageable age (18 y.o.) have rights to freely create family. Both spouses have equal rights within the family end during the divorce. The Constitution prohibits polygamy. Articles 34 and 35 of the Constitution state that mother and child are under special protection and patronage of the state; women and men have equal right to work and equal pay for equal work except heavy and underground work or work with harmful conditions where the employment of women and children is prohibited as per the Labor Code which lists 326 professions considered heavy and harmful for women. The Constitution guarantees women the right to the inviolability of home (Article 22), right to free movement (Article 24), right to participate in political life and government (Article 27), right to property and inheritance (Article 32), the right to housing (Article 36), the right to health (Article 38), the right to social protection (Article 39), and the right to education (Article 41).
Domestic violence Gender Referral Pathway	National Law on the Prevention of Violence in the Family	Adopted in 2013, the Law governs the prevention of domestic violence (DV) and determines tasks of the agencies responsible for prevention of violence in the family including measures for identification, prevention and elimination of conditions that promote violence. The Law lists the state agencies responsible for its implementation, which includes the national and local bodies of the Ministry of Education, Ministry of Health, Ministry of Labor and Social Protection, Ministry of Internal Affairs, local administrations, Committee on Women and Family Affairs, and victim support centers. The main purposes of the Law are (i) providing legal protection to the family; (ii) legal regulation of relations related to the prevention of DV; (iii) supporting and promoting the state policy on prevention of DV; (iv) identifying, preventing and eliminating the causes and conditions leading to DV. Article 6 describes the rights of the victim which include receiving medical, psychological, social and legal support as well as having access to victims' support centers, medical institutions and rehabilitation services. The law mentions procedures for registering complaints/appeals to law enforcement agencies, referral to support and rehabilitation centers for victims, administrative detention of perpetrators, child custody and protection orders. The law reviews physical, psychological, sexual and economic violence in the framework of family only and prescribes administrative responsibility for DV and as per Code of Administrative Offences (Article 931), actions which violate the Law but not classified as crimes under the Criminal Code, should be punished by fines. If perpetrator violates the restraining order, he/she can be fined or get administrative detention from 5 to 15 days.
Discrimination Gender equality	Equality and Elimination of all Forms of Discrimination Act 2022	This Law was developed as part of the National Action Plan for the implementation of recommendations of the member states of the UN Human Rights Council - one of the recommendations was about developing a separate law on prevention and elimination of discrimination.

Key aspect/s	National Law / Article/s	Content
Sexual harassment and non-physical harassment in the workplace		The Law determines the organizational and legal basis of implementation of the equal rights and opportunities for all persons in the Republic of Tajikistan and installs system of law for the prevention and effective protection against all forms of discrimination. The law cites that: All citizens of Tajikistan have the right to equality and effective protection against discrimination in all its forms; and Positive measures may be taken to assist disadvantaged groups to gain equality, although this must not take the form of granting special rights to certain groups. The Law provides a clear definition of the term's "discrimination" (Article 1), "direct and indirect discrimination" (Article 5), "prosecution", "sexual harassment and non-physical harassment in the workplace" (Article 6). However, the terms "sexual orientation" or "gender identity" are not mentioned which means that sexual minorities are yet not recognized by the government and don't claim for legal protection. The Commissioner for Human Rights is responsible for implementation of the Law.
Gender discrimination & equal opportunities Safe working conditions for both men and women Women's rights in the workplace Equal access to resources	State Guarantees of Equality of Men and Women and Equal Opportunities for their Implementation 2005	This law affirms state guarantee of gender equality and forbids discrimination between men and women, with the exception of measures pertaining to healthcare, pregnancy, birth, and positive measures to promote equality. According to this Law, the employer shall provide: Equal opportunities for men and women at the time of entering an employment contract; Equal access of men and women to vacant positions (posts); Equal salary (remuneration) for men and women when both do the same work or work of equal value; Equal opportunities for advance training, retraining and promotion; and Safe working conditions, preserving of lives and health of both men and women. Article 3 forbids gender-based discrimination, but doesn't consider other types of discrimination that both men and women may face, i.e. discrimination based on race, religion, disability, age, etc. The Law obliges the state to carry out gender education of civil servants, promotion of equal opportunities for women and men, develop social programs aimed at eliminating discrimination (Article 4); guarantees equal participation of women and men in executive, legislative, judicial branches of government (Article 5). However, the Law doesn't provide for a remedy if these guarantees are not met by the state. Article 7 particularly mentions family responsibilities of workers of both sexes in performance of their duties. To this end, it is provided that during recruitment, career promotion, vocational education and establishment of working schedules, dismissal of workers including civil servants, legal guarantees and rights of workers of both sexes with family responsibilities have to be taken into account. It is the responsibility of employers to establish a system of refreshment courses for workers of both sexes, particularly those who took leave related to birth and upbringing of children.

Key aspect/s	National Law / Article/s	Content
		Article 12 of the Law states that national and local authorities are obliged to provide men and women with access to economic resources, including movable and immovable property, land, financial assets, and loans and ensure the rights for entrepreneurial and other activities not prohibited by the legislation. The article 13 of the Law prohibits discrimination in employment based on gender and mandates equal opportunities in the labor contracts, equal access to positions and remuneration for work of equal value. At the same time, Article 3 states that if the work is considered hazardous for women' and men' health or during the women's pregnancy, the access to some kind of work may be constrained. This matter is brought up in Article 216 of Labor Code, but it restricts only women's engagement in work considered heavy, underground or hazardous.
Marriage and divorce Equal rights Women's rights to property and control over assets	Family Code of the Republic of Tajikistan	This law was adopted in 1998 and its provisions include: Only marriage concluded in state civil registration bodies shall be legally recognized; A woman can access employment, choose where to live, travel outside of her home, travel outside of her country, be 'head of household', sign a contract or open a bank account in the same way as a man; Women and men have equal ownership rights to immovable property and equal administrative authority over assets during marriage; and A woman can obtain a judgment of divorce in the same way as a man and has the same rights to remarry as a man. The Family Code states that both spouses have equal rights in the family; intra-family issues should be resolved by mutual agreement; education of children, care for their well-being and development, including protection of the rights and interests of minors and disabled family members should be the priority of family. Property acquired by spouses during marriage, including movable and immovable property, is their joint property. The right to joint property also belongs to the spouse, who during the marriage period was engaged in housekeeping, childcare or for other valid reasons did not have an independent income. The marriage age in the initial Family Code was 17, but because of marriage becoming customary among 15- and 16-years old girls, the Family Code was amended in 2010 and the legal marriage age was raised to 18 (for both women and men), in line with CEDAW. However, even though marriage of a minor is criminalized under Article 168 of the Criminal Code, child forced marriage is still widely practiced, especially in rural areas posing threats to the well-being of young girls. There are also provisions under the Family Code for the courts to reduce the age of marriage by one year under in "exceptional circumstances".
Inheritance and women's rights to property and assets Common and joint property	Civil Code of the Republic of Tajikistan	Adopted in 2005, this law provides sons and daughters with equal rights to inherit assets from their parents. Female and male surviving spouses have equal rights to inherit assets. Inheritance law applies to dekhan farms (Article 1141). According to article 304 of the Civil Code, property acquired by spouses during marriage is their joint property, unless the law or the contract between them does not establish a different mode of this property.

Key aspect/s	National Law / Article/s	Content
Workplace discrimination Conditions for women's employment Maternity leave Childcare leave Prohibition of women employment in specific sectors	Labor Code of the Republic of Tajikistan of July 23, 2016, No.1329	The Labor Code prohibits discrimination in employment based on gender. Provisions in the Labor Code include: Provisions for 140 days paid maternity leave; Government administered maternity leave; and Prohibits dismissal of pregnant workers. The Labor Code includes the principle of equality of rights and opportunities for all employees (Article 4) and prohibits forced labor (Article 8). Article 159 of the Labor Code prohibits the refusal to employ pregnant women and women with children or to decrease their salaries on the grounds of their pregnancy and responsibilities related to their children. Article 164 provides that women shall be granted a maternity leave of 70 calendar days before delivery and 70 calendar days after delivery. In the case of difficult delivery, the duration can be extended up to 86 days and in giving birth to two or more children, it can be extended up to 110 calendar days. Women can use their maternity leave at their discretion, i.e. either before or after actual delivery. In addition to maternity leave, women are entitled to receive maternity benefit that is equivalent to 100% of the average worker's wage (wage of recipient of benefit) for the whole period of maternity leave regardless of division of leave to pre- and post-natal periods (Article 13). Furthermore, according to Article 173 of the Labor Code, all guarantees and benefits afforded to women with regards to their maternity (night time work and overtime, etc.) are applicable to fathers engaged in the upbringing of their children in the absence of the children's mother (in cases of death, deprivation of rights, prolonged presence in medical institutions and other situations of lack of maternal care). Article 165 foresees several modalities of childcare leave. Upon termination of maternity leave, women are free to choose childcare leave until the child reaches the age of 1.5 years old, the payment is covered by the State social insurance or, alternatively, women may have additional child care leave until their children reach the age of 3 years. In this case, payment of salary or benefit is not provided. The terms of the legal provision are applicable to fathers, grandparents and other relatives who de facto take care of the child. The job is preserved for the duration of the childcare leave. In addition, the leave shall be included into the working records/experience. The Labor Code envisages similar terms of maternity leave and childcare leave for persons who have adopted a child or are exercising custody over a child or children (Article 166). Article 216 prohibits women's employment in specific sectors and professions which are considered difficult or dangerous for women and may cause harm for them and their reproductive health. There is an extensive list of professions (326 professions) approved by the governmental decree that prohibits women to work in construction, mining, geological exploration and topography, railway transport and subways, even agriculture.

Key aspect/s	National Law / Article/s	Content
		See Appendix A for a list of banned professions of particular note for Project.
Registration of a business Land ownership and rights	Law on State Registration of Legal Entities, ARTS. 10-11	Under this law a woman can register a business in the same way as a man. The Law does not require joint registration of jointly held entities. If land is contested, those whose names are not registered are required to go to court to prove ownership.

NATIONAL POLICY CONTEXT

17.7.5. The Committee for Women's and Family Affairs (Women's Committee) is the primary institution responsible for gender policy in Tajikistan. Established in June 1991 by a Decision of the Government of Tajikistan, the Women's Committee's mandate focuses on measures to prevent violence against women and the provision of assistance to survivors of violence. Its responsibilities range from developing state policy on sexual equality and the prevention of violence, delivering training, conducting research, promoting women's rights in the media and monitoring violence against women[21]. The Women's Committee operates a network of regional information, consultation and crisis centres throughout the country. However, the committee has limited resources and capacity to carry out its mandate and relies on international donor agencies[22].

17.7.6. **Table 17-6** below describes key national strategies focused on addressing gender equality and gender aspects in Tajikistan.

Table 17-6 - Summary of Key National Policies and Strategies

Policy or Strategy	Content
National Strategy for the Activation of the Role of Women in the Republic of Tajikistan for 2021 - 2030	The National Strategy for the Activation of the Role of Women in the Republic of Tajikistan for 2021-2030 is a nationwide policy document approved by the Government aimed at raising the status of women in society, including the activation of their role, the need to ensure gender equality and the implementation of gender policy. The Strategy defines the key directions of the state policy to enhance the role of women through implementation of the principle of equality of rights and freedoms of men and women, creating equal opportunities for its implementation by women, ensuring equal representation of men and women in various fields of activity, preventing and eradicating violence against women.

[21] UN Women (2011), Global Database on Violence against Women, https://evaw-global-database.unwomen.org/en/countries/asia/tajikistan/1991/committee-on-women-and-the-family#:~:text=The%20Committee%20on%20Women%20and,deputy%20chairs%2C%20and%20expert%20advisors

[22] Asian Development Bank (2016), Tajikistan Country Gender Assessment, https://www.adb.org/sites/default/files/institutional-document/185615/tajikistan-cga.pdf

Policy or Strategy	Content
	The main goal of the Strategy is to create the necessary prerequisites and conditions for the full manifestation of the potential of women in all spheres of social and economic life, the implementation of the state gender policy, mechanisms for the implementation of constitutional guarantees of equality between men and women, the prevention and eradication of domestic violence, the development of women's entrepreneurship, education of women, ensuring their broad participation in public life and, thereby, ensuring the sustainable development of the state. The Strategy addresses the following problems: unequal participation of men and women in the civil service, especially at the level of holding positions with decision-making powers; insufficient representation of women in the branches of government, their low representation in leadership positions in organizations with different forms of ownership; existing old stereotypes about the role of women and regarding equality of women and men; limited effective means of promoting women at the decision-making level; lack of strategies and programs to promote women in government in the activities of political parties; the imperfect activity of women's public organizations, the fragmentation of the efforts of women's organizations aimed at protecting women's interests; the presence of superstitions and social prejudices that prevent promotion and activation of the role of women; insufficient protection of the rights and legitimate interests of women for achieving gender equality; improper execution and implementation of legislative acts, concerning the family, women and children; lack of political experience of women; and creating conditions for the realization of women's economic rights and opportunities, ensuring their equal participation in society, ensuring gender equality in the field of employment, increasing the competitiveness of women in the labor market is one of the main goals of the Strategy. In addition, in 2021 GoT issued a new Order (No. 5) initiating additional Presidential grants for 2021-2025 to support the development women-owned businesses and female entrepreneurship.
National Strategy for Enhancing the Role of Women for 2011 - 2020	This strategy, now concluded, was superseded by the one above. The main purpose of this strategy was creating favorable conditions for women's participation in education, labor market, entrepreneurship, and politics. One of the main achievements attained during this period is the adoption of the Law "On prevention of violence in the family". With the support of the donors' community, numerous survivors and crisis centers, awareness raising campaigns and Technical and Vocational Education and Training (TVETs) were created in the country. Women and youth received financial and technical support from various sources to establish businesses and create additional job places for other women. Many financial institutions launched women-oriented programs providing financial training and special loans programs for women.
National Development Strategy for the	Approved in 2016, this strategy focused on the long-term development of the country including the implementation of the UN Sustainable Development Goals. The four main strategic goals of the NDS-2030 are as follows:

Policy or Strategy	Content
Period up to 2030 (NDS-2030)	Ensuring energy security and efficient use of electricity; Exit from communication deadlock and turn country into a transit country; Ensure food security and people's access to good quality nutrition; and Expand productive employment. The NDS-2030 promotes gender equality and the preventions of all forms all violence against women and girls through improving relevant policies. The main actions to be undertaken during this period include: Improving the legislation for implementing the state guarantee for creating equal opportunities for men and women; Developing institutional mechanisms for introducing the national and international commitments on gender equality and women's empowerment into all sectoral policies; Improving the legislation for ensuring legal literacy and social inclusion of women, including rural women; Increasing gender potential and gender sensitivity of government employees; and Considering gender budgeting during the budgeting process. The NDS-2030 proposes the following actions for the prevention of all forms of violence against women and girls: Developing legislative and regulatory frameworks for prevention of violence against women and provision of support to the victims of violence; Creating institutions for coordinating and expanding the role of governmental structures in prevention of violence against women and provision of support to the victims of violence; Expanding the range of actions to ensure access to quality services for the victims of violence; and Improving gender-disaggregated statistics and creating a consolidated database for collection of information on all types of violence. To gradually implement all these actions, the GoT approved the National Strategy for the Activation of the Role of Women in the Republic of Tajikistan for 2021-2030.

NATIONAL GENDER REFERRAL PATHWAY

17.7.7. The Law on Prevention of Violence in the Family recognizes the rights of victims to legal, medical, and psychosocial assistance and individual remedies, including registering a case of violence and obtaining protection orders. It prescribes the roles and responsibilities of the key service providers both at national and local levels in prevention or addressing of DV cases, as described in Table 17-7 below.

17.7.8. However, awareness of these mechanisms is low and several factors (the need for the victim to prove the fact of the violence, a lack of free legal aid, weak responses from law enforcement, a lack

of provisions protecting survivors from contact with the perpetrator) make it challenging for female survivors of GBV to bring their perpetrators to justice[23].

17.7.9. Shelters and crisis centers are supported by donors leaving services at risk when funding ceases.

17.7.10. However, compared to previous years, the availability and provision of GBV services for survivors is reportedly gradually improving in Tajikistan[24]. Multi-Disciplinary Working Groups (MDWGs) chaired by CWFA and comprising the actors described in Table 17-7 below have been established to work toward the prevention of domestic violence through the delivery of informational campaigns, meetings with communities, consolidating all efforts to support DV survivors, collecting and analyzing the data on DV and adapting further interventions accordingly as described below. The capabilities of these entities has been supported by GBV focused projects (such as GOPA/PDV (German-based NGO GOPA that implemented a Prevention of Domestic Violence project) in the past and currently UN Women, Organization for Security and Co-operation in Europe (OSCE), and the EU-funded Spotlight Initiative) that have provided numerous trainings about the effective support of survivors; developed and published instructions for each of the agencies on how to react to and address DV cases and what to do if a DV survivor approaches them and organized study tours for them to learn about best practices from other countries.

Table 17-7 - Key National GBV Service Providers and Roles and Responsibilities

Key Service Provider	Role / Responsibility
National Government of the Republic of Tajikistan	**Responsibilities:** • ensure state policy on prevention of domestic violence; • approval of state programs for prevention of domestic violence; • coordinate the activities of entities preventing domestic violence; and • approval of regulations and charters of support centers.
Local Governments	**Responsibilities:** • ensure the implementation of state programs for the prevention of domestic violence; • develop, approve and implement local programs for prevention of domestic violence and cooperation with other entities responsible for prevention of domestic violence; • take measures for prevention of domestic violence; and • establish institutions that will provide social and legal protection for citizens from domestic violence.

[23] Human Rights Watch (2019), 'Violence with Every Step', https://www.hrw.org/report/2019/09/19/violence-every-step/weak-state-response-domestic-violence-tajikistan
[24] Based on findings from Key Informant Interviews as outlined in this report.

Key Service Provider	Role / Responsibility
Committee of Women's Affairs (CoWFA)	**Responsibilities:** • participate in the development and implementation of programs for prevention of DV and cooperate with other entities responsible for prevention of DV; • analyze the causes of DV; • support the local government to develop measures for DV prevention; • conduct explanatory works and awareness-raising campaigns on prevention of DV; and • coordinatef national GBV response / Multi-disciplinary Working Groups.
Commission for protection of child rights	**Responsibilities:** • participate in development and implementation of programs for prevention of domestic violence and cooperate with other entities responsible for the prevention of domestic violence; • support the local government on adoption of measures for prevention of domestic violence among juveniles; • deliver necessary measures for protection of juvenile victims and their rehabilitation in cooperation with other entities responsible for prevention of domestic violence; • represent the legitimate interests of juveniles exposed to domestic violence in preliminary investigations and courts; consider placing children, who systematically face domestic violence, in orphanages; and • submit information to the internal affairs departments for taking appropriate measures against persons who have committed violence against a minor family member, or who threaten to commit such act.
Internal Affairs Agencies	**Responsibilities:** • participate in development and implementation of programs on prevention of domestic violence; cooperate with other entities that are responsible for prevention of domestic violence; • accept, review the appeals and other information about violence or threat of violence in the family as it is prescribed by the legislation of the Republic of Tajikistan; • identify the causes of committing domestic violence; • register the person who has committed domestic violence, and carry out explanatory and preventive measures; • explain to victims their rights and refer them for a medical examination, if necessary; • referral of victim, on the basis of their written consent, to support centers or medical and social rehabilitation centers for victims; • issue protection order to the person who committed domestic violence; • prepare materials, initiating administrative offenses cases or criminal cases against the person who committed domestic violence as it is prescribed by the legislation of the Republic of Tajikistan;

Key Service Provider	Role / Responsibility
	• register families with systematic domestic violence and implement preventive measures to reconcile and strengthen the family; • maintain statistics of DV cases; and • organize special trainings on the prevention of domestic violence for employees of internal affairs bodies. Operates two hotlines that can be utilised by survivors of GBV - 19 19 – Support service and 221 21 21- Helpline.
Education Sector Agencies	**Responsibilities:** • participate in development and implementation of programs on prevention of domestic violence; cooperate with other entities that are responsible for prevention of domestic violence; • cooperate with parents and other legal representatives of minors on children's education and upbringing matters; • identify and inform relevant state authorities about the DV cases that children and students face; and • conduct explanatory and informational works on prevention of violence in the family.
Health Sector Agencies	**Responsibilities:** • participate in development and implementation of programs for prevention of domestic violence and cooperate with other entities responsible for prevention of domestic violence; • develop instructional guidelines on provision of primary medical and psychological aid to victims of DV and enforce their practical implementation in medical facilities; • provide primary medical, psychological, psychic, narcological and treatment-and-prophylactic assistance to the victim and perpetrator of domestic violence; and • inform the internal affairs bodies about the DV victim and medical assistance provided to him/her. Emergency assistance can be obtained by dialing 103 – Ambulance (if dialing from mobile phones. For landline phones – 03)
Social Protection Agencies	**Responsibilities:** • participate in development and implementation of programs for prevention of domestic violence and cooperating with other entities responsible for prevention of domestic violence; • explain to DV victim his/her social rights and providing him/her with social assistance; and • in cooperation with the state employment agencies, take measures for employment of the victim and perpetrator.

Key Service Provider	Role / Responsibility
Self-government bodies of settlements and villages	**Responsibilities:** • coordinate the activities of entities responsible for prevention of domestic violence which are located locally (in settlements and villages); and • participate in development and implementation of local programs to prevent domestic violence and take necessary measures to prevent and eliminate its consequences. • Carry out explanatory and outreach work on prevention of DV and take measures to strengthen the family. • Ensure enterprises, institutions and other organizations, regardless of their organizational and legal forms, take necessary measures to prevent domestic violence and eliminate its consequences, and can provide assistance to victims who are their employees or members in restoring their health.
Support Centers (legal entities for prevention and social and legal protection from domestic violence)	**Responsibilities:** • participate in development and implementation of programs for prevention of domestic violence and cooperating with other entities responsible for prevention of domestic violence; • receive DV victims; • provide necessary free medical, psychological, legal and social support to victims; • provide temporary stay for the victims; • inform the internal affairs bodies about the revealed facts and threats of violence or the facts of committing such violence with the consent of the victims; • analyze the causes of domestic violence; • take measures to raise the level of awareness among population on prevention of domestic violence; • provide information on DV cases at the request of other entities responsible for prevention of domestic violence; and • perform other tasks stipulated by the regulation or charter of the support center.
Medical and social rehabilitation centers/departments for victims	Created by the local authorities in cooperation with health authorities in city or district hospitals/clinics and are not a legal entity. **Responsibilities:** • provide primary health care, social, psychological and other types of support; • refer the victim for appropriate treatment, if necessary; • provide information to the relevant law enforcement agencies about the violence committed with the consent of the victim, if necessary; and • provide information on cases of domestic violence at the request of other entities working on prevention of domestic violence.

17.7.11. The official coordination of responses to GBV are coordinated by CWFA and its subordinate departments at local levels.

17.7.12. At a national level, there is a referral mechanism for survivors of DV comprising the following steps:

- Police: In majority of districts, police have a dedicated officer specialized in handling domestic violence cases.
- Ambulance: Women can call 103 for ambulance services (if dialing from mobile phones. For landline phones – 03). At the hospitals across the country there are medical and rehabilitation rooms where GBV survivors can get medical and psychological support and stay until their physical condition is restored.
- CWFA regional and district representatives: Women can approach CWFA and its subordinate bodies at regional and district levels regarding DV, where they can seek an initial consultation and advice on further actions.
- CWFA hotline: The CWFA has a hotline number 13-13 with specialists who provide counselling and legal support to the survivors as well as informing them about other existing opportunities they could use for own protection and assisting them in benefitting the services.
- Crisis centers: There are a 14 crisis centers for the survivors of DV throughout the country supported by NGOs and providing legal and psychological aid. One of them "Rohnamo" is based in Lakhsh and three in Dushanbe:
  - Women's Self-Awareness Centre
  - League of Women Lawyers
  - Center for Social and Legal Support of Women and Teenagers of Tajikistan "Femida"
- Women's shelters: There are five shelters functioning across the country[25:]
  - Two shelters of "Korvoni Umed" in Dushanbe. Women who stay at the premises of Korvoni Umed get the opportunity to take vocational courses, such as in sewing or culinary, to help find employment after the completion. To ensure sustainability of the shelter and support to the survivors, Korvoni Umed established a social café "Chatr" where the women can work.
  - One shelter under the Ministry of Health and Social Protection
  - Shelter "Gulrukhsor" in Sughd region
  - Shelter "Ghamkhori" in Khatlon region

17.7.13. Women can also reach out to the Ministry of Justice for legal counselling and information via its hotline 30 30.

[25] Based on information provided during a meeting with Korvoni Umed (2023)

LOCAL GENDER REFERRAL PATHWAYS

17.7.14. In rural areas, women will often first turn to community-based services provided by village heads and Women's Councils to report complaints of GBV. Women's Councils exist in the villages and generally comprise three women-leaders who support others with various issues, including playing an important role in supporting and referring GBV survivors. If the issue cannot be resolved, it will be escalated to jamoats and local governmental working groups (comprising DWFA and other local government agencies such as the Ministry of Health and Social Protection (together with doctors), the Ministry of Education and Science, Civil Registration Office, Police of Tajikistan, Committee on Religion, Regulation of Traditions, Celebrations, and Ceremonies (CRA) and jamoats).

17.7.15. There is strong cooperation between the village's head / Women's Council and Jamoat / DWFA / police and hospitals. Reportedly, women in Project affected districts often approach DWFA with complaints of DV. However, given the more remote location of some villages within the Project affected districts, not all women can reach a DWFA office to seek support. In view of this, DWFA works closely with jamoats and where DV issues are raised the local governmental working group becomes involved[26].

17.7.16. The local police department reports that few women turn directly to the police in the first instance, but rather will reach out to the police when other options haven't succeeded[27]. More often, it is the hospital or DWFA that will contact the police as they refer survivors as appropriate. Police inspectors specialized in prevention of GBV issues are not located in Rogun or Nurobod, however local police officers often participate in training on GBV prevention where they learn how to respond to DV cases and communicate with DV survivors. To promote the implementation of the Law "On the Prevention of Domestic Violence", the OSCE Office in Tajikistan has assisted the Ministry of Internal Affairs in recruiting and training police officers, most of whom are women, specializing in the prevention of domestic violence. In the Project area, a police inspector on prevention of DV is available in Rasht district only.

17.7.17. 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.

17.7.18. Table 17-8 below presents the support services available for GBV/SEA/SH survivors in the Project affected districts of Rogun, Nurobod and Rasht and beyond. Recommendations have been included in response to the identified gaps and constraints in the services provided and indicate areas where the Project can consider actions to support the management of GBV/SEA/SH risks and impacts and facilitate positive gender-related outcomes within Project affected communities. Note that these are recommendations only and should be further explored with local partners and stakeholders to determine the most effective options to address gaps. The recommendations are provided here for

[26] Key Informant Interviews conducted with DWFA in Rogun and Nurobod (2023)
[27] Key Informant Interviews with Head of Duty Unit, Police, Rogun and Head of the Department of Internal Affairs, Police, Nurobod (2023)

consideration and further exploration by the Rogun JSC Gender Focal Point, DFZ's Gender Specialist and DLEOs.

Table 17-8 – Assessment of GBV/SEA/SH survivor services available in Project affected areas

Key Facilities for GBV/SEA/SH	Services Provided	Gaps in Services	Recommendations
Mahalla (Village) Committee (consists of Head of Mahalla and Women's council)	Present in all districts – serve as a focal point for the village. Conducting explanatory works with conflicting parties Taking the family under supervision until the conflict dissolves Striving to support families to avoid divorce. If additional support is required, the Women's Council will reach out to the DWFA either directly or through jamoat.	Women's councils are not trained on GBV matters. Traditional methods of reconciling families in which wives or daughters-in-law have to be submissive are applied. Don't address or resolve the root cause of violence. Peace within families can often be short term rather than sustainable change. Don't report on DV cases which they consider to be resolved. Involve or refer to other services only when the violence intensifies.	Deliver training for Women's Councils on how to communicate with GBV survivors, to recognize the psychological status of the survivor and provide her with psychological first aid. Support Women's Councils to strengthen reporting mechanisms. Engage Women's Councils in awareness raising regarding opportunities for women's economic empowerment including training and job opportunities. Disseminate contact information of service providers for GBV survivors among women, so they could approach them directly.
Department of Women and Family Affairs (DWFA)	DWFA based in all districts. If the issue isn't resolved at the village level, then DWFA intervenes. DWFA officially registers DV cases and follow them up until they are resolved. DWFA also tries to prevent family breakdown as not all parents want their daughters to come back. Depending on the complexity of the problem, DFWA involves other members of the Inter-	DWFA and IAWG usually take GBV preventive measures and intervene when the situation intensifies. Lack of professional psychologists who know how to work with GBV survivors or perpetrators. Rural women don't have information about the services available for GBV survivors (including	Capacity building of DWFA and other members of IAWG on dealing with GBV survivors and perpetrators. Enrolling perpetrators in special correction programs. Inform communities about the services available for GBV survivors by disseminating communication including leaflets and

Key Facilities for GBV/SEA/SH	Services Provided	Gaps in Services	Recommendations
	Agency Working Group (IAWG) on Prevention of Domestic Violence for supporting the survivors of GBV. Provides presidential grants which are aimed at women entrepreneurs. Last year 4 women from Nurobod and 4 others from Rogun received the grant. During the first six months of 2023, 14 women approached DWFA Rogun with DV issues. In two cases spouses got divorced, the remaining cases were resolved. (DWFA Nurobod hasn't recorded any DV cases to date during 2023, which may reflect staffing changes).	the CWFA hotline 1313). Lack of shelters in the area where women could spend time away from the violent environment. Lack of skills and confidence of women to find a job and earn money.	posters with all necessary information. Enroll women (including GBV survivors) in vocational programs to learn income-generating skills. Provide small grants to those who completed the courses and need tools or equipment for work.
Inter-Agency Working Group on Prevention of Domestic Violence (IAWG)	Consists of local government agencies, such as DWFA, health department (including hospital doctors), education department, civil registration office, police department, social protection department, department of religion/regulation of celebrations, and ceremonies of traditions, jamoat representatives, etc. Regular visits once a week visits to villages/jamoats to meet with communities and hold discussions on healthy family relationships, importance of education for girls and boys, importance of official marriage registration, physical and mental health literacy, especially for pregnant women, prevention of domestic violence (DV), etc. In case of having any DV cases, the group members within their powers, provide immediate support to the survivors.		
Police department	Local police are also a member of the IAWG and attend meetings with communities.	Given that the majority of police inspectors are men, it is difficult for women	The engagement of female police inspectors focused on DV prevention and

Key Facilities for GBV/SEA/SH	Services Provided	Gaps in Services	Recommendations
	Within the first six months of 2023, Rogun's police department registered 10 complaints from women on DV. Complaints are officially registered. Perpetrators get punished based on the level of violence (warnings, protocol on administrative offences or protective orders). Visit conflicting families once or twice a week for conducting preventive and explanatory works and for tracking positive changes in perpetrator's behavior. The police department works closely with DWFA and local hospitals and refers DV survivors as needed to relevant services. Depending on the emotional state of survivors, police officers may accompany them to the nearest hospital (police receive training on DV prevention and supporting survivors of DV). In case of having physical injury, women approach hospital first, then doctors inform police. Local police department are required to provide a separate report on DV to the Ministry of Interior Affairs.	to communicate with them. Moreover, DV cases can be overlooked until serious.	cases, currently available in some districts, could be extended to all districts to help overcome barriers to survivors reaching out to police.
Rooms for rehabilitation of DV survivors	Each district's hospital has a room for rehabilitation of DV survivors within the central hospitals in each district (Rogun Central Hospital in Rogun town, Nurobod Central District Hospital in Darband town, Faizabad Central District Hospital in Faizabad town, Rasht Central District Hospital in Garm).	The hospital rehabilitation room in each district serves as the only rehabilitation room, which is insufficient to meet the needs of survivors. There is no space for children and women cannot spend much	Increase the number of these rooms or organize shelters for women facing DV (currently there are no shelters within the affected districts and the closest is located in Dushanbe). Provide day care/kindergarten for

Key Facilities for GBV/SEA/SH	Services Provided	Gaps in Services	Recommendations
	. The rooms were established at maternity hospitals as both patients and doctors at maternity are women. When women approach the hospital with injuries, doctors inform police.	time away from their children. All the services/treatment are provided by the hospital's doctors which on top of their existing workload. Psychologists are not available. As a result, after getting physical treatment, survivors return home with the same emotional state.	children while mothers receive treatment. Employ doctors specifically to care for DV survivors. Effective rehabilitation program covering both medical and psychological state of survivors.
Non-Governmental Organizations			
NGO "Marifatnoki" (Rasht)	Promotion of education, entrepreneurship and vocational training among women and youth. Organizing business courses for migrants' wives. Under the NGO operates a Girls Club which provides various courses to girls, such as sewing, embroidering, computer and English. Has experience working with GBV issues.	NGOs are not self-sustainable and fully depend on donors' funding. Once funding is over, activities are shutdown. Unavailability of grants usually leads to closure of NGOs, thus the number of NGOs in the area is constantly changing.	All these services, including shelters should be established on the basis of a local women-led business or dehkan farms. GBV survivors, during their stay in a shelter, could be enrolled in the business both as a trainee and laborer.
OSCE Women Resource Center «Markazi Dastgirii Garm» (Rasht)	Offers psychological counselling, legal support and vocational courses in sewing, computer skills and needlework. The Women Resource Centres support women from vulnerable families to develop skills that are in local demand, thereby helping them to earn money and support their families. Men who request counselling and vocational training from the centres are also provided with assistance.		
OSCE Women Resource Center «Rohnamo» (Lakhsh)			
NGO "Rushdi Kuhiston" (Rasht):	Work with women on environmental, health, and social issues.		

Key Facilities for GBV/SEA/SH	Services Provided	Gaps in Services	Recommendations
	Support vulnerable women on income-generating activities, i.e. preparing and selling eco-friendly shopping bags.		
NGO "Nihol" (Nurobod)	Provides legal and psychological support to vulnerable women, including DV survivors and supports them in accessing justice.		
NGO "Zanoni Komyob" (Rogun)	Supports vulnerable women through legal and psychological support Promote handmade products of rural women and support them to participate at various exhibitions.		

17.7.19. For a full list of service providers within the Project-affected districts please see Appendix B.

NATIONAL SOCIO-ECONOMIC CONTEXT – GENDER ASPECTS

17.7.20. Tajikistan has a population of approximately 10 million and is ranked 122 out of 191 countries on the United Nations Development Program's Human Development Index (HDI). However, despite progress growing its economy and reducing poverty, poverty rates remain high at 29.5 percent in 2017 and Tajikistan ranks as the poorest country in Europe and Central Asia[28].

17.7.21. Tajikistan has established an enabling policy framework for gender equity, as described. Discrimination based on gender is illegal, the legal processes and rights for women establishing businesses is the same as for men and equal remuneration for equal work is mandated. However, gender inequality remains high in Tajikistan, largely driven by family-related factors and social institutions[32]. The World Economic Forum's Global Gender Gap Report 2022 highlights that progress in closing the gender gap is stagnant in Central Asia, with Tajikistan ranking among the bottom three countries within the region and scoring low on women's economic participation, educational attainment and political empowerment[29]. Social vulnerabilities persist following the 1992 – 1997 civil war, including high levels of unemployment particularly among women and youth, with

[28] World Bank Group (2019), 'Country Partnership Framework for the Republic of Tajikistan for the period FY19-FY23', https://documents1.worldbank.org/curated/en/962981557781100857/pdf/Tajikistan-Country-Partnership-Framework-for-the-Period-of-FY19-FY23.pdf

[29] World Economic Forum, 2022, Global Gender Gap Report 2022, https://www3.weforum.org/docs/WEF_GGGR_2022.pdf

almost one in three youth – and nine out of ten female youth – not in employment, education or training (NEET)[28.] A reduction in poverty rates post-civil war was lower for women than for men, widening the gender gap[30]. Women's equality also lags in areas such as tertiary education enrolment, labor pay, household decision-making and control over assets.

Gender-based Violence and Harassment

17.7.22. 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[31, 32.] According to the United Nations UN CEDAW, gender-based violence remains underreported in Tajikistan. Physical abuse is most common, followed by emotional abuse as well as economic abuse[32.] 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[33.]

17.7.23. The majority of legislation and policy on DV prevention has focused only on spousal abuse and not on other potential perpetrators in the extended family. Often families including several brothers and their families live in one compound under the control of the parents.

17.7.24. The Law on the Prevention of Domestic Violence is the first law prescribing sexual violence in the family; prior to that the majority of families did not realize that non-consensual intercourse between husband and wife is considered as rape which is punishable by the Article 138 of the Criminal Code. However most rape cases go unreported, attributed to survivors wishing to avoid humiliation and social stigmatization, being fearful of reprisal, or lacking confidence that perpetrators will be brought to justice[35.]

17.7.25. Statistics from the U.S. Agency for International Development (USAID)'s Demographic and Health Surveys (DHS) Program provides insights into social norms and national attitudes to GBV, with 2017 data showing that over 63 percent of women felt that wife beating was justified for at least one specific reason[34.] Reports show a lack of investigation of and accountability for gender-based violence[35.]

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[30] World Bank Group (2017), 'Tajikistan Risk and Resilience Assessment', file:///C:/Users/UKEJB009/Downloads/Tajikistan-Risk-and-resilience-assessment.pdf

[31] - Statistical Agency under the President of the Republic of Tajikistan (2019), Tajikistan Demographic and Health Survey 2017, https://www.dhsprogram.com/pubs/pdf/FR341/FR341.pdf

[32] World Bank Group, 2021, Tajikistan Country Gender Assessment

[33] World Bank Group (2022), Gender Data Portal, https://genderdata.worldbank.org/data-stories/overview-of-gender-based-violence/

[34] US AID, DHS Program Stat Compiler, https://www.statcompiler.com/en/

[35] United States Department of State Bureau of Democracy, Human Rights and Labor (2022), 'Country Reports on Human Rights Practices for 2022', https://www.state.gov/wp-content/uploads/2023/02/415610_TAJIKISTAN-2022-HUMAN-RIGHTS-REPORT.pdf

17.7.26. Human rights reports show that survivors of sexual harassment in the workplace likewise seldom report incidents for fear of social stigma, retaliation from their employers, scrutiny from families and communities and public shame[35.]

17.7.27. 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[35.]

17.7.28. The prevalence and issues around GBV in Tajikistan is of significant relevance as the Project must take measures not to exacerbate these issues among Project affected populations. It can also impact the economic empowerment of women and be a hurdle to their ability to access the opportunities that the Project may provide for this. On the other hand, gender mainstreaming measures and carefully considered approached to developing project-supported opportunities for women can support improved gender equality outcomes for women.

Female Employment and Income

17.7.29. 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)[36.] 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)[37.]

17.7.30. Young women in Tajikistan face barriers to entering the labor market which are exacerbated by limited skills 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.

17.7.31. Many rural women are engaged in informal labor and usually perform agricultural work, but sometimes partake in construction, or cleaning work. Depending on the complexity of work, sometimes women work together in groups or "brigades". Their performance is concentrated at peak times, such as the harvest season, and during the winter months their income-earning opportunities can be more restricted. While this type of labor offers flexibility, women generally receive very low pay or only in-kind payments such as cotton stalks or a small part of the harvest.

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[36] World Bank Group, 2021, Tajikistan Country Gender Assessment, https://documents1.worldbank.org/curated/en/874641637562869105/pdf/Tajikistan-Country-Gender-Assessment.pdf

[37] https://blogs.worldbank.org/europeandcentralasia/working-towards-gender-equality-tajikistans-labor-market#:~:text=Many%20factors%20contribute%20to%20low,and%20moving%20of%20heavy%20loads.

17.7.32. In general, employment status in Tajikistan differs from one region to another. In 2017 the highest employment rate across the country was in Sughd region (31 percent) and the lowest (14 percent) in the Districts of Republican Subordination (DRS)[38] (where the Project is based).

17.7.33. In 2017 and 2018, women earned 60 percent of what men earned. Many factors contribute to this gap in employment and income. These include social norms that increased the likelihood that women would remain at home and a high numbers of male workers employed overseas who send remittances home. This often means that women's primary occupation are full-time home makers and carers who are unable to enter employment or look for work[37.] Differences in fields of study likewise contribute to the gender pay gap with female dominated sectors, such as education, lower paid than male dominated sectors such as construction and transport[36.]

17.7.34. In addition to disparities in the distribution of domestic tasks, lower levels of education (particularly in vocational training) among women, limited access to professional qualifications, and challenges related to childcare availability and gender stereotypes also contribute to women's disadvantaged position in the labor market. Another factor exacerbating the gender pay gap is Tajikistan's Labor Code, in which Article 216 prohibits women from working in certain occupations deemed to be dangerous, difficult or involving heavy and manual work. While an updated Labor Code was introduced in 2016 that allows women to work the same night hours as men, prohibits any discrimination based on gender and mandates equal pay for equal work, restrictions remain on women's employment in 336 professions within sectors such as construction, mining and transport– including many high paying jobs and industries.

17.7.35. The most gender-equal sectors are agriculture and education and the most unequal are high paying sectors such as mining, energy and gas supply, transport, warehousing and construction with only one percent of all employed in the construction sector being women.

17.7.36. Women are left in a position where they are economically dependent or reliant on self-employment in retail businesses, provision of domestic services or production and sale of agricultural, homemade or sewing products for their livelihoods[56]. This informal economy is typically associated with lower salaries, absence of social benefits and few opportunities for skills development[39.]

17.7.37. Women in Tajikistan do have equal access to credit, supporting women who want to start their own business. However, women face additional hurdles when it comes to entrepreneurship, with women citing the need for stronger skills, self-esteem and self-confidence.

17.7.38. The administration of maternity leave benefits is the responsibility of the Government of Tajikistan, reducing disincentives to private employers looking to hire women of childbearing age. Lower retirement ages and longer life expectancy contributes to gender gaps in pension benefits[36.]

Female Access to Education and Literacy

17.7.39. 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

[38] Tajikistan Demographic and Health Survey, 2017

[39] World Bank Group (2017), 'Tajikistan Risk and Resilience Assessment', file:///C:/Users/UKEJB009/Downloads/Tajikistan-Risk-and-resilience-assessment.pdf

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. A lack of financial resources for books and uniforms etc., and social norms that mean that education is prioritised 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[40].

17.7.40. Girls with disabilities have particularly limited opportunities for education, with families not expecting them to work or marry and not prioritising their education or being concerned for their safety[40].

17.7.41. To improve the education levels of girls in Tajikistan, in 1997, the GoT introduced a Presidential quota to resolve unequal access of rural girls to higher education. This provided annual access for approximately 600-700 girls from rural and vulnerable families to higher education. In 2012, to counteract the traditional practice of families restricting girls from attending secondary school due to social and gender norms, the GoT also approved the second National Strategy of Education Development of the Republic of Tajikistan till 2020, which promoted the involvement of girls in education and contributed to an increase in girls' access to secondary education from 44 percent in 2000 to 60 percent in 2015[41]. While this has helped increase the number of women attending higher levels of education, women still account for less than 30 percent of the total number of all university students[42].

Women's Health and Wellbeing

17.7.42. Life expectancy for both men and women has increased in Tajikistan over the past two decades, with women expected to live over 4.5 years longer than men. Maternal and infant deaths are decreasing and where they do occur are linked primarily to poor quality health facilities and a lack of proper equipment or skilled staff, as well as the distance to health facilities and limited transport for women in rural areas. There is a lack of family planning and sexual and reproductive health services in rural areas and taboos around accessing these services and modern contraception contributes to a median age at first birth of 21.9 in 2017 as well as an increase in the share of women affected by HIV[43]. While the proportion of women receiving antenatal care has increased and maternal mortality has decreased, the rate remains high compared to other countries in Central Asia and the Commonwealth of Independent States[44].

Female Voice and Agency

17.7.43. 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

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[40] World Bank Group (2021), Tajikistan Country Gender Assessment, https://documents1.worldbank.org/curated/en/874641637562869105/pdf/Tajikistan-Country-Gender-Assessment.pdf
[41] UNDP (2019), Human Development Report
[42] The World Bank (2015), https://data.worldbank.org/indicator/SE.TER.ENRR.FE?locations=TJ
[43] Asian Development Bank (2016), Tajikistan Country Gender Assessment, https://www.adb.org/sites/default/files/institutional-document/185615/tajikistan-cga.pdf
[44] Asian Development Bank (2016), Tajikistan Country Gender Assessment, https://www.adb.org/sites/default/files/institutional-document/185615/tajikistan-cga.pdf

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.

17.7.44. 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[45]. 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.

17.7.45. At the household level, women sometimes have little decision-making power, with strong gender stereotypes and persistent social norms resulting in women becoming less engaged and the proportion of women who report participating in decisions regarding their own health care, household purchases, and visits to family or friends dropping from 43 percent in 2012 to 33 percent in 2017. Within patriarchal family structures, newly married women live with their husband's extended family and are excluded from decision-making, however this influence and social status increases as women age and have children[46]. Among such women in rural areas those with good leadership skills can actively participate in and are respected by the community. These are the women who usually initiate women' self-help groups or brigades and support other women to find sources of income and serve as their voice while negotiating any issues.

17.7.46. Women's engagement in the civil sector includes local organizations such as communal councils and neighborhood councils to more formal public associations. In addition to public associations, groups such as water users associations and 'mahalla' councils allow women to engage with local issues. Women's NGOs include those that focus on social protection and directly providing community assistance and those that operate at a national level focused on advocacy and monitoring of gender equality commitments. However, women's NGOs face limitations with a lack of information on regional women as well as concerns about financial viability due to a reliance on external donors[47].

Social Norms and Traditions

17.7.47. 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

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[45] United States Department of State Bureau of Democracy, Human Rights and Labor (2022), 'Country Reports on Human Rights Practices for 2022', https://www.state.gov/wp-content/uploads/2023/02/415610_TAJIKISTAN-2022-HUMAN-RIGHTS-REPORT.pdf

[46] World Bank Group, 2021, Tajikistan Country Gender Assessment, https://documents1.worldbank.org/curated/en/874641637562869105/pdf/Tajikistan-Country-Gender-Assessment.pdf

[47] Asian Development Bank (2016), Tajikistan Country Gender Assessment, https://www.adb.org/sites/default/files/institutional-document/185615/tajikistan-cga.pdf

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[48].

17.7.48. 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[49]. In rural areas women can 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.

17.7.49. Approximately 65 percent of men and almost 60 percent of women in Tajikistan believe that a woman should do household chores even if her husband is not working[50].

Social Institutions

17.7.50. The Organization for Economic Co-operation and Development's (OECD) Social Institutions and Gender Index (SIGI) measures discrimination against women in social institutions across 179 countries. Tajikistan is assessed as having a medium level of gender discrimination in its social institutions, with women in Tajikistan experiencing the greatest discrimination in the form of 'restricted physical integrity' which includes gender-based violence and social institutions that limit women's control their bodies and reproductive autonomy. Within this data, social norms including women's acceptance of intimate partner violence contribute scored particularly poorly, [51].

Religious and Unregistered Marriages

17.7.51. Family gender discrimination is evident in religious marriages that (while not recognized by law) 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[52]. Women in religious and unregistered marriages are left vulnerable with a lack of legal standing or rights[53]. 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[54].

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[48] Asian Development Bank (ADB), 2020, Women Time in Use in Rural Tajikistan
[49] Inter-American Development Bank (IDB), 2020, Environmental and Social Policy Framework
[50] World Bank (2021) Tajikistan Country Gender Assessment
[51] OECD (2023), Social Institutions & Gender Index, https://www.oecd.org/stories/gender/social-norms-and-gender-discrimination/sigi/dashboard?country=TJK
[52] Institute for War and Peace Reporting, 2011, 'Multiple Marriages in Tajikistan', https://iwpr.net/global-voices/multiple-marriages-tajikistan
[53] United States Department of State Bureau of Democracy, Human Rights and Labor (2022), 'Country Reports on Human Rights Practices for 2022', https://www.state.gov/wp-content/uploads/2023/02/415610_TAJIKISTAN-2022-HUMAN-RIGHTS-REPORT.pdf
[54] Asian Development Bank (2016), Tajikistan Country Gender Assessment, https://www.adb.org/sites/default/files/institutional-document/185615/tajikistan-cga.pdf

17.7.52. The issue of unregistered marriages is also linked to child marriage, which is criminalized within the law but remains prevalent driven by factors including high levels of poverty and gender discrimination in employment, leaving parents with little incentive to continue supporting their daughters to obtain higher education. However, some reports indicate that with the involvement of subdistrict heads, heads of mahalla, women leaders, religious leaders, and other local activists awareness and control around unregistered marriages is increasing and the numbers of unregistered marriages are starting to drop, at least in some districts[55].

Migrant Workers and the Impact on Women

17.7.53. 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[56]. Women are reported to comprise 14 percent of migrant workers in 2017 and are largely excluded from decision-making about migration[36].

17.7.54. 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[57].This abandonment leaves women responsible for generating a family income despite limited education, resources or access to employment. Abandoned wives are also often largely excluded from local communities[58]. Women are left in a position where they are vulnerable to prostitution and human trafficking while polygamy becomes a socially acceptable option as they seek to support themselves and their families[62]. This abandonment is reported to have led to a high number of suicides among abandoned wives, often leaving children alone[59].

17.7.55. High levels of male migration has substantially increased women's responsibilities in agriculture, with the proportion of women in the agricultural labor force increasing from 54 percent in 1999 to more than 75 percent in 2020[60]. Many dekhan farms headed by women produce cotton, wheat and fodder crops and many of the women work as informal agricultural workers.

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[55] UNFPA (20

[56] ILO, Work and family: The Republic of Tajikistan, https://www.ilo.org/wcmsp5/groups/public/---europe/---ro-geneva/---sro-moscow/documents/publication/wcms_312658.pdf

[57] ADB, 2020, Strengthening support for labor migration in Tajikistan

[58] World Bank Group (2019), 'Country Partnership Framework for the Republic of Tajikistan for the period FY19-FY23', https://documents1.worldbank.org/curated/en/962981557781100857/pdf/Tajikistan-Country-Partnership-Framework-for-the-Period-of-FY19-FY23.pdf

[59] UN Women, Tajikistan, https://eca.unwomen.org/en/where-we-are/tajikistan

[60] ADB, 2016, Tajikistan : Climate- and Disaster-Resilient Irrigation and Drainage Modernization in the Vakhsh River Basin Project

17.7.56. However, the absence of men due to labor migration has presented opportunities for women who have taken on more leadership positions in rural areas with many female mahalla leaders emerging since male migration increased[61].

Female-headed Households

17.7.57. 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[28].

17.7.58. 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[36]. Female headed households have a higher risk of poverty than those headed by males[62].

The Energy Sector and Women in Tajikistan

17.7.59. Tajikistan is ranked eighth in the world for hydropower potential and has greater hydroelectric power capacity than any other Central Asian country but as of 2022 only 4 percent of the country's hydro potential is exploited [63]. However, shortfalls in energy infrastructure mean that the country does not produce enough energy in winter and does not have the capacity to export surplus in the summer. This energy poverty particularly effects women who spend time gathering, preparing and storing alternative fuels and do not have access to labor saving electrical appliances to assist with daily tasks in the home. Women, who spend more time at home, are also more greatly impacted by insufficient heating[64].

17.7.60. Energy security is a key priority for the Government of Tajikistan and development of the energy sector is a key pillar in Tajikistan's National Development Strategy of the Republic of Tajikistan for the Period up to 2030. In 2022, the World Bank increased its financing to strengthen the long-term sustainability of the sector with the intention that revenues from sales of clean, renewable energy domestically and from exports continue to be reinvested in adequate and reliable electricity supply for households, businesses, schools and hospitals, contributing to economic growth, poverty reduction and development of human capital[65].

17.7.61. However, the gender gap in participation in the labor market is even wider in the electricity and gas supply sector where the share of women employed was only 4 percent in 2016[66]. The ADB

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[61] World Bank Group (2017), 'Tajikistan Risk and Resilience Assessment', file:///C:/Users/UKEJB009/Downloads/Tajikistan-Risk-and-resilience-assessment.pdf

[62] Asian Development Bank (2016), Tajikistan Country Gender Assessment, https://www.adb.org/sites/default/files/institutional-document/185615/tajikistan-cga.pdf

[63] IEA (2022), Tajikistan 2022 Energy Sector Review

[64] ADB (2021), Tajikistan Country Gender Assessment

[65] World Bank (2022), Additional Financing from the World Bank to Strengthen Tajikistan's Energy Sector

[66] World Bank (2021), Tajikistan Country Gender Assessment

Tajikistan Country Gender Assessment (2016) suggests that women could play a key role in implementing energy efficiency measures in the home if their capacity is improved and they are empowered as decision-makers.

The Gender Development Index

17.7.62. The Gender Development Index measures the gender gap in relation to the different values assigned to men and women and shows a Human Development Index (HDI) value of 0.909 in Tajikistan in 2021. This measures gender inequalities in three basic dimensions of human development: health, measured by female and male life expectancy at birth; education, measured by female and male expected years of schooling for children and female and male mean years of schooling for adults ages 25 years and older; and command over economic resources, measured by female and male estimated earned income, as shown in below.

17.7.63. On the whole, Tajikistan is rated 'Medium Human Development' on the Gender Development Index. Tajikistan lags slightly behind neighboring countries, with the exception of Afghanistan. The most prominent gap in Tajikistan is in income, with females averaging $2980 purchasing power parity (ppp) and males averaging $6096 (2017 ppp), reflecting a low proportion of females in paid employment as well as lower female participation in higher paid occupations. Potential factors contributing to this gap are described in paragraphs 17.7.29 through 17.7.38.

HDI Value	Female	Male	Gender gap
Life expectancy at birth	73.7	69.6	4.2 years
Expected years of schooling	11.2	12.1	-0.9 years
Mean years of schooling	10.9	11.8	-0.9 years
Gross National Income per Capital (2017 PPP$)	2,980	6,096	-3,115

Source: Gender Development Index | Human Development Reports (undp.org)

LOCAL SOCIO-ECONOMIC CONTEXT - GENDER ASPECTS

17.7.64. For a full description of the local socio-economic context including demographics profiles please see **Section 11** of **Volume 2, Appendix 7-1: Baseline Conditions Report** of this ESIA. Key findings relating to gender, derived from a household survey of 900 households within the Project affected area, include the following.

17.7.65. The social study area is the three districts where villages are going to be resettled from and to - Rogun, Nurobod and Rasht.

Demographics;
Household composition;
Women's employment / livelihoods – what are women in the Project area working on?
Poverty rate in Project area;
Women's income;
Women's education / skills;
Women with disabilities or functional difficulties;
Women Head of Households;
Women's agency;

Social and cultural norms;
Project affected communities: Social area of influence – villages etc.

17.7.66. Table 17-9 below provides an overview of the education and employment status of women within the surveyed households.

Table 17-9 – Female education and literacy data from household survey

Number of women household members for which data was obtained	Highest level of formal education	Other education received	Currently in education?	Able to read / write?	Proportion of women with an income/ occupation	Of those with an income, what is the main source?
Female survey population: 2,478	5.3 % No formal education	1.0 % Informal education (courses)	22.4 % yes	76.0 % yes	14% (339 out of 2478 women)	6% Farmer (arable agriculture)
	6.9 % Primary education only	0.6 % Adult education	77.5 % no	23.8 % no		1% Farmer (cattle breeding)
	15.4 % Incomplete secondary education	1.6 % Professional / Technical training	0.1 % Don't know / prefer not to say	0.2 % Don't know / prefer not to say		1% Farmer (subsistence)
	32.6 % Complete secondary education	0.2 % Don't know / prefer not to say				4% Employee (private sector)
	1.8 % Professional secondary education	96.6 % Don't have				17% Employee (public sector)
	1.9 % Higher education / University					7% Self-employed (craftsman, merchant, etc.)

Number of women household members for which data was obtained	Highest level of formal education	Other education received	Currently in education?	Able to read / write?	Proportion of women with an income/ occupation	Of those with an income, what is the main source?
	17.3 % Pre-school age child					1% Daily/seasonal worker (construction, agriculture, etc.)
	18.6% Currently in education					1% Casual work (not seasonal)
	0.2% Don't know / prefer not to say					50% Pension
						5 % Labor migration / Remittances
						0% Employed by Rogun HPP
						0% Employed at construction site for Rogun HPP

Number of women household members for which data was obtained	Highest level of formal education	Other education received	Currently in education?	Able to read / write?	Proportion of women with an income/ occupation	Of those with an income, what is the main source?
						0% Employed at Hydropower plant site.
						0% Student
						1% Home-maker
						0% No income
						0% I don’t know/ prefer not to say
						6% Other (please specify)

17.7.67. Table 17-10 below shows the main source of income for the household members within surveyed households, showing the comparison between men and women. Of note is the relatively high proportion of women who are on a pension, hired within the public sector or self-employed.

Table 17-10 – Source of income by gender – data from household survey

Source of Income	Male	Female	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 by the Project	5.0%	0.3%	**4.0%**
Employed at construction site for the Project	1.1%	0.3%	**0.9%**
Employed at Hydropower plant site.	0.1%	0.0%	**0.1%**
Student	0.1%	0.0%	**0.1%**
Home-maker	0.3%	0.7%	**0.3%**
No income	0.5%	0.3%	**0.5%**
I don't know/ prefer not to say	0.1%	0.3%	**0.1%**
Other	3.9%	5.7%	**4.3%**
TOTAL	100.0%	100.0%	**100.0%**

17.7.68. The proportion of female-headed households within the Project affected area (as per the sample surveyed) is nearly 18 percent. This is below the national average but higher than the average within rural areas.

17.7.69. Eight percent of respondents in the household surveys stated that they had particular expectations or concerns associated with the impact of the Project on women. Information from the FGDs

suggest that these mainly pertain to positive expectations regarding improved employment opportunities and infrastructure.

17.7.70. When asked whether women feel safe walking or taking public transport within the resettled communities, respondents generally agreed that they do. Of the 361 respondents across the resettlement sites, 100 percent of respondents in Rogun, Nurobod, Faizobod and Danghara, and 97.5 percent in Tursunzoda, agreed. Just three individuals (0.8 percent of the total surveyed population) disagreed.

17.7.71. When asked about incidents of gender-based violence, sexual exploitation and abuse and/or sexual harassment or an increase in violence within Project affected communities since the commencement of the project, almost 100 percent of respondents stated that there have been no incidents. Just one individual in Tursunzoda stated that there had been incidents.

17.8 NATIONAL LAW, GAPS AND CURRENT DEVELOPMENTS

17.8.1. Table 17-11 below describes applicable lender standards and guidelines with regards to gender equality and compares these with Tajikistan national laws and requirements, highlighting any gaps or omissions.

Table 17-11 - National Laws and Gaps Compared to International Standards

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
Gender-based violence (GBV)	**Summary of applicable lenders' standards (as detailed in** Table 17-2**):** Measures must be taken to prevent and address risks of gender-based violence, sexual exploitation and abuse and/or sexual harassment among Project affected persons and communities and Project workers. This must include adequate safeguards and management procedures within the workplace and a grievance mechanism for workers and communities to raise concerns including provisions for reporting and management of sensitive grievances. Measures such as codes of conduct and communication and awareness campaigns must be supported where gender related risks exist. Specific measures to address gender-based violence risks associated with an influx of workers must be implemented.			
	National Law on the Prevention of Violence in the Family	Law governs the prevention of domestic violence (DV) and determines tasks of the agencies responsible for prevention of violence in the family including measures for identification, prevention and elimination of conditions that promote violence.	The Law does not criminalize domestic violence, marital rape, or sexual harassment and views domestic violence as an act with administrative punishment. It only addresses specific acts of violence, disregarding violence that can be expressed through neglect or the withholding of resources or care. The Law lacks a clear definition of GBV which therefore prevents a prohibition of all forms and types of GBV. The definition of a victim is narrow, and the Law does not define family / family relations including all those who may perpetrate violence on a partner or family member. The Law is not adequately implemented or enforced and Police and judicial responses	Robust and well communicated Project level gender sensitive codes of conduct that include reference to zero tolerance to GBV/SEA/SH. GRMs to effectively respond to grievances including those relating to GBV.

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
			to domestic violence are reportedly inadequate[67]. The Law does not clearly define roles and responsibilities for service provision, as well as GBV monitoring. Social norms continue to view domestic violence as a family affair and a lack of awareness and lack of access to services and shelters prevents women from seeking support. There is no system in place to collect statistical data on GBV to aid an understanding of its prevalence and the effectiveness of responses. The national legislation does not require mandatory training for all actors involved in responding to GBV. The laws do not define or provide for protection against online violence against women.	

[67] Human Rights Watch (2019), 'Violence with Every Step'.

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
	Criminal Code	The Criminal Code describes criminal responsibility for 25 GBV related crimes including rape and polygamy. Article 138 provides for penalties of 3 – 7 years jail for rape. According to Articles 48 (1), 52 and 54, pregnant women; d) persons who are on parental leave; e) disabled people of I and II groups cannot be assigned to mandatory works, compulsory works or restricted freedom. Unreasoned refusal or unreasoned dismissal from the work of woman due to pregnancy or having a child under three years old is punishable by a fine or by two years of correcting labor (Article 155). Bigamy or polygamy, that is, cohabitation with two or more women with a common household, is punishable by a fine or two years of correctional labor or restraints for up to five years or arrest for 3-6 months (Article 170).	Marital rape, sexual harassment and family violence are not criminalized. The current definition of rape does not cover all forms of penetration and there is no requirement for the age of consent (international standards set this at 16 years). With respect to land relations, there is not any connection between land use and marriage. The spouse of a formal land user who received the land use right during the marriage has no rights to the land, despite his/her contribution to its improvement. At the disposal of land use rights, in particular upon its pledge, the spouse has no influence on these actions, and at the death of a spouse, he/she is deprived of actual rights. The law contains no concept of transfer of land use rights.	Robust and well communicated Project level gender sensitive codes of conduct that include reference to zero tolerance to GBV/SE/SH. GRMs to effectively respond to grievances including those relating to GBV. Gender mainstreaming initiatives to promote gender equality within the Project and communities.
	Summary of applicable lenders' standards (as detailed in Table 17-2**):**			

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
Discrimination and equality	International standards require a commitment to non-discrimination, equal opportunity and fair treatment with respect to labor rights and any aspects of the employment relationship. This must be set out in management plans, policies and procedures. Gender equality must be considered when assessing and managing Project impacts, risks and opportunities so that women aren't disproportionately adversely impacted by project-related activities and have equal access to opportunities and benefits. The importance of consultation processes that include and obtain women's perspectives is emphasized so that women's and men's perspectives and preferences are understood and accounted for.			
	Constitution of the Republic of Tajikistan	The Constitution states that men and women have equal rights and freedoms. This includes equal right to work and equal pay for equal work. The Constitution guarantees women the right to the inviolability of home (Article 22), right to free movement (Article 24), right to participate in political life and government (Article 27), right to property and inheritance (Article 32), the right to housing (Article 36), the right to health (Article 38), the right to social protection (Article 39), and the right to education (Article 41).	Women are prohibited from 326 professions considered harmful for women including heavy and underground work or work with harmful conditions as per the Labor Code. Unofficial marriages including underage, forced or polygamous marriages leave women with few rights to property during separations. Despite legislation mandating equal pay for equal work, estimated female earned income is 4.5 times lower than the estimated male earned income due to gender inequality.	Project policies and procedures to mandate equal pay for equal work. Transparency in recruitment and procurement processes to support adherence to non-discrimination and equality policies.
	Equality and Elimination of All Forms of Discrimination Act 2022 (No. 773)	The law cites that: All citizens of Tajikistan have the right to equality and effective protection against discrimination in all its forms. Positive measures may be taken to assist disadvantaged groups to gain equality,	There is no obligation placed on an employer to take action to eliminate violence and harassment in the workplace. The terms "sexual orientation" or "gender identity" are not mentioned which means that sexual minorities are not	Robust and well communicated project-level equal opportunity policies and procedures.

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
		although this must not take the form of granting special rights to certain groups.	recognized by the government and don't claim for legal protection.	
	State Guarantees of Equality of Men and Women and Equal Opportunities for Their Implementation 2005	The Law obliges the state to carry out gender education of civil servants, promotion of equal opportunities for women and men, develop social programs aimed at eliminating discrimination (Article 4); guarantees equal participation of women and men in executive, legislative, judicial branches of government (Article 5).	The law forbids gender-based discrimination but doesn't clearly state that GBV is a form of discrimination against women that should be prohibited. The Law doesn't provide for a remedy if these guarantees are not met by the state.	Robust and well communicated project-level non-discrimination policies and procedures.
	Family Code of the Republic of Tajikistan	This law was adopted in 1998 and its provisions include: Only marriage concluded in state civil registration bodies shall be legally recognized. A woman can access employment, choose where to live, travel outside of her home, travel outside of her country, be 'head of household', sign a contract or open a bank account in the same way as a man. Women and men have equal ownership rights to immovable property and equal administrative authority over assets during marriage.	There are no provisions relating to domestic violence the Family Code of the Republic of Tajikistan. Even though marriage of a minor is criminalized under Article 168 of the Criminal Code, child forced marriage is still widely practiced, especially in rural areas posing threats to the well-being of young girls. There are also provisions under the Family Code for the courts to reduce the age of marriage by one year under in "exceptional circumstances".	Robust and well communicated Project level gender sensitive codes of conduct that include reference to GBV/SEA/SH. GRMs to effectively respond to grievances including those relating to GBV. Gender mainstreaming initiatives to promote gender equality within the Project and communities.

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
		A woman can obtain a judgment of divorce in the same way as a man and has the same rights to remarry as a man.		
	Civil Code of the Republic of Tajikistan	This law provides for equal rights to inherit assets. According to article 304 of the Civil Code, property acquired by spouses during marriage is their joint property, unless the law or the contract between them does not establish a different mode of this property.	However, with respect to land relations, there is not any connection between land use and marriage. The spouse of a formal land user who received the land use right during the marriage has no rights to the land, despite his/her contribution to its improvement. At the disposal of land use rights, in particular upon its pledge, the spouse has no influence on these actions, and at the death of a spouse, he/she is deprived of actual rights. The law contains no concept of transfer of land use rights.	Recognition of equality with regard to land use rights and adoption measures to facilitate their access to the documents they need to exercise this right.
	Labor Code of the Republic of Tajikistan of July 23, 2016, No. 1329	The Labor Code prohibits discrimination in employment based on gender. Article 159 of the Labor Code prohibits the refusal to employ pregnant women and women with children or to decrease their salaries on the grounds of their pregnancy and responsibilities related to their children.	The Labor Code does not include mention of or any protection against sexual harassment or any other form of verbal or non-verbal harassment. Article 216 which prohibits women's employment in 326 professions deemed dangerous to women presents an obstacle to equal access to	Robust and well communicated Project level gender sensitive codes of conduct that include reference to GBV/SEA/SH. Equal opportunity policies and procedures that promote gender equality in access to employment and career progression opportunities as far as possible within legislative constraints.

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
		Article 164 provides that women shall be granted a maternity leave of 70 calendar days before delivery and 70 calendar days after delivery. Under Article 165, on termination of maternity leave women / primary carers are entitled to childcare leave covered by State social insurance until the child is 1.5 years. Article 216 of Tajikistan's Labor Code prohibits women's employment in specific sectors and professions which are considered difficult or dangerous for women and may cause harm for them and their reproductive health. This includes 326 professions that prohibits women to work in sectors including construction, mining, geological exploration and topography, railway transport and subways, even agriculture.	Project benefits and opportunities.	Record and report on data relating to GBV/SEA/SH in the workplace.
	Criminal Code	According to Articles 48 (1), 52 and 54, pregnant women; d) persons who are on parental leave; e) disabled people of I and II groups cannot be assigned to mandatory works, compulsory works or restricted freedom.	The Criminal Code does not criminalize domestic violence, sexual harassment or discrimination.	Robust and well communicated Project level gender sensitive codes of conduct that include reference to zero tolerance to GBV/SEA/SH.

Topic Area	Tajikistan Laws	Key Requirement	Key Gaps and Omissions	Project Measures
		Unreasoned refusal or unreasoned dismissal from the work of woman due to pregnancy or having a child under three years old is punishable by a fine or by two years of correcting labor (Article 155). Bigamy or polygamy, that is, cohabitation with two or more women with a common household, is punishable by a fine or two years of correctional labor or restraints for up to five years or arrest for 3-6 months (Article 170).		GRMs to effectively respond to grievances including those relating to GBV. Gender mainstreaming initiatives to promote gender equality within the Project and communities.
	The Law on State Services	This law provides provisions for social and psychological support to victims of GBV.	There lacks details on the scope of the free social and psychological support and who should be responsible for the provision of these support services.	Understand local gender referral pathways and ensure internal capacity to receive and manage GBV complaints and refer women appropriately is in place.
	Law on State Registration of Legal Entities	Under this law a woman can register a business in the same way as a man. The Law does not require joint registration of jointly held entities. If land is contested, those whose names are not registered are required to go to court to prove ownership.	Women may be placed at risk during resettlement if land or assets not jointly registered is contested.	Measures should be taken to ensure women gain security of tenure and receive due compensation on equal terms to men as per international standards.

17.9 KEY FINDINGS FROM THE KEY INFORMANT INTERVIEWS

17.9.1. Key Informant Interviews were undertaken in March and July 2023 to understand the roles and perspectives of NGOs, service providers and those providing support to women within Project affected communities, as well as women working on the Project. The key findings from these meetings are described in **Table 17-12** below.

Table 17-12 - Summary of Key Informant Interviews

Date	Participants	Summary of Key Discussions
09.03.2023	Women's NGO representatives: NGO "Gender Development" Local Gender Specialist - Viloyat Mirzoeva NGO "Madina" - Nabot Dodkhudoeva	Discussions regarding NGOs active in Tajikistan. Organizations and campaigns include: Gender and Development; Don't be Silent Central Asia; Spotlight; and Life Free of Violence. Approximately 49 NGOs that deal with DV are based in Tajikistan; There are reports of NGOs being asked to close down in Rogun area; Some government and NGO DV/GBV referral mechanisms do exist e.g. pilot initiatives to set up 'safe rooms' in medical centers; Importance of ensuring that support for women to set up businesses and cooperatives is economically viable; and Labor migration leads to increased double burden on women, but this burden is lessened if men can be retained in Tajikistan.
09.03.2023	UN Women: Diana Ismailova Aziza Hamidova	Work, activities and functioning of UN women in Tajikistan, including: Spotlight – in cooperation with three other NGOs. Strong implementation and government buy-in reported; Creation of a database of CSOs working against violence. Services are not present in all districts; however they are usually not restricted to users living in the local area; Carrying out surveys and data gathering; Work in the community to spread awareness of what violent actions break the law; and PSEA (prevention of sexual exploitation and abuse) taskforce – community GBV reporting mechanism being developed by UN Women and the World Bank. When active will cover all districts where the UN is active. Referral mechanisms – at least two options are always available, police and public healthcare services; Particular difficulties for women with disabilities; Intra-family marriage – the Government have taken measures to prevent this for civil marriages, however this cannot be applied to non-registered religious marriages; Women in very religious areas – harder to access but can be reached by working with imams and local authorities. Imams controlled very tightly by the Government; Discussions regarding the benefits of employment for women within and outside the home; and Risks and opportunities in the post-Covid era due to the increased prevalence of digital technologies – opportunities for commerce and

Date	Participants	Summary of Key Discussions
		communication but also cyber-harassment. Online commerce may also pose risks if tax implications are not well understood.
09.03.2023	Committee of Women and Family Affairs (COWFA): Nigora Gafarzoda (Commissioner)	COWFA has representatives in all districts of Tajikistan and has been involved in the Rogun project; Operate a grievance mechanism in each district, including for women reporting violence (also available to men and other types of complaints and requests), since 2022. Training on its operation available. First such mechanism in Central Asia. 235 grievances had been received at the time of the meeting. COWFA cooperates with relevant ministries and authorities to solve these issues; Involvement in livelihood restoration for resettled women; A training program for women to gain skills to work on the Project coordinated with the Ministry of Labor. However, it is unclear whether this led to real employment; Involvement in three shelters – one public and two private; The Presidential Fund provides grants up to 20,000 somoni for women to start businesses, all over Tajikistan. A business case is required to access this, but the businesses are not monitored; and New legal projects concerning violence against women and girls (e.g. 'No to Violence' in 2023).
09.03.2023	Woman nurse at Project on-site medical center	Discussions regarding working conditions and safety; Works the 7am-7pm shift for 15 days on followed by 15 days off; Medical centre is located approximately 100km away from dormitory, with no transportation provided back to their accommodation at the end of their shift; Medical workers all live together (15 people); and All 15 medical workers living in the camp have to share shower facilities as there are no separate washing facilities for men and women in doctors' camp. Female worker expressed that she would like more female only shower facilities.
09.03.2023	Women workers at Vakhsh Sokhtmon Accommodation	Up to 190 residents live in the accommodation – majority are men, but six women also live there and share one room; The women work as cleaners and cooks/kitchen staff; Six women share one shower; and Transport provided to and from work site.
11.03.2023	Women workers at TGEM Accommodation	Mixed-sex accommodation block located below the TGEM canteen for the canteen workers; Separate rooms for men and women (5-6 people per room); and Separate toilet and shower cubicles for men and women are provided but these are located in close proximity within the same room, with only a poor-quality shower curtain for privacy.
12.03.2023	Women workers at Rogun JSC Accommodation	Free accommodation provided to workers in blocks in Rogun town; A female worker (who lived with her sister and their children) was interviewed. Both women had professional jobs at Rogun JSC. The children attend the state-run school in Rogun town; Discussions regarding working and living conditions. The interviewee reported a 'friendly' atmosphere at work and was happy with the flat.

Date	Participants	Summary of Key Discussions
		The flat provided by Rogun JSC was of a high standard. Grievances can be raised by reporting to the head HR manager at Rogun JSC, but there is no anonymous grievance reporting channel; and Twice yearly medical screenings are provided free of charge. Maternity leave is available via an application process.
7 July 2023	Head of Department of Women and Family Affairs (DWFA) Nurobod Head of DWFA Rogun	DWFA of both Rogun and Nurobod districts are closely engaged with community through the local government working group (which comprises local representatives from DWFA and other government agencies such as the Ministry of Health and Social Protection (together with doctors), the Ministry of Education and Science, Civil Registration Office, Police of Tajikistan, Committee on Religion, Regulation of Traditions, Celebrations, and Ceremonies (CRA) and jamoats). Once a week the working group visits the villages to meet with people and hold discussions on healthy family relationships, importance of education for girls and boys, importance of official marriage registration, physical and mental health literacy, especially for pregnant women, prevention of domestic violence (DV), etc. These meetings are attended by young and older generations of both genders. People who were resettled from other places due to the Project attend those meetings along with others. To support and promote women economic empowerment, DWFA provides presidential grants to female entrepreneurs who want to start own business. In 2022, four women from Rogun and four others from Nurobod received grants for launching bee-keeping business and greenhouses (Nurobod), and bee-keeping business, bakery and two sewing shops in Rogun. DFWA linked them to specialists who provide business and technical consultations. Many women approach DWFA regarding DV. DWFA works in close collaboration with jamoats in relation to DV within the villages. According to DWFA, they try to prevent family breakdown as not all parents want their daughters with her children to come back. DWFA office in Rogun has a corner with various publications on DV issues and instructions for each agency-member of the working group on their roles and actions to be taken. DWFA in both districts have registration books with all complaints received, which they track until resolved.
7 July 2023	Head of Department of Labor and Employment of Population (DLEP) Nurobod; Senior specialist of DLEP Rogun	DLEP of both districts register unemployed people. DLEP runs monthly job fairs and invite those registered as unemployed. Since January 2023, 341 women approached DLEP regarding employment in Nurobod, 240 of them received seasonal jobs at dekhan farms and were paid in-kind. Forty-two of them were enrolled in vocational courses. There are vocational schools in both districts, which offer various vocational courses (ranging from one month to three months in duration), including computer courses, welding, accounting, sewing and cooking courses. In Nurobod the Head of DLEP mentioned that women are interested in other trainings, such as growing strawberry and vegetables in greenhouses, beekeeping, livestock breeding, etc. DLEP provides small no-interest loans for the amount of 1,000-5,000 TJS for a three-year term to those who want to start a business related

Date	Participants	Summary of Key Discussions
		to trade, services, and agriculture. Women have priority in receiving those loans due to government efforts on promoting employment among women and their economic advancement. In Nurobod, 15 women out of 90 who completed the vocational courses in 2022 received such loans to initiate home-based business. In Rogun, 60 women completed vocational courses during this period.
7 July 2023	Head of Duty Unit, Rogun – Police Department	Women often don't turn to the police as the first port of call relating to DV but rather become involved when the hospital contacts them or through their participation in the local government working groups. Within the first six months of 2023, Rogun's police department registered 10 complaints from women on DV. Police are actively involved in the local working groups including its weekly visits to villages to meet with people. Police officers often participate at various training on GBV prevention where they learn how to react to DV cases and communicate with DV victims. They understand that women are reaching out the police department when other options haven't succeeded, and they might be in a poor psychological state. Police report that they will often involve female doctors or DWFA when they observe a survivor in a poor emotional state. There are no police officers specializing in DV in Rogun or Nurobod. However, the representatives interviewed were well aware of the Police's roles and responsibilities in relation to receiving GBV complaints and had undergone training / had knowledge of GBV prevention measures and actions to be taken.
9 July 2023	Head of the Department of Internal Affairs, Nurobod – Police Department	
July 2023	NGO "Nihol"	Nihol is a new NGO established in early 2023 with EU funding. It provides legal aid to women. According to the representative, Nihol provides psychological assistance to women in addition to legal aid.
July 2023	Director - NGO "Zanoni Komyob"	The NGO's remit doesn't directly relate to GBV however they support the empowerment of women by promoting handmade products produced by women in rural communities, helping them to sell it and make profits. The NGO has been working for one year and so far, hasn't received any grants.

KEY FINDINGS FROM THE FOCUS GROUP DISCUSSIONS

17.9.2. Focus group discussions (FGDs) were held with 18 women only groups in July and August 2023, including seven in Nurobod district, six in Rogun, four in Rasht and one in Faizobod.

17.9.3. **Table 17-13** below describes key findings from FGDs

Table 17-13 - Key findings from women FGDs

Subject	Key findings
Awareness of the Project	Awareness of the Project was generally high in all districts, including awareness of the benefits that it is expected to deliver to local communities (including improved power supply, national economic development and the opportunities to open businesses and access jobs as power reliability increases). Many of the women commented on a desire for more information about the project, the construction process and timelines.
Perspectives on current situation	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 lacked, few women were in formal employment (instead engaged in agriculture and orchard activities in their household plots) due to few opportunities and a lack of kindergarten. Girls were less likely to remain in education as parents are reluctant to send them to boarding school therefore female literacy rates are low. Where villages have a secondary school, girls have better access to education but are often not allowed (by family) to continue after secondary education. Where there are lots of facilities, higher rates of women are in employment in roles such as teachers, nurses and cleaners, however unemployment for men and women remains an issue. Few women are employed on the Project citing the distance but also the 15-day shifts as barriers as they cannot be away from home for this period. Additionally, they shared that husbands would not be likely to allow their wives to work in such a male-dominated environment.
Participation in decision making	While some women had attended meetings regarding resettlement, the majority cited men as being involved in consultation and decision-making regarding resettlement. Where women are heads of household, they are free to make decisions. In most other cases, including husbands working overseas, it is the husbands or parents who attend the meetings and make decisions and manage assets.
Expectations regarding resettlement	In general, women did not express concern about resettlement, but rather were positive about the opportunities that this could provide in terms of employment, education, community infrastructure. They were excited about improved medical facilities, schools, infrastructure and also see the availability of these facilities as providing employment as well as services. In case of resettlement women want to be provided with the same job/position, property, facilities and other conditions (water, weather conditions, electricity, transport) they have now. Kindergarten is must-have for them as there were women among participants whose children go to kindergarten while they are at work. In addition to the 0.08ha of land they have already received, some of them are looking forward to receiving additional land for agriculture or business (building shops, cafes) purposes. While they acknowledge that resettlement won't be easy initially, women expected that moving closer to Dushanbe will open for them other opportunities, such as access to finance - small grants programs, zero-interest loans; access to education: vocational and other specialized schools where girls can learn new skills.

Subject	Key findings
	People, including vulnerable women need help with transporting their belongings to new place.
Concerns	Concerns raised included compensation not yet received for relocation and the value of compensation. Other concerns centered around the availability of water at the new residences as well as assurance that they would be provided with jobs, property, facilities and other conditions (water, weather conditions, electricity, transport) they have now. Some women who currently live with their parents are concerned about when they will receive a land plot. Some women in resettled communities (particularly Qadi Ob and Sicharogh) described some concerns around not being able to get jobs and suggested the creation of sewing shops, bakeries or canning shops to create employment opportunities. They viewed there being many more job opportunities for men who could work at the Project. Other concerns centered around the many vulnerable women with the communities, for example those with disabilities, divorced women and widows either with small children or no children at all who need additional support during the resettlement. Participants suggested to help these women with house construction as well. Another concern of participants was their neighbors – they live together for a long time and would like to keep the same neighborhood after the resettlement as well.
GBV/SEA/SH support	Women reported turning to the village's head / Women's Council when concerns such as GBV occur. If it can't be resolved, they next turn to the Jamoat / Local Government working groups.

17.10 INTERNAL CAPACITY AND MECHANISMS

17.10.1. This section assesses the extent to which the Project has the capacity to prevent GBV/SEA/SH from occurring, encourage and enable safe and confidential reporting of GBV/SEA/SH and respond appropriately when reports are made. It also considers equitable access to Project opportunities and benefits to women within the local community.

PROCESSES, PROCEDURES AND POLICIES

17.10.2. Observations from a Labor Audit undertaken in 2023 showed a lack of adequate policies, procedures and codes of conduct relating to GBV / SH / SEA, as described below. There are currently no project-wide or site-specific HR policies or Code of Conduct and no requirements in the contracts of local contractors or sub-contractors to adhere to any particular labor standards or codes of conduct other than the national Tajik Labor Code and the Labor Management Procedures of the project. The Labor Code does not provide an obligation on employers to provide protection from GBV/SEA/SH in the workplace.

HUMAN RESOURCES POLICIES

17.10.3. The Labor Audit (2023) found that only three out of the 20 audited contractors that are currently engaged in the construction works for the Project have a Human Resources (HR) Policy.

17.10.4. While two of these contain sections on GBV and non-discrimination, there is no training conducted on these policies and they are therefore not cascaded from the corporate level down to the workforce.

CODE OF CONDUCT

17.10.5. Only seven of the 20 contractors working on the Project and audited as part of the preparation of the Labor Audit (2023) had a Code of Conduct to govern the behavior of employees on-site.

17.10.6. One of the contractors had developed a Project-specific Code of Conduct that was signed by the HR Director at the organization in January 2023, however although non-discrimination was covered there were no specific guidelines on harassment or GBV.

17.10.7. Only two contractors were found to have policies relating to GBV and none of the contractors were found to have a separate procedure to handle sensitive grievances.

17.10.8. Where Codes of Conduct were in place, it was evident that these were not communicated with all Project workers, majority of them were not signed by workers and no suitable training was in place. According to the Labor Audit findings, there was no evidence of reporting against the Codes of Conduct.

17.10.9. The Labor Management Procedures (2024) include a sample Code of Conduct for implementation. This has been widely shared and communicated throughout the Project workforce, as well as other Company and contractor policies regarding the prevention of GBV/SEA/SH and promotion of equal opportunities.

INTERNAL CAPACITY, ROLES AND RESPONSIBILITIES

17.10.10. While key entities including PMG, Rogun JSC, EPC contractors including Tractebel and WeBuild and non-EPC contractors have personnel to plan and supervise environmental and social matters, including OHS and human resources, none of the contractors working on the Project has a dedicated role or responsibility assigned to oversee gender related aspects or non-discrimination on the project.

17.10.11. The 2024 RLRF committed a standalone gender specialist under the Environmental and Social department of DFZ. Currently, the district level representatives of DFZ cover grievances and gender-related issues, as well as dealing with routine resettlement activities. Given the increased work under the upcoming resettlement program some of the roles and responsibilities need to be designated to individual technical specialists. DFZ is engaging at least three gender specialists under its E&S department.

TRAINING AND AWARENESS RAISING

17.10.12. The Labor Audit (2023) found that all contractors have mandatory Health and Safety (H&S) inductions when commencing works for the Project. Four provided sample H&S induction training content for review which included social aspects. In particular, Tractebel H&S induction has a section specifying the company Code of Conduct, including a statement prohibiting physical, sexual or verbal abuse, harassment, bullying, intimidating or discriminating against any other person. However, it was found that these induction processes are not always completed in full.

PROCUREMENT AND RECRUITMENT PROCESSES

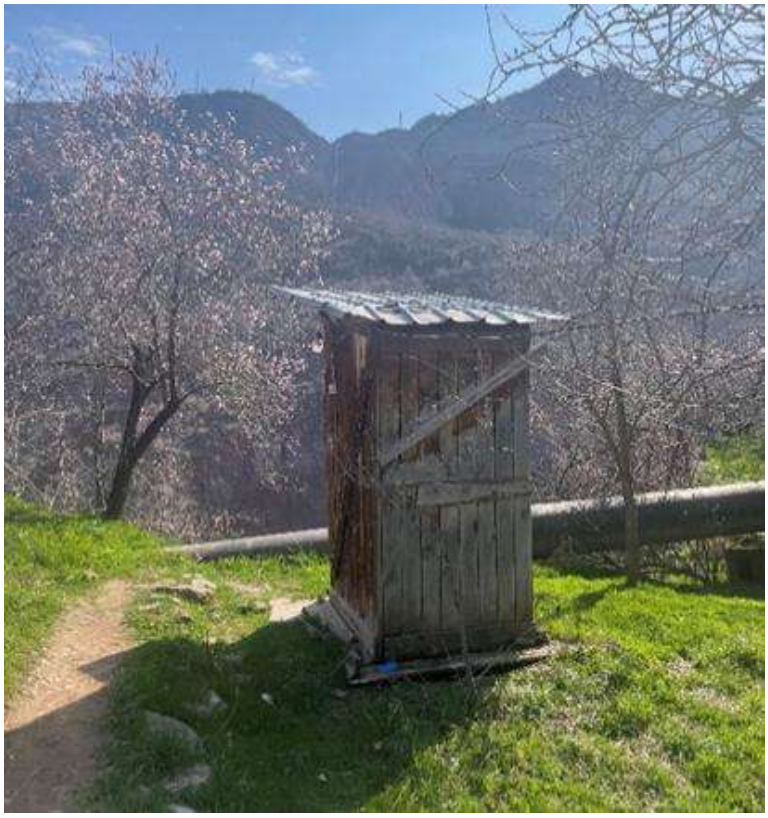
17.10.13. Contractors seeking to recruit for positions on the Project write a list of job vacancies which is sent to Rogun JSC which then sources applicants through advertisements and monthly employment fairs. The LMP requires that the project provide equal opportunities for recruitment.

WORK ENVIRONMENT

17.10.14. Currently, the majority of women employed on the Project 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. However, all OHS, and risk assessment should consider gender safety aspects and how to improve the safety of women working on the project.

17.10.15. Other risks to female workers can include sanitary facilities provided. During a 2023 Labor Audit, toilet and sanitary facilities within some worker camps (particularly camps for local Tajik workers) were found to be basic and unsanitary (for example the women's toilets shown in **Figure 17-3**). This included inequalities between male and female facilities with women's toilets located in dimly lit areas and without appropriate sanitary provisions. Shared shower facilities were also observed to exist in places. Since then, PMG and OJSC have worked with contractors to improve sanitary facilities for women.

Figure 17-3 - Women's Toilets at a Workers' Camp Site within the Construction Zone (August 2023)



GRIEVANCE REDRESS MECHANISMS

17.10.16. There is a GRM in place for workers. It includes procedures for handling sensitive grievances.

17.10.17. Three processes have been identified through which workers can submit grievances at the Project – through contractor HR staff, through the contractor's Trade Union, and through Rogun JSC.

17.10.18. All of the 20 contractors engaged in the construction activities for the Project have formal grievance mechanism procedures for workers to raise suggestions, complaints and requests. None of the contractors engaged in the construction works for the Project have a separate grievance procedure to handle sensitive grievances, such as for those relating to GBV/SEA/SH.

17.10.19. The many contractors without GRMs in place relied on 'open door' policies where staff could raise concerns to their health and safety, site or HR managers or through their trade union worker representative.

17.10.20. Workers can raise grievances with the Leader of the Primary Trade Union of Rogun JSC, however procedures are not in place to handle sensitive grievances nor anonymous submissions.

17.10.21. The Mayor of Rogun's Office plays a leading role in managing and monitoring local community complaints. Members from the local community can go into the mayor's office on Saturdays to file complaints either in person or via a complaints box on the Project. However, this is not an avenue for the submission or management of sensitive or even anonymous grievances.

PROPOSED SENSITIVE GRIEVANCE REDRESS MECHANISM

17.10.22. PMG is working on strengthening the GRM to include appropriate mechanisms for receiving and managing sensitive grievances within the workforce and the community. It will be critical to disseminate information on the sensitive grievance process, the company and contractors' policies relating to SEA/SH, the Code of Conduct provisions relating to acceptable behaviors including SEA/SH and policies on equal opportunities and non-discrimination.

17.10.23. Sensitive grievances need to be dealt with in a confidential and timely manner. Survivors of sexual harassment may feel too intimidated to lodge a grievance in person, so measures are being put in place to allow allegations relating to SEA/SH to be submitted through anonymous and confidential channels.

17.10.24. The person responsible for the sensitive GRM must have experience dealing with SEA/SH issues and be specialized training in safeguarding policies and procedures. This individual will also monitor and report on the presence or absence of violation cases and should be supported by nominated gender focal points, as per the Gender Action Plan appended.

17.10.25. Sensitive grievances, such as those relating to SEA/SH, will be recorded in a separate grievance logbook with restrictive access measures e.g., password protection.

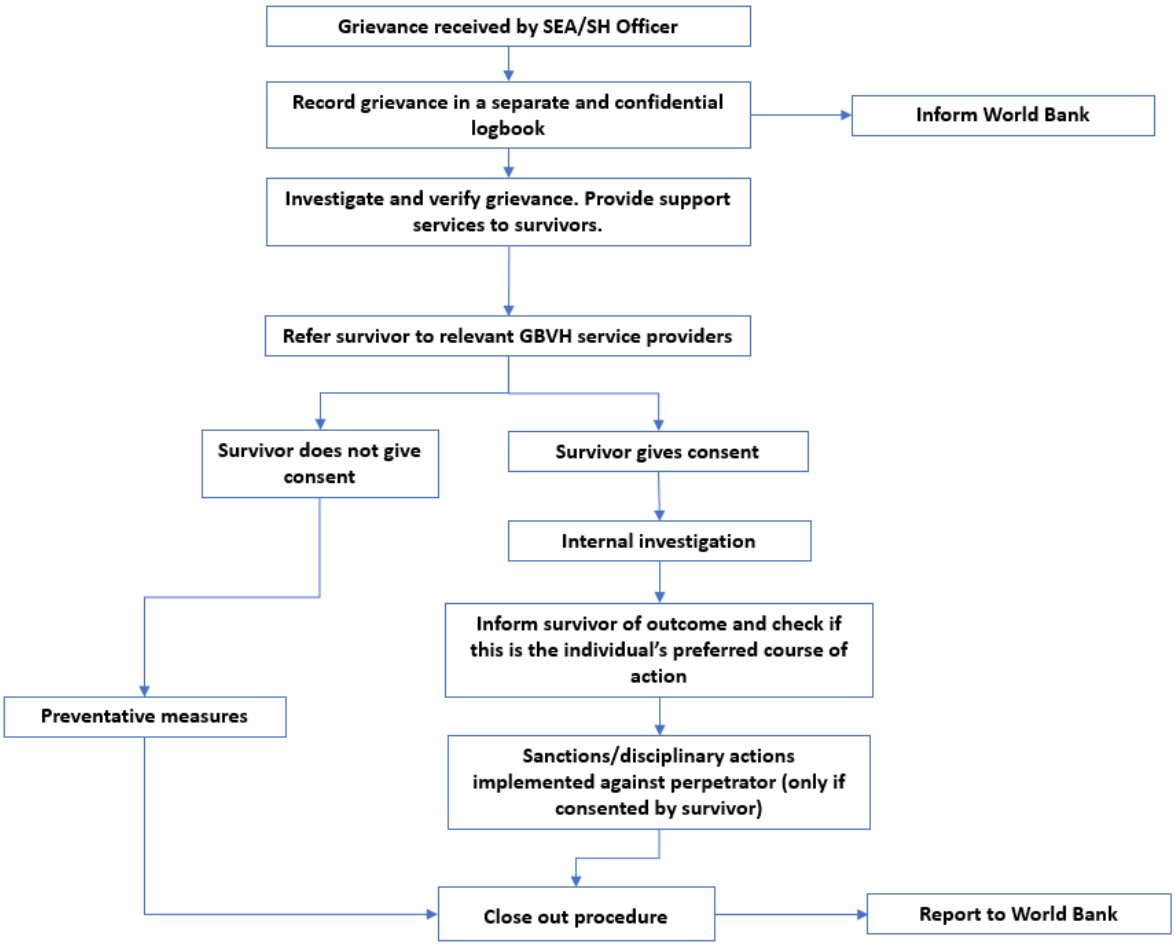
17.10.26. Multiple communication channels are available for workers and community members to find an avenue that they are comfortable using. Communication channel options for workers include verbally, through discussions with managers or worker representatives, letters, suggestion boxes located on-site and within worker accommodation facilities, mobile phone hotlines or a QR code scanning system. Options for community members include mobile phone hotlines or WhatsApp, via website or QR code scanning systems, by letter, or through District Livelihood and Engagement officers (DLEO) (see Gender Action Plan appended below).

17.10.27. The grievance mechanism, including its function to handle sensitive grievances, should be widely communicated among workers and affected communities. Further details on grievance mechanisms including the handling of sensitive grievances, mechanisms for the communication of the GRMs, timeframes for responding and escalation processes are described within the Stakeholder Engagement Plan chapter (Volume 13, A13 of this ESIA) and the Labor Management Procedures (Volume 3, A12 of this ESIA).This includes a two-tier process, whereby tier 1 is an

internal process that seeks to address and resolve grievances with the grievant, and tier 2 is an external process involving third parties which applies if a resolution was unable to be reached (subject to the grievant approval). It should be noted that all sensitive grievances, such as those relating to GBV/SEA/SH will be directed to and managed by a sensitive GRM officer.

17.10.28. Upon receipt of a sensitive grievance, the SEA/SH Officer will register a grievance within two working days of submission and acknowledge receipt of a complaint with the complainant (where not anonymous) within three working days. The target date for resolving a grievance will be ten working days from the date of receipt of a complaint, however more complex investigations may take longer. If an investigation requires more than ten days, a notice of delay will be issued three working days before the expiry of the resolution target date.

17.10.29. The sensitive grievance procedure is presented below[68].



[68] The diagram mentions informing and reporting to the World Bank at certain steps. The World Bank is one of the project's lenders. PMG will be expected to inform other lenders in accordance with their policies.

17.10.30. If a resolution to a grievance cannot be reached, serious or persistent grievances may be addressed through the World Bank Grievance Redress Service (GRS). Further details of the GRS, including contact details, are set out in the Stakeholder Engagement Plan (Volume 3, A13 of this ESIA).

17.11 GENDER SAFETY AND PROJECT DESIGN

17.11.1. The Project is located in a remote site accessible by narrow, steep, unsealed and un-lit roads. Reports of female staff having to flag down a lift to return to their homes following shifts working on the Project presents significant risk of GBV / SEA / SH. Adequate staff transport needs to be put into place to manage this risk.

17.11.2. Worker accommodation was observed to be of varying standards, with a proportion of sub-standards including female camps and unsanitary female facilities as well as female showers located in close proximity to male showers with only a curtain for privacy. Worker accommodation and facilities must meet standards as described in the Labor Audit Report (2023). Additional gender-responsive health and safety (H&S) measures are being implemented across the Project site 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. Additional CCTV could also be considered.

17.11.3. In relation to resettlement, there are risks of resettled women feeling unsafe in new communities and environments. Additionally, women in host communities may feel unsafe with the new influx of resettled populations. Women impacted by resettlement must be engaged in consultation on this including decision-making regarding selected communities for resettlement. Where possible, women may be offered the chance to visit resettlement communities to aid informed decisions regarding choice of destination. The SEP includes measures for women's participation in consultation processes.

17.12 IMPACT ASSESSMENT

INTRODUCTION

17.12.1. This section provides overview of key social impacts where gender aspects are prominent, highlighting where and how particular adverse impacts may be felt by women (and mitigation and management measures relating to these) or where opportunities exist for women.

17.12.2. While the Project provides the potential for many 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), 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.).

17.12.3. Key when identifying potential impacts is consideration of how to avoid adverse impacts being experienced disproportionately by the vulnerable, including women, and ensuring that Project benefits are equitably distributed.

17.12.4. Mitigation and management of impacts should be considered within the context of a mitigation hierarchy consistent with the World Bank's ESF and described below:

a. Anticipate and avoid risks and impacts;

b. Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels;

c. Once risks and impacts have been minimized or reduced, mitigate; and

d. Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible[69].

17.12.5. 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 GBV.

KEY RISK FACTORS

Country Risk Factors

17.12.6. At the national level, a number of factors including limited employment opportunities, security risks emanating from the border with Afghanistan and social risks from high poverty rates and limited-service delivery in rural areas contributes to risk of social and economic vulnerability. As outlined in Section 17.7 above, a number of key GBV risk factors[70, 71, 72] exist within the Tajikistan national context. These include:

- High levels of gender inequality;
- High levels of partner violence;
- High levels of poverty;
- Male dominated/non-egalitarian decision-making and income;
- High levels of unemployment, particularly in rural areas;
- Cultural and social norms that include high levels of acceptance of partner violence and the justification of violence against women and girls;
- Limited access to/engagement in formal wage employment for women, particularly in rural areas;
- Ease of divorce; and
- High levels of perceived corruption among local authorities[73].

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

[70] IfC (2020), 'Addressing Gender-Based Violence and Harassment Emerging Good Practice for the Private Sector', https://www.ifc.org/wps/wcm/connect/f1645167-7eff-439b-922b-7656c75320ab/GPN_AddressingGBVH_July2020.pdf?MOD=AJPERES&CVID=orHDkxv

[71] World Bank Group, 'Violence Against Women and Girls (VAWG) Resource Guide', https://www.worldbank.org/content/dam/Worldbank/document/Gender/VAWG%20Resource%20Guide%20Introduction%20July%202014.pdf

[72] World Bank (2020) 'Good Practice Note: Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works', https://thedocs.worldbank.org/en/doc/741681582580194727-0290022020/original/ESFGoodPracticeNoteonGBVinMajorCivilWorksv2.pdf

[73] Corruption Perceptions Index (2022), https://www.transparency.org/en/cpi/2022

Project-related risk factors

17.12.7. This section provides a high-level assessment of key gender-related risks and relating to women living or working on the Project or within Project affected communities.

17.12.8. There are a variety of risk factors that can contribute to SEA / SH in major projects[74, 70.] Of these, risk factors that are notable on the Project include:

- High levels of national and/or regional GBV (presents a higher risk that a project will reinforce or exacerbate this in some way);
- Limited services or low capacity for service provision for survivors;
- Large geographic span of the Project and affected communities;
- High levels of poverty and vulnerable populations within the Project area;
- Long term duration of the Project;
- Project workers who are not local including a large influx of male workforce;
- Worksites in remote locations; small and/or rural host community (noting that the majority of incoming workers are housed within accommodation on site rather than within local communities);
- Unequal participation of community members in consultations;
- Lack of sanctions for inappropriate behavior from employers;
- High incomes for project workers compared to surrounding communities;
- Increases in income enables transactional sex and risks exploitative relationships;
- Lack of information for individuals on how to report grievances;
- Transportation of goods over long distances; and
- The use of security personnel.

17.12.9. The key identified project-related gender impacts as they relate to the Project are described in Table 17-5 below. Impacts have been rated according to the methodology described in the Social Impact Assessment (2023) including the Impact Significance Matrix shown in Table 17-4 below.

17.12.10. 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 and key informant interviews.

17.12.11. 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 17-14 – Impact significance matrix

[74] World Bank Group (2020), 'Good Practice Note Environmental & Social Framework for IPF Operations - Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works', https://thedocs.worldbank.org/en/doc/632511583165318586-0290022020/original/ESFGPNSEASHinmajorcivilworks.pdf

Impact Magnitude	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

DIRECT CONSTRUCTION-PHASE GENDER-RELATED RISKS AND IMPACTS

Table 17-15 - 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
1. 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.	As of May 2025, there is a construction workforce of approximately 17,000 of which approximately 75% are estimated to be non-local workers (based on 2021 data and noting that at the time of writing, updated data have not been available). Peak workforce size is expected to be near 20,000 workers by the late 2020s. The large influx of a majority male workforce could present a threat of GBV / SEA /SH (including physical or verbal harassment) to women in the local community (which is relatively small – Rogun City has an estimate population of approximately 15,000 or 44,000 when including surrounding communities). The workforce is largely segregated from the community with dedicated workforce accommodation provided. Employees work in shifts (generally 15 days on and 15 days off) and transportation is provided so that they can return to their home communities during time off work. However, there is still potentially a significant number of workers residing within and	**Major** (Considering the High vulnerability of females within the workforce and community, and the Large magnitude of impacts).	• A Project Code of Conduct, which governs behavior on site and in accommodation and is applicable to all workers, must be in place and widely communicated. Contractors must have supporting policies and procedures in place to prevent GBV/SEA/SH. • Effective Grievance Redress Mechanisms must be in place and well communicated to the workforce and local community. • Mandatory inductions and refresher training must be in place to raise awareness of GBV/SEA/SH policies, grievance procedures, acceptable interactions with the community and the Code of Conduct. • Appropriate and adequately trained staff must be employed to handle reports of misconduct including sensitive grievances. This includes engagement of an expert gender consultant to be embedded within the PIU. • Workforce accommodation arrangements that house workers in separate and well-serviced self-

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		interacting with communities such as Rogun City. The risk of domestic violence for women in local communities may also increase as social dynamics change including potential social conflict between incoming workers and the local community, fraternization between Project workers and women in the local community and shifting power relations. The large expat male workforce can create demand for sex work and there is potential for risks related to prostitution, although no evidence for this has been found to date. It should also be noted that evidence from FGDs and household surveys does not suggest that a significant increase in GBV/SEA/SH has occurred.		contained facilities, as recommended in the Labor Management Plan, should be utilized as much as possible. • Transportation arrangements allowing workers to return to their home communities during time between shifts to continue. • Contractors to have policies in place relating to GBV/SEA/SH and the handling of sensitive grievances. • 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. • Actions should be investigated to support the increased capacity of community service providers to prevent and respond to GBV/SEA/SH, for example through engagement of additional staffing or resources and the creation of additional shelters and other facilities that respond to community needs. • H&S inductions to be completed in full.
2. Gender appropriate facilities and accommodation	Inadequate or inappropriate worker accommodation	Limited accommodation and social amenities and unfavorable conditions in some worker camps for female employees increases SEA / SH risks and may	**Major** (Considering the High vulnerability of females within the workforce, and the	• Improve living and working conditions for Project workers to a consistent level that meets international standards and includes safeguards to reduce

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	and facilities increases the vulnerability of women.	discourage women from accessing employment opportunities on the Project. The remote location of the Project site presents a risk for female employees who may need to travel to and from local communities or worker camps. Inadequate transportation for workers travelling to and from the Project site, including female workers walking long distances and hitch-hiking to return to their accommodation following work shifts, leaves women at increased risk of violence and harassment.	Large magnitude of impacts).	GBV/SEA/SH risks to female employees. This includes provision of separate, lockable male and female showers and suitable (safe and sanitary) toilet facilities with sanitary provisions. • A Worker Accommodation Management Plan should be implemented which adheres to international standards (e.g. EBRD/IFC, ILO, WHO) and all accommodation in compliance with this (including the provision of safe, secure and sanitary facilities and adequate lighting in corridors and along pathways to communal areas such as canteens). • Implement women-only transport arrangements that meet the needs of workers including timely transportation to and from the workplace / accommodation at the beginning and end of shifts. • Well-communicated, appropriate grievance mechanisms in place so that workers can report any issues with inadequate transport.
3. Health and Safety for female employees	The work environment may present health and safety risks	Work conditions that are not gender-sensitive may adversely impact female employees, for example where the Project environment and workforce facilities lack	**Major** (Considering the High vulnerability of females within the workforce, and the	• Integrating gender-responsive H&S measures across the Project site, including adequate lighting around the roads and worker camps, well-lit

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	for female employees	appropriate health and safety measures, or the work environment is designed for a male workforce.	Large magnitude of impacts).	lockable wash 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.
4. 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 Grievance Redress Mechanisms for Project workers or the community, leaving women with limited options to confidentially and anonymously report concerns or GBV/SEA/SH related grievances. The lack of internal policies and procedures including a Project wide Code of Conduct adequate HR policies also leave women at risk. Lack of internal capacity including required roles and capabilities to effectively and appropriately address grievances leaves women at increased risk of SH / SEA.	**Major** (Considering the High vulnerability of females within the workforce, and the Large magnitude of impacts).	• Implementation of gender sensitive workers' and community GRMs aligned with international standards and requirements. • Project staffed with adequately trained personnel equipped to manage and report on sensitive grievances. • Implementation of Project wide Code of Conduct including training and communication in relation to this. • Awareness raising of GRM among Project workforce and community. • Project to recruit an appropriately trained gender focal point or resource/s to manage gender aspects including handling of sensitive grievances received from Project workers and the community.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
5. Recruitment bias	Poor quality policies and procedures presents a risk of discrimination and bias during recruitment processes.	While the Labor Code (Article 7) prohibits discrimination, a lack of policies and procedures relating to recruitment processes (only 3 out of 20 contractors currently working on the Project have a HR Policy in place) along with the absence of training and awareness on this increases the risk of potential discrimination and unconscious bias during recruitment that 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).	• Project must implement policies of non-discrimination, equal treatment, and equal pay for work of equal value in line with international standards. • Every employer to direct or contracted Project workers to ensure that the selection process bias-free. • Training and awareness activities must be delivered relating to these policies and procedures and unbiased and transparent recruitment processes.
6. Resettlement and livelihood restoration	Resettlement can potentially leave women at increased risk of GBV.	Resettlement can potentially leave women at increased risk of GBV in households. Increased pressure, potential changes in social dynamics and loss of social networks could expose women to higher levels of vulnerability. Male partners could feel overwhelmed due to the changes resulting from relocation, causing tensions and violations towards their spouses. The Project seeks to enable women to participate in consultation and decision-making, which may affect the dynamic of households in which women have limited voice. This can leave women vulnerable to DV if husbands and fathers feel like they are being challenged. However, all key resettlement decisions are the ultimate	**Moderate** (Considering the High vulnerability of females within the community, and the Small magnitude of impacts (assessed as 'Small' due to lower level of likelihood based on little evidence of concern within the community and general positive sentiment regarding resettlement).)	• Conduct resettlement processes in accordance with the Resettlement and Livelihood Restoration Framework, Resettlement Action Plan and in line with national and international standards to minimize adverse social impacts. • Establish and widely communicate (among women being resettled and women within host communities) an effective grievance redress mechanism. • 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
		responsibility of the registered Head of Household (HoH) (who may be male or female) under the current process, while the level of influence of other household members is dependent on existing intra-household relationships. This means that power dynamics are unlikely to be affected. Women may have increased access to economic empowerment opportunities after resettlement, which may leave them at a heightened risk of GBV within their homes if social norms and gender expectations within patriarchal households are disrupted. A lack of local services enhances this risk. Additionally, women's real and perceived safety may be impacted if resettled into communities considered to be unsafe. However, it should be noted that no concerns about GBV/SEA/SH were raised during the FGDs, while >99% of household survey respondents stated that women felt safe in the resettled communities and that no GBV incidents had occurred (the few individuals expressing concern about women's safety were in Tursunzoda). Just 1.7% of female respondents selected DV as the most important problem in the community.		

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	Resettlement can lead to increased vulnerability and disadvantage for female heads of household.	There is a significant proportion of female headed households within the Project area (the household survey (900 households) showed nearly 18 percent were female-headed households, compared to an average of approximately 16% across rural Tajikistan). Female-headed households (HoH) (as well as women acting as de facto HoH while the HoH is absent, e.g. for labor migration) may be more adversely impacted by the need to resettle and build their new houses. For example, they are less likely to be able to rely on construction labor from their own households, which typically contain few adult males, and may be required to hire construction workers from their own funds or using their asset compensation. Sometimes these women are assisted by the community, but this cannot be guaranteed. There is a risk that resettlement will more adversely impact these women if their specific needs and requirement for support are not understood and accounted for in the resettlement process. During FGDs, female head of households expressed concern about their ability to transport goods and construct new homes –	**Moderate** (Considering the High vulnerability of females within the community, and the Small magnitude of impacts (assessed as 'Small' due to support available to help with resettlement).)	• Additional assistance should be provided to vulnerable groups, such as female headed households as per the RLRF. • Livelihood restoration processes should understand and account for the challenges faced by households left behind by men undertaking labor migration. • Information disclosure and consultation processes should carefully consider engagement of women, identifying and overcoming barriers to equal participation so that women's views, needs and concerns are understood and incorporated, in line with the RLRF, SEP and existing efforts. • Ensure that transportation and construction assistance is available for women unable to source labor from within their own household if needed. • Women to be given entitlements on an equal basis to men.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		there was a lack of clarity regarding the support available. Women may lose social connections, support networks, decision-making power or employment opportunities during resettlement processes, particularly those living within households where they have limited influence. Stress and isolation could lead to health impacts. Men and women in FGDs were unsure if single adult women living with their parents would be eligible for additional land plots in the same way as adult sons. Policy on this matter is unclear.		
	Resettlement processes may place women at risk of losing assets or compensation where there is a lack of clear	Women can be 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[75]. This risk is enhanced by the legislation whereby the Law on State Registration of	**Moderate** (Considering the High vulnerability of females within the community, and the Small magnitude of impacts (assessed as 'Small' due to little	• Security of tenure should be ensured for women on equal terms to men, as required by national law. • Measures should be taken to ensure receive due compensation on equal terms to men, as required by national law.

75 World Bank (2019) 'Good Practice Note - Environment & Social Framework for IPF Operations – Gender'

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	ownership or tenure.	Legal Entities does not require joint registration of jointly held entities. If land is contested, those whose names are not registered are required to go to court to prove ownership. The prevalence of unregistered marriages in Tajikistan is also a factor that puts many women at risk. The proportion of local men who are working overseas, some of whom don't return, may also present a risk for abandoned families where a property is in the absent husband's name.	evidence that this has emerged as an issue to date).	• Women's ownership rights are recognized regardless of marital status as per international and national standards. • Ensure that support is available to assist those who are not legally or financially literate, including facilitating access to documents required. • 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.	While it is noted that focus group discussions show a high level of optimism among women about the enhanced opportunities that resettlement presents, consideration must be given to addressing impacts related to women's income generation activities. Women are generally more likely to generate income from informal income generation activities such as through selling excess produce and homemade wares at markets and roadsides. Their ability to do this will be greatly affected and disrupted by resettlement and special consideration will	**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 including the Entitlement Matrix. • Understand the perspectives of women through inclusive consultation processes targeting equal participation of men and women to inform the planning and implementation of livelihood restoration and enhancement measures. Seek specific feedback from women on their desires in terms of employment, skills and training and preferences around vocations. Consultation processes must be designed to support equal participation of women (e.g. appropriate

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		need to be given during livelihood restoration processes. Data (from the household survey) shows that 14% of women in the sample have an income, of whom 7% described themselves self-employed (compared to 5.5% of men), although it is possible that irregular incomes were under-reported. Women moving from rural to urban areas can be particularly vulnerable group, due to the reduced opportunities for agricultural livelihoods and the need to gain additional income-generating skills. The household survey shows over 4.5 percent of women highlighting arable agriculture as their primary source of income and a total of nearly 6.5 percent when including cattle breeding and subsistence farming. Women wishing to enter the workforce for the first time will also require special support and consideration (FGDs show significant interest among currently unemployed women in accessing employment opportunities following resettlement). Many women in Tajikistan, including within some of the Project affected communities (particularly where there is a current lack of opportunities), do not have an income, leaving them vulnerable due to a lack of		meeting times, transport, childcare support, as well as convening of women-only meetings when appropriate). • Livelihood restoration processes must be based on an understanding of, and accounting for, differences between typical income streams of men and women and the different project impacts experienced by each, as well as differing preferences and cultural expectations. • Ensure that kindergarten facilities are provided at resettlement sites. • Consider partnerships to best support training and employment opportunities for women affected by resettlement.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		economic independence and agency. If the Project impacts women's access to informal income generation, it could exacerbate this. However, resettlement could also increase women's access to employment opportunities, and the interviewed women were optimistic about this. Some post-resettlement women, however, expressed concern over a lack of culturally acceptable jobs in their new locations. Other women stressed the importance of kindergartens in enabling them to work (children in Tajikistan start school at age seven).		
	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. Women in particular rely on informal means of generating income such as through the sale of surplus produce. This leaves women particularly vulnerable to economic shocks and insecurity. 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. • Undertake inclusive consultation with women to understand their activity in the informal economy manage this through livelihood restoration programs.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	Resettlement may adversely impact women by disrupting access to resources or services and increasing the burden relating to unpaid and home-based work.	Women are likely to be disproportionately impacted by infrastructure and service interruption as women are the main users of utilities at home. This can increase the burden felt by women in relation to unpaid and home-based duties. Women also take on additional childcare responsibilities where schools and kindergartens are not available or accessible. The majority of women engaged through focus group discussions were optimistic about improved access to resources during resettlement, often citing issues – for example with access to water – in their current communities. However, previous studies for the Project in 2021 and focus group discussions in 2023 found evidence of families being resettled before facilities such as schools, kindergarten or water infrastructure were fully established.	**Moderate** (Considering the High vulnerability of females within the community, and the Small magnitude of impacts (Assessed as Small considering the likelihood with many resettled and host communities positive about the facilities available).	• Understand use of and reliance on resources from Census and Household Survey as well as consultation programs and take measures to avoid disruption where possible and manage adverse impacts where disruption is unavoidable. • 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.	Loss of social capital as social and other support networks are disrupted, and social fabric weakened due to displacement and resettlement may disproportionately impact women who particularly rely on these	**Minor** (Considering the High vulnerability of females within the community, and the Very Small magnitude of impacts (Assessed	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

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		networks and therefore increase their vulnerability. HoH/HoF have a free choice between resettlement sites. The level of input from other family members varies between communities and households. 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.	as Very Small due to the likelihood being low with efforts being made to relocate communities together / provide choice).	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.	Women in host communities may be impacted as the newly resettled communities create competition for scarce community resources or social infrastructure. Improvements in infrastructure resulting from investment due to resettlement may also benefit host communities. 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 that attract equal participation from men and women to understand concerns and issues – including those that may relate to services, social infrastructure and community resources – are understood and can be addressed.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	The process of splitting large households into smaller family units may impact women's position within the household dynamic, positively or negatively.	DFZ currently provides land and asset compensation to the HoH, but large households containing multiple nuclear families are provided with an additional land plot for each family as an additional benefit. The families use the additional land plots in different ways; some families continue to reside within the same household and use the plots for farming, but the majority construct a new house (from their own funds, from saving while the family stays with the original household temporarily, or by splitting the asset compensation to build multiple smaller houses instead of one large one). 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 may become more isolated and vulnerable, particularly in DV situations perpetrated by the spouse. Conversely, though, women experiencing DV from other family members, such as in-laws or parents, may experience increased freedom and a healthier home environment. FGD participants were unsure whether single women were eligible for land plots but appeared supportive of the idea.	**Minor to Positive** (Considering the High vulnerability of females within the community, and the Very Small to Beneficial nature of impacts, given the evidence.	• Establish and widely communicate (among women being resettled and women within host communities) an effective grievance redress mechanism. • Build internal capacity to address sensitive grievances and refer women appropriately. • Only married children in a household are eligible for land plots.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
7. 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.	Women may be prevented from having equal access to opportunities with the Project due to factors including the Tajikistan Labor Code (that prohibits women from certain professions including many of relevance to the Project), social norms and family expectations, home-based duties or limited education or skills. Perceptions, as evident in focus group discussions, are that the Project provides job opportunities for men but fewer for women. Poor policies and procedures and unfavorable conditions may contribute to preventing women from benefiting from enhanced employment opportunities on the project. Care responsibilities and a lack of childcare facilities may hinder women's ability to have equal access to Project opportunities. 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)).	• Explore opportunities to support skills related programs for women to position them to access employment opportunities, including through partnerships. • Awareness raising (through accessible communication channels that will effectively reach women) a wide range of employment opportunities with the Project including those not within banned professions and those that are not subject to shift work. • Clear and mandated policies and procedures relating to non-discrimination, equal treatment, equal pay for work of equal value and transparent recruitment opportunities must be implemented and communicated. • Employee selection processes and relationships must be free and based on the principles of fair treatment, non-discrimination and equal opportunity in line with the Labor Management Plan. • Consideration must be given to appropriate transportation that meets the needs of workers in accordance with international standards so that

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
				women are able to travel safely to and from work enhancing their access to job opportunities. • Consideration to be given to the availability of childcare facilities to enable women (including women in resettled communities) to participate in employment. • Efforts must be made to enable equal participation by men and women in consultation processes – including identification of barriers to this and how they may be overcome – so that women's views are understood and incorporated and influence outcomes.
8. 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 and women's limited role in decision-making risks Project decisions being informed by community input and feedback that predominantly reflects the interests and views of men. During female focus group discussions, most participants reported that it was the men from their households that attended meetings regarding resettlement, but some women had attended and / or had influence on household decisions.	**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	• Enable women's equal opportunity to participate in consultations by considering location, timing, transport, childcare requirements or the need for women only activities. • Consider special arrangements to allow women with disabilities and of different ages to participate in consultation. • Tailor consultation questions to women to understand specific perspectives. • Use female/appropriately trained facilitators to lead successful consultation with women.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		Women therefore may be in a position where they disproportionately experience adverse impacts as these are not so well understood by Project teams, and women may stand to benefit less from the Project as their needs and priorities are less well understood. Women may be at increased risk of GBV / SEA / SH as they lack opportunities to make their concerns known so that they can be addressed, although available data suggests this is not a major concern for women in the Project area. Female heads of household attend head of household consultations on an equal basis to men.	measures to address this impact)).	• Encourage and enable the participation of young women in consultation by considering timing and location and provision of childcare / play equipment etc. • Leverage the influence of jamoats, village heads and women's councils to encourage inclusive male and female participation in decision-making.
9. Gender Referral Pathway	A lack of gender-related services and support leaves women more vulnerable to GBV/SEA/SH.	A lack of gender-related resources and support (nationally and particularly in rural and remote areas) as well as a lack of awareness where these services may exist, and referral pathways leaves women more vulnerable to GBV. While there is some evidence that improvements are being made in relation to the support available for GBV/SEA/SH survivors, reports highlight a severe 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. • Establish an appropriate gender-sensitive grievance redress mechanisms to address grievances. • Internal appropriate resourcing and capacity to manage grievances, refer survivors to appropriate support and services.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
				• Communication and awareness raising of support available. • Explore opportunities to support and increase the capacity of local service providers.
10. 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 a 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 sign Project Code of Conduct that includes reference to GBV/SEA/SH. • Security personnel to undergo regular training relating to the Code of Conduct and GBV aspects. • Security personnel to be screened appropriately for previous abuses or crimes. • Security and safeguarding measures such as CCTV to be considered. • Consider security staff of both genders.
11. Community Health and Safety	The large influx of a majority male workforce presents an increased risk of the spread of communicable disease including sexually	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 (9% stated communicable disease as the most serious problem in their community, including non-sexually transmitted diseases such as COVID-19).	**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	• Measures as per the Community Health and Safety Management Plan relating to management of risk of communicable diseases must be observed including consideration of gender aspects including women's access to health facilities and availability of education and testing regarding sexually transmitted diseases.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	transmitted diseases.		spread of disease within the community)).	• Training and awareness for Project workers to cover Sensitization on STDs/STIs/communicable diseases.
	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)).	• Engage women in decision-making relating to resettlement to ensure that their needs and perspectives are understood and accounted for. • Increase awareness of services available including grievance mechanisms 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.
12. Economic empowerment	The Project has the potential to present employment and economic empowerment opportunities for women seeking work or skills development.	The Project has the potential to offer a range of opportunities to increase women's labor market participation, and economic empowerment opportunities to women seeking these. Livelihood restoration and improvement processes have the potential to present new employment and entrepreneurial opportunities to resettled women who seek work or other income generation or self-employment opportunities.	**Positive** (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	• Implement appropriate gender mainstreaming and equal opportunity measures and policies in place as described in this assessment and the Gender Action Plan to remove hurdles and make opportunities accessible to women. • Engage women equally in consultation to understand their needs and desires in relation to Project opportunities and benefits.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		The RAP 1 audit found that 180 women had begun working outside the home in their new location, 40 of whom had benefited from DFZ-provided training, highlighting the potential and the appetite among women to access employment opportunities. FGD data supports the conclusion that many women in PACs wish to enter the workforce, and some in post-resettlement communities have already done so. However, they express a desire for workplaces considered culturally acceptable for women, such as pharmacies, sewing shops and bakeries, and supporting infrastructure such as kindergartens. Women already working expressed a preference to continue their current livelihoods.		• Particular attention including consultation should be undertaken with women who wish to work outside the home for the first time, or who are moving from a rural to an urban setting and therefore may be unable to continue previous livelihoods. • Explore partnerships to deliver skills and training opportunities for women that align with community needs and employment opportunities. • The benefit-sharing program to be developed in equal consultation with women and men to support equal distribution of Project benefits and positive outcomes for improving the lives of women.
13. 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 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. • Understand barriers to educational attainment for girls and approaches to removing these (through improved school facilities for girls, transport and access, improved real or perceived safety, better support for home-based responsibilities, etc.)

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		School attendance, particularly among girls, was found to have improved in an audit of already resettled communities (RAP 1 audit). Women participating in focus groups also stated that they hoped more girls would be able to finish their education after resettlement, although issues with unfinished schools were identified. In Darband it was observed that maternal health had improved due to a new maternity hospital. This highlights the potential for positive educational and health outcomes for women and girls through the resettlement process.		• Engage and partner with local service providers to support the enhancement of these in line with community needs to facilitate the improvement of lives and livelihoods.
14. Gender mainstreaming	Gender mainstreaming measures implemented by the Project can improve lives and livelihoods of women	Measures taken to remove obstacles to women's participation in civic life and the labor market along with measures to tackle discrimination and GBV/SH/SEA can positively impact social norms and expectations in favor of gender equality. Training, capacity building and awareness campaigns targeting employees and community contributes to a bottom up strengthening of understanding of GBV/SEA/SH issues including a zero tolerance to these and knowledge of where to turn to for support when required.	**Positive** (Consider the High vulnerability of females within the community, and the Beneficial nature of the impacts).	• Implement gender mainstreaming including gender-sensitive Codes 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.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Impact (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
		Opportunities to reduce social stigma relating to gender aspects and gender equality.		
15. Benefits sharing mechanisms	Investments and commitments made in benefit sharing can lead to positive outcomes and shared benefits for women.	The benefit sharing program can improve lives and livelihoods of communities impacted by the Project including women; for example, through community-led, sustainable initiatives to improve the 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).

DIRECT 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
16. GBV/SEA/SH	Changes to local populations and social fabric may enhance the vulnerability of	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	• Gender-sensitive GRM appropriate for operation phase. • Inclusive consultation processes to understand and account for women's views

Key Aspect	Gender Related Risk / Impact	Description	Significance of Risk (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	women and girls including GBV risks		phase required to assess this accurately).	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.
17. Economic empowerment	Employment opportunities may benefit women.	Employment opportunities related to operation of the Project 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.

INDIRECT 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
18. Gender wage gap	The gender wage gap that exists in Tajikistan risks perpetuating gender inequality and discrimination.	The persistent and significant gender wage gap perpetuates gender inequality risks increasing 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)).	• Project policies and procedures to mandate equal pay for equal work. • Transparency in recruitment and procurement processes to support adherence to non-discrimination and equality policies.
19. Electricity supply	Improved electricity supply and a reduction in energy poverty can positively	Improved electricity supply leads to better living and socio-economic conditions for households across the country including the creation of jobs and economic stimulation. Women stand to benefit from these improved living conditions,	**Positive** (Consider the High vulnerability of females within	• Consider opportunities to measure the extent that improved electricity supply and a reduction in energy poverty impacts women's lives, e.g. through surveying.

Key Aspect	Gender Related Risk / Impact	Description	Significance of Risk (Covering Existing Mitigation Measures in Place)	Recommended mitigation / management / enhancement measures
	impact the lives of women as domestic tasks are made easier and health improved.	especially considering that they are often disproportionately adversely impacted by energy poverty. Improved electricity supply can lead to positive health outcomes for women as unclean solid fuels no longer need be relied on for cooking and homes can be sufficiently heated.	the community, and the Beneficial nature of the impacts).	Include consideration of transboundary impacts on women in riparian communities.

17.13 PARTNERSHIP OPPORTUNITIES

17.13.1. Partnerships across sectors including with the private sector, local and national authorities and NGOs are recognized as essential to advancing gender equality outcomes including preventing and responding to GBV/SEA/SH and advancing women's economic opportunities.

17.13.2. Potential partnerships to support positive gender related outcomes for the Project include the below.

ADB SKILLS AND EMPLOYABILITY ENHANCEMENT PROJECT

17.13.3. ADB's Skills and Employability Enhancement Project (SEEP) aims to promote inclusive growth in Tajikistan by improving the vocational, technical and soft skills and employability of youth (ages 15 - 29), women, and labor migrants. It is implemented by the project administration group under the Ministry of Labor, Migration, and Employment of Population (MOLMEP). The project is constructing job centers and migration service centers in areas including Rogun, Danghara and Dushanbe and is currently scheduled to run until 2027. Its Gender Action Plan includes a target of increased job participation rate for youth and women in Dushanbe, Rogun and Danghara by 5 percent for youth and 10 percent for women (from a 2020 baseline: 43.6% for youth and 27.8% for women)[76]. It also lists targets including the employment of three job counsellors at each job center with one to act as a gender focal point.

17.13.4. The Gender Action Plan also refers to awareness raising campaigns relating to training and jobs for women in the energy sector.

IMON INTERNATIONAL

17.13.5. IMON began as a program of the National Association of Businesswomen of Tajikistan and today is the country's largest microfinance institution (MFI). Imon operates across Tajikistan and its services include a range of non-financial services to women entrepreneurs including advisory services, networking and confidence building. With the National Association of Businesswomen, IMON offers business courses and business planning. Together with the ILO, IMON has developed women-focused content covering business education, leadership development, confidence and communication. IMON has previously (2015) received lending from the IFC, together with the Agence Française de Développement (AFD) and the OPEC Fund for International Development (OFID), to in turn boost lending to MSMEs in the country's remote and rural areas, with a special focus on women entrepreneurs.

FIRST MICROFINANCE BANK-TAJIKISTAN (FMFB-T)

17.13.6. First MicroFinance Bank-Tajikistan (FMFB-T) is a commercial bank of the Aga Khan Development Network involved in microfinancing operations including for women. It has branches in Faizabad and Nurobod.

[76] ADB, Skills and Employability Enhancement Project: Gender Action Plan (adb.org)

NATIONAL ASSOCIATION OF BUSINESSWOMEN OF TAJIKISTAN

17.13.7. The National Association of Businesswomen of Tajikistan claims to have approximately 3,000 members and provides support to help women entrepreneurs and artisans build vocational and personal capacity. It lobbies for the interests of women entrepreneurs at the national level, provides professional training (for example in sewing, hairdressing, machine embroidery) and provides legal assistance to women entrepreneurs on business related issues, such as taxation, business registration, licensing and custom fees. While not currently active in the Project area, it is a national association and works throughout the country if funding is available.

ALC TRAINING PROGRAMS

17.13.8. The Government of Tajikistan runs training courses through Adult Learning Centers (ALCs) that are financed by various development organizations and free of charge for those who are officially registered at the Employment Bureau as unemployed. After completing a training course, which can range from one to six months (depending on complexity of the course), participants get official certificates. The Centers have agreements with potential employers to help graduates to find a job after the graduation. In addition, MoLMEP and its subordinate bodies in cooperation with job providers organize vacancy fairs on a quarterly basis to promote available positions within the organizations.

DEPARTMENT OF LABOR AND EMPLOYMENT OF POPULATION (DLEP)

17.13.9. DLEP in Rogun and Nurobod registers unemployed people and conducts monthly job fairs where they invite those registered as unemployed.

17.13.10. DLEP also provides small no-interest loans for the amount of 1,000-5,000 TJS for a three-year term to those who want to start a business related to trade, services, and agriculture. Women have priority in receiving those loans due to government efforts on promoting employment among women and their economic advancement.

VOCATIONAL SCHOOLS

17.13.11. Each district has a vocational school offering various vocational courses, including computer courses, welding, accounting, sewing and cooking courses.

17.13.12. Duration of the courses varies from one to three months depending on the curriculum. Students also receive 60 TJS as a monthly stipend. In 2022, 90 women completed vocational courses in Nurobod. Besides the courses offered by vocational schools, women have expressed interest in other trainings, such as growing strawberry and vegetables in greenhouses, beekeeping, livestock breeding, etc.

17.13.13. MoLMEP provides small no-interest loans for the amount of 1,000-5,000 TJS for a three-year term to those who want to start a business related to trade, services, and agriculture. Women have priority in receiving those loans due to government efforts promoting employment among women and their economic advancement. In Nurobod, 15 women out of those 90 who completed vocational courses received such loans to initiate home-based business.

APPENDIX A –RELEVANT OCCUPATIONS WHERE THE USE OF WOMEN'S LABOR IS PROHIBITED

Under Article 216 of the Labor Code of Tajikistan, Women's labor is prohibited in 194 professions considered heavy and harmful for women (as of 30th December 2023). The professions listed that are of particular note to the Project are listed below.

1. **Jobs linked to manual lifting and moving of heavy loads**: The law sets maximum weight limits that can be lifted by women:

   - a total of 350kg per shift from a work surface

   - a total of 157kg per shift from the floor

   - a maximum of 15kg per item lifted

2. **Underground jobs:** Women's labor is prohibited in underground jobs, mining industry and in construction of underground structures.

   Metalworking: Including:

   Foundry work

   3. Furnace worker
   4. Casting knocker
   5. Roles involving pouring of molten metal
   6. Iron casting welder
   7. Metal filler
   8. Cutter engaged in work with pneumatic tools
   9. Smelter of metal and alloys
   10. Workers engaged in the suspension of hot casting on the conveyor and maintenance and repair of equipment in the tunnels of foundries.

   Welding works

   11. Gas welder and manual electric welder, working in closed containers (tanks, boilers, etc.), as well as on high-rise communications structures (towers, masts) over 10 meters and working at height.

   Boiler rooms, cold molding, drawing and pressure works

   12. Boiler fireman
   13. Manual turning of rotating machinery

   Smith work, forging-pressing and thermal work

   14. Band maker, engaged in hot work
   15. Wire drawer, engaged in drawing hot wires with a diameter of more than 10 mm.
   16. Operating rolling machines engaged in rolling rings in a hot state

   Metal coatings and painting

   17. Sealing the inside of caisson tanks

18. Continuous work on hot lead (not electroplated)

Repair and assembly works

19. Drilling operator performing work with a pneumatic tool

Maintenance work

20. Installation and adjustment of equipment in workshops and sections
21. Repair of hot selenium devices (equipment);
22. Adjustment of equipment in workshops and sections for the preparation and use of organosilicon varnishes and varnishes containing >40% toluene, xylene;
23. Repair of equipment in closed fuel and oil storage facilities at thermal power plants, as well as the repair of equipment in tunnels and heating chambers in heating networks;
24. Adjustment and repair of foundry molds in a hot state.

Working with lead

25. Smelting, casting, rolling, broaching and stamping of lead products, as well as lead-coating of cables and soldering of lead-acid batteries.

Construction, installation and repair - construction works

26. Hot repair of furnaces and boiler furnaces
27. Fastening of structures and components using a cartridge-operated gun
28. Breaking stone slabs, dismantling of buildings and structures
29. Manual drilling of cracks in concrete, reinforced concrete, and stone (brick) structures using pneumatic tools
30. Asphalt concrete worker, asphalt concrete installer, engaged in manual work.
31. Earth or tunnel digger
32. Steel roof installer.
33. Caisson builder, caisson digger, caisson repairman, caisson electrician.
34. Operator of a mobile electric welding machine with an internal combustion engine.
35. Operator of a mobile power station with an internal combustion engine with a capacity of 150 horsepower or more.
36. Installer of steel and reinforced concrete structures, working at height.
37. Lead solderer.
38. Carpenter.
39. Plumber, engaged in repairing sewer networks.
40. Pipe fitter of industrial reinforced concrete pipes.
41. Pipe fitter of industrial brick pipes.

Mining work

42. Driller of blast holes (shpurs).
43. Miner for prevention and firefighting.
44. Timberman.
45. Blacksmith - drill installer.
46. Pusher, manually pushing and pulling wagons.
47. Miner.

48. Electrician (repairman), on duty for equipment repair, engaged in servicing and repairing equipment, mechanisms, water and air mains in mining.
49. Furnace operator, engaged in the smelting of raw materials and substances in mercury production.
50. Workers and masters of cleaning, crushing, and sorting ores, mines, and metallurgical plants, engaged in crushing, grinding, and smelting of ferrous, non-ferrous, and rare ores.
51. Workers engaged in lead cleaning plants.
52. Workers and masters engaged in cleaning niobium group ores (lopars).
53. Surface miner
54. Electrician or repairman for on-site equipment

Oil and gas drilling

55. Operational and exploratory driller of oil and gas wells.
56. Tower assembler, tower welder, tower electrician.
57. Pipe clamp operator.
58. Assistant driller of operational and exploratory oil and gas wells (first).
59. Assistant driller of operational and exploratory oil and gas wells (second).
60. Drilling fluid preparer, engaged in manual preparation of the fluid.
61. Repairman for servicing drilling rigs.
62. Repairman, engaged in repairing drilling equipment.
63. Drilling lock installer.
64. Electrician for servicing drilling rigs.

Oil and gas extraction

65. Driller for major well repairs.
66. Operator of a mobile steam unit for paraffin removal.
67. Operator of a mobile compressor.
68. Operator of a lifting unit.
69. Operator of a washing unit.
70. Assistant driller for major well repairs.
71. Workers, supervisors, and specialists regularly engaged in underground oil extraction.
72. Repairman, servicing technological equipment and repairing oil field equipment.
73. Electrician for repairing and servicing electrical equipment.

Ferrous metallurgy

74. Smelter, engaged in metal smelting.
75. Metal heater.

Furnace Production (Blast Furnace)

76. Supervisor of the blast furnace.
77. Blast furnace pipe operator.
78. Blast furnace operator.

Rolling Production

79. Hot rolling mill operator.
80. Hot pitch (tar) cooker.

81. Rail joint clamp operator.
82. Repairman-transporter in rolling production.

Iron Alloy Production

83. Iron alloy furnace operator.
84. Ferrite alloy smelter.
85. Workers engaged in silicon alloy smelting in open arc furnaces.
86. Workers engaged in the production of metallic chromium and chromium alloys by aluminothermic and thermic methods.

Steel Smelting Production

87. Operator of a tilting unit.
88. Mixing worker.
89. Block mold caster.
90. Iron recovery and iron ore re-smelting furnace operator.
91. Pickling heater.
92. Assistant steel smelter of a converter furnace.
93. Assistant steel smelter of a Martin furnace.
94. Assistant steel smelter of an electric arc furnace.
95. Assistant steel smelter of an electric furnace.
96. Steel caster.
97. Steel smelter of a converter furnace.
98. Steel smelter of an electric arc furnace.
99. Steel smelter of an electric furnace.

Electrical and Technical Production

100. Mercury distiller.
101. Mercury rectifier mold caster, working with open mercury.

Cable Production

102. Cable lead or aluminum sheather, working with hot lead sheathing.

Abrasive Production

103. Balancer - abrasive stone caster, engaged in casting lead into abrasive products.
104. Bulldozer operator, engaged in dismantling hot resistance furnaces in abrasive production.
105. Abrasive material smelter.
106. Resistance furnace dismantler, engaged in silicon carbide production.

Non-Ferrous Metallurgy

107. Anode caster, engaged in casting anode parts in aluminum, silumin, and silicon production.
108. Bath repair assembler, engaged in drilling the cathode shaft in aluminum, silumin, and silicon production.
109. Smelter.
110. Heater.

111. Repairman in main metallurgical workshops.
112. Smelter-assembler.
113. Smelter, engaged in tin production in furnaces.
114. Anode worker in aluminum production.
115. Titanium sponge separator.
116. Metal caster-molder.
117. Cathode worker.
118. Converter furnace supervisor.
119. Condenser worker.
120. Reactor assembler.
121. Mercury washer.
122. Zinc dust furnace operator.
123. Sheet metal furnace operator.
124. Recovery and distillation furnace operator for titanium and rare metals.
125. Nickel powder recovery furnace operator.
126. Furnace operator for processing titanium and rare earth materials.
127. Worker engaged in hot metal rolling.
128. Worker engaged in tasks performed by workers and masters.
129. Repair work performed by a loader operator in hard-to-reach places with pneumatic and hydraulic loaders.

Repair of Power Plant and Electrical Network Equipment

130. Electrician for repairing overhead power transmission lines.
131. Electrician for repairing and installing cable lines.

Chemical Production

132. Calcium carbide production.
133. Workers, shift supervisors, and specialists engaged in manual crushing of carbide in furnaces.
134. Workers, shift supervisors, and specialists engaged in technological stages.
135. Refinery equipment supervisor, engaged in manual disassembly and assembly of refinery presses with a frame size of more than 500 mm.

Processing of Oil, Gas, Oil Shale, and Coal, Processing of Synthetic Oil Products, Oils, and Fats

136. Coke cleaner.
137. Coke loader.
138. Workers, shift supervisors, and specialists engaged in installing equipment for gasoline ethylation technology.

Cement Production

139. Tasks performed by workers in cleaning sedimentation tanks and frames.

Stone Processing and Production of Stone Casting Products

140. Caster of stone and casting products.
141. Stone baker.

142. Stone carver.
143. Mill operator, engaged in grinding diabase gravel into powder.
144. Stone processing equipment assembler.
145. Stone sawyer.
146. Stone driller.

Production of Concrete and Reinforced Concrete Products and Structures

147. Worker engaged in cutting concrete and reinforced concrete products.

Textile and Light Industry

148. Plumber, engaged in cleaning sewer installations and channels.
149. Loading and unloading large raw hides and semi-finished materials into tanning, dyeing, and oiling drums.
150. Transporting, unloading, and loading large raw hides and semi-finished materials into tanning, dyeing, and oiling drums manually in leather processing plants.

Food Industry

151. Press section supervisor, engaged in servicing presses (diffusers) during manual loading operations.
152. Bone charcoal preparer.
153. Abattoir worker, engaged in stunning, hanging, bleeding large and small cattle and pigs, cutting internal organs, manually separating the hide of large cattle, cutting halves, burning and boiling pig halves and heads, processing halves of large cattle in a lying position.
154. Worker engaged in kneading dough in kneading machines with a capacity of more than 330 liters.
155. Pool preparer.
156. Mobile worker in a salt lake.

Railway Transport

157. Battery maker, engaged in repairing lead-acid batteries.
158. Draisine driver and assistant, working on broad-gauge railway lines.
159. Locomotive fireman in the depot.
160. Diesel train driver and assistant.
161. Motor train driver and assistant, working on broad-gauge railway lines.
162. Steam locomotive driver and assistant.
163. Diesel locomotive driver and assistant.
164. Traction unit driver and assistant.
165. Electric locomotive driver and assistant.
166. Electric train driver and assistant.
167. Porter, engaged in moving loads from place to place and manual handling of loads from place to place.
168. Locomotive repair supervisor.
169. Pipe driller - blower.

170. Train repairman, performing the following tasks: repairing garniture in steam locomotives during washing, disassembling, repairing, and assembling tools (devices) and protective covers.
171. Electrician for installation network.
172. Stone wool waste loader, regularly engaged in stone wool waste ponds.

Automotive Transport

173. Automobile repairman, engaged in manually washing engine parts of cars running on ethyl gasoline.
174. Automobile repairman, engaged in testing engines running on ethyl gasoline.
175. Fuel equipment repairman, engaged in repairing fuel equipment of carburetor engines running on ethyl gasoline in automotive farms.
176. Asphalt concrete worker, asphalt concrete installer, engaged in manual work.
177. Earth digger - miner.
178. Asphalt and concrete laying machine operator.
179. Miner.
180. Mining equipment installer.
181. Surface miner.

Civil Aviation

182. Aircraft mechanic (technician) for airframe and engines, aircraft mechanic (technician) for instruments and electrical equipment, aircraft mechanic (technician) for radio equipment, aircraft technician (mechanic) for parachutes and emergency rescue equipment, aircraft technician for fuel and lubricants, engineer directly engaged in technical servicing of aircraft (helicopter).
183. Workers engaged in preparing bitumen and repairing runways and taxiways (paving cracks) at airports.

Agriculture

184. Performing operations in crop production, animal husbandry, poultry farming, and wild animal breeding using toxic drugs, pesticides, and cleaning agents (up to the age of 35).
185. Servicing breeding bulls, breeding horses, and boars.
186. Loading and unloading animal carcasses, confiscated and pathological materials.
187. Separating hides from the carcasses of cows, horses, and cutting halves.
188. Transporting, loading, and unloading toxic drugs.
189. Manual installation of drainage pipes.

Jobs in Various Economic Sectors

190. Direct firefighting.
191. Gas rescuer.
192. Mercury measurer, engaged in manually determining the amount of open mercury.
193. Tar crusher.
194. Emergency and recovery repairman, engaged in cleaning sewer networks.

APPENDIX B – GBV/SEA/SH- RELATED SERVICE PROVIDERS BY DISTRICT

DEPARTMENTS OF WOMEN AND FAMILY AFFAIRS (CWFA AT DISTRICT LEVEL)

District	Contact details	Responsibility
Roghun	Address: 27 Sokhtmonchiyon Street, Rogun town Phone: (8+3134) 221144	Formulates the State policy on sexual equality and the prevention of violence; Holds training courses, round tables and conferences on gender equality and the prevention of GBV; Conducts sociological research into violence against women.
Faizobod	Address: 18 Somoni Street, Faizobod town, Faizobod district Phone: (8+3135) 32384	
Nurobod	Address: 21 Somoni Street, Darband, Nurobod district Phone: (8-3133) 30097	
Rasht	Address: 57 Ismoil Somoni Street, Gharm, Rasht district Phone: (8-3131) 22339	
Roghun	Address: 27 Sokhtmonchiyon Street, Rogun town Phone: (8+3134) 221144	

REHABILITATION ROOMS FOR GBV SURVIVORS (UNDER THE MINISTRY OF HEALTH AND SOCIAL PROTECTION)

District	Contact details	Responsibility
Central hospital of Rasht district	Address: 14 Somoni Street, Gharm, Rash district Phone: 98 598 5201	Provide medical first aid and hospitalize the survivor for further treatment; Provide counselling; Inform police department of case.
Central hospital of Nurobod district	Address: 18 Rozi Roziqov Street, Darband, Nurobod district Phone: (3133) 2-12-48 / 2-12-35	
Central hospital of Rogun district	22/1 Sokhtmonchiyon Street, Rogun town	
Central hospital of Faizabad district	5 Sino street, Faizabad town, Faizabad district	

District	Contact details	Responsibility
Central hospital of Rasht district	Address: 14 Somoni Street, Gharm, Rash district Phone: 98 598 5201	

POLICE DEPARTMENTS

District	Responsible person	Contact details	Services
Rasht	Zarina Nosirova, Police inspectors on prevention of GBV	Address: 36 Somoni Street, Gharm, Rasht Phone: 91 832 7528	Registering complaints and other information about violence or the threat of violence in the family; Identifying the causes of violence; Based on the complexity of the violence, takes measures against the perpetrators and for the protection of the survivor in accordance with the relevant legislation of Tajikistan.
Nurobod	Komiljon Saidzoda, Head of Department of Internal Affairs in Nurobod district	Address: 17 Roziqov Street, Darband, Nurobod district Phone: (3133) 3-00-77	
Rogun	Alisher Shodizoda, Head of Duty Union, Department of Internal Affairs in Rogun	Address: 27 Javonon Street, Rogun Phone: 93 999 4944	

LEGAL AID CENTERS (UNDER THE MINISTRY OF JUSTICE)

District	Lawyer	Address	Services
Nurobod	Murodbek Badalov, Phone: 93-706-0790 93-355-7820	11 Izatullo Halimov Street, Darband	Provision of primary legal advice consultation; Preparation of applications, complaints and other legal documents; Referring to lawyers providing both paid and free of charge legal assistance during the investigation and at courts. Free legal assistance is supported by the government;
	Abdullojon Habibzoda Phone: 98-727-2746 93-355-9562		
Rasht	Izatullo Shirinjonov Phone: 93-355-9631	98 Ismoili Somoni Street, 2nd floor, Gharm town	

District	Lawyer	Address	Services
			clarifying the procedures and rules for provision of free legal services; explaining the possibilities of pre-trial dispute resolution.

NATIONAL HELPLINE FOR SUPPORTING GBV SURVIVORS

Organization	Phone	Services
Committee on Women and Family Affairs	13 13 - Information center for GBV survivors	Psychological and legal support
Ministry of Interior Affairs	19 19 – Support service	Appeals on: public violations, emergencies, natural disasters, health problems, fires, traffic accidents and other incidents.
	221 21 21- Helpline	In addition to the above-mentioned, people can complain on improper actions of police officers through this phone
Ministry of Health and Social Protection	511 - Information center	Initially was launched for provision of necessary information about Kovid-19. Now serves an information center on any health-related issues.
	103 – Ambulance (if dialing from mobile phones. For landline phones – 03)	• Provides fist medical aid and hospitalization, if needed; • In case of signs of violence, informs police department.
Ministry of Justice	30 30 – Information center for legal counselling	Provides legal consultations

WOMEN RESOURCE CENTERS FUNDED BY OSCE

The Women's Resource Centers are available in Rasht only.

District	WRC	Contact information	Services
Rasht	WRC «Markazi Dastgirii Garm»	Address: 29 Somoni St., Gharm town, Rasht district Phone: 918 21 47 37 907 74 22 96 Email: matlubar@mail.ru	Psychological counselling; Legal support; Vocational courses.
	WRC «Khingob»	Address: 36 Sino St., Sangvor (former Tavildara) district Phone: 918 26 42 22 / 987 21 50 26 Email: npo.khingob@mail.ru	
	WRC «Rohnamo»	Address: 55 Somoniyon St., Lakhsh, Vahdat town, (former Jirgatol) district Phone: 93 889 57 12 Email: rohnamo@mail.ru	

NON-GOVERNMENTAL ORGANIZATIONS (NGO)

NGO	Contact Information	Contact Information
Niso	Address: 29 Somoni Street, Gharm, Rasht district Phone: 91-858-7235/ 93-190- 9109 Email: niso61@mail.ru	• Vocational courses for vulnerable women and girls
Marifatnoki	33 Burhonov Street, Gharm, Rasht district	• Vocational courses for vulnerable women and girls Legal and psychological support.
Nihol	Address: 13 Halimov Street, Darband, Nurobod district Phone: 988 -21-0749	Legal and psychological support

NGO	Contact Information	Contact Information
Zanoni Komyob	Address: 12 Somoni Street, Rogun town Phone: 93-336-6651	Vocational courses for rural women and girls

Annex 20-1 – Gazetteer of Archaeological, Historical, Paleontological, Cultural and Sacred Sites

(n.b. GPS co-ordinates for sites are not provided in this gazetteer but can be shared on a 'need-to-know' basis)

Site ID	Type	Sub-type	Historical Period	Location	*MASL*	Sensitivity (low / medium / high / very high)
RHPP-AR-01	Archaeological	Fortress – Kalai Kofir	16 – 18 C	Pandovchii Agba	1,250	Low
RHPP-AR-02	Archaeological	Fortress – Kalai Shokhon / Mir	18 – 19 C	Magzori Sir	-	Medium
RHPP-AR-03	Archaeological	Fortress – Kalai Dahana	18 – 19 C	Dahana	-	Low
RHPP-AR-04	Archaeological	Mound – mound at Dahana	4 – 6 C	Dahana	-	Medium
RHPP-AR-05	Archaeological	Fortress – Kalai Bacha	Unknown	Navdonak	-	Medium
RHPP-AR-06	Archaeological	Fortress – Kalai Dukhtarak A	Unknown	Navdonak	-	Medium
RHPP-AR-07	Archaeological	Fortress – Kalai Dukhtarak B	Unknown	Navdonak	1,356	Medium
RHPP-AR-08	Archaeological	Fortress – Kalai Shule	Unknown	Shule	1,366	Medium
RHPP-AR-09	Archaeological	Fortress – Kalai Shakhrisab	Unknown	Shakhrisab	1,308	Medium
RHPP-AR-10	Archaeological	Fortress – Kalai Shohindara	Unknown	Shohindara	1,280	Medium
RHPP-AR-11	Archaeological	Tower – possible site of Dalhana Watchtower	Unknown	Dalhana	-	Medium
RHPP-AR-12	Historical	Building – Lughuri poyon Mill	19 – 20 C	Lughuri poyon	-	Medium

Site ID	Type	Sub-type	Historical Period	Location	*MASL*	Sensitivity (low / medium / high / very high)
RHPP-AR-13	Archaeological	Fortress – Kalai Imlok	10 – 12 C	Darband	-	Very High
RHPP-AR-14	Archaeological	Settlement – location of historical site	Unknown	Mehrobod (formerly Komsomolobod) / Furudgoh, Nurobod District	-	Medium
RHPP-AR-15	Archaeological	Tower – Sarihisor Watchtower	18 – 20 C	Sorihisor, Baljuvon District	-	Medium
RHPP-AR-16	Archaeological	Fortress – Ruiob Fortress	18 – 19 C	Khatlon region, Baljuvon District	-	Medium
RHPP-AR-17	Archaeological	Fortress – Shindara Fortress	18 – 19 C	Khatlon region, Baljuvon District	-	Medium
RHPP-AR-18	Archaeological	Fortress – Guldara Fortress	18 – 19 C	Guldara, Baljuvon District	-	Medium
RHPP-AR-19	Archaeological	Fortress – Mulokoni Fortress	18 – 19 C	Mulokoni, Baljuvon District	-	Medium
RHPP-AR-20	Archaeological	Finds – Mulokoni archaeological finds, including flint splinter	6 – 4 millennium BCE	Mulokoni, Baljuvon District	-	Low
RHPP-AR-21	Archaeological	Settlement – abandoned settlement at Chashmanato	Unknown	Chashmanato, Rogun District	-	Medium
RHPP-AR-22	Archaeological	Unidentified – square stone with pitted side	Unknown	Tagov Detai, Baljuvon District	-	Low
RHPP-AR-23	Archaeological	Settlement – abandoned settlement at Tagov Detai	1 – 4 C	Tagov Detai, Baljuvon District	-	Medium
RHPP-AR-24	Archaeological	Settlement – remains of an abandoned settlement located on a platform above the Vakhsh River	Unknown	Kavlokho, Nurobod District	-	Medium

Site ID	Type	Sub-type	Historical Period	Location	*MASL*	Sensitivity (low / medium / high / very high)
RHPP-AR-25	Archaeological	Settlement – remains of an abandoned settlement in mountainous terrain	Unknown	Labi Jar, Nurobod District	-	Medium
RHPP-AR-26	Archaeological	Settlement – potential remains of an abandoned settlement in mountainous terrain	Unknown	Unknown, Rogun District	-	Medium
RHPP-AR-27	Archaeological	Settlement – potential remains of a cluster of abandoned structures in mountainous terrain	Unknown	Unknown, Rogun District	-	Medium
RHPP-AR-28	Archaeological	Structure – potential remains of structures located on low ground	Unknown	Dehai Amirbek, Rasht District	-	Low
RHPP-AR-29	Archaeological	Structure – potential remains of structures in mountainous terrain	Unknown	Darband City, Nurobod District	-	Low
RHPP-AR-30	Archaeological	Structure – potential remains of abandoned structures in a valley	Unknown	Darband City, Nurobod District	-	Low
RHPP-AR-31	Archaeological	Structure – potential remains of structures on a plain	Unknown	Roghuni poyon, Nurobod District	-	Low
RHPP-AR-32	Archaeological	Structure – potential remains of multi-rooms structure	Unknown	Darband City, Nurobod District	-	Low
RHPP-AR-33	Archaeological	Agricultural – possible remains of field systems	Unknown	Numerous (see Appendix A15-E, Drawing A15-2)	Numerous	Low
RHPP-AR-34	Archaeological	Agricultural – possible remains of lynchets	Unknown	Numerous (see Appendix A15-E, Drawing A15-2)	Numerous	Low
RHPP-AR-35	Archaeological	Agricultural – possible remains of terraces	Unknown	Numerous (see Appendix A15-E, Drawing A15-2)	Numerous	Low
RHPP-AR-36	Paleontological	Fossil – dinosaur footprints	145 – 66 million years ago	Rogun	-	High

Site ID	Type	Sub-type	Historical Period	Location	*MASL*	Sensitivity (low / medium / high / very high)
RHPP-AR-37	Archaeological	Structure – poorly preserved ruins/settlement, pottery	19 C	Khakimii poyon, Nurobod District	1,337	Low
RHPP-AR-38	Archaeological	Fortress – poorly preserved ruins of the fortress, ceramics	18 – 19 C	Mehrobod, Nurobod District	1,318	Medium
RHPP-AR-39	Archaeological	Fortress – Kalankok Fortress, poorly preserved ruins, ceramics	18 – 19 C	Sari Ju, Nurobod District	1,276	Medium
RHPP-AR-40	Archaeological	Fortress – ruins, ceramics	18 – 19 C	Roghuni poyon, Nurobod District	1,320	Medium
RHPP-AR-41	Archaeological	Fortress – Gumushkala Fortress ruins, ceramics	18 – 19 C	Dakhani gumush, Nurobod District	1,310	Medium
RHPP-AR-42	Archaeological	Fortress – Yapoloki Fortress ruins, ceramics	Early medieval	Yapoloki, Rasht District	1,315	High
RHPP-AR-43	Archaeological	Early Stone Age lithic scatter	40-50 thousand years ago	Vahdat	1,294	Medium
RHPP-AR-44	Archaeological	Late Stone Age lithic scatter	6-4 thousand years ago (?)	Sari Ju	1,252	Medium
RHPP-AR-45	Archaeological	Late Stone Age lithic scatter	6-4 thousand years ago (?)	Yakhch	1,299	Medium
RHPP-AR-46	Archaeological	Fortress – Kalai Chungi Zubaid	Unknown	Zarda	-	Medium
RHPP-CR-01	Cultural and sacred	Cemetery	Modern	Khakimii bolo	-	High
RHPP-CR-02	Cultural and sacred	Burial – Oftobkhuja Tomb	17 – 18 C	Khakimii bolo	-	High
RHPP-CR-03	Cultural and sacred	Burial – Mohtobkhuja Tomb	17 – 18 C	Khakimii bolo	-	High

Site ID	Type	Sub-type	Historical Period	Location	*MASL*	Sensitivity (low / medium / high / very high)
RHPP-CR-04	Cultural and sacred	Burial – Bobokhuja Tomb	18 – 20 C	Khakimii bolo	-	High
RHPP-CR-05	Cultural and sacred	Mosque	Modern	Khakimii bolo	-	Low
RHPP-CR-06	Cultural and sacred	Cemetery	Modern	Khakimii poyon	-	High
RHPP-CR-07	Cultural and sacred	Mosque	Modern	Khakimii poyon	-	Low
RHPP-CR-08	Cultural and sacred	Mosque	Modern	Khumrogh (formerly Kumok or Qumoq)	-	Low
RHPP-CR-09	Cultural and sacred	Cemetery	Modern	Khumrogh	-	High
RHPP-CR-10	Cultural and sacred	Burial – Hazrat Shamsiddinkhoja Tomb	16 – 17 C	Khumrogh	-	High
RHPP-CR-11	Cultural and sacred	Burial – Tomb of Sayedawazi Kozi	16 – 17 C	Khumrogh	-	High
RHPP-CR-12	Cultural and sacred	Cemetery	Modern	Obiboriki bolo	-	High
RHPP-CR-13	Cultural and sacred	Spring	Modern	Obiboriki bolo	-	High
RHPP-CR-14	Cultural and sacred	Mosque	Modern	Obiboriki bolo	-	Low
RHPP-CR-15	Cultural and sacred	Mosque	Modern	Obiboriki poyon	-	Low
RHPP-CR-16	Cultural and sacred	Mosque	Modern	Lughuri poyon	-	Low

Site ID	Type	Sub-type	Historical Period	Location	*MASL*	Sensitivity (low / medium / high / very high)
RHPP-CR-17	Cultural and sacred	Cemetery	Modern	Lughuri poyon	-	High
RHPP-CR-18	Cultural and sacred	Burial – Tomb	18 C	Lughuri poyon	-	High
RHPP-CR-19	Cultural and sacred	Spring	Modern	Obiboriki poyon	-	High
RHPP-CR-20	Cultural and sacred	Burial	18 – 19 C	Khakimii bolo	-	High
RHPP-CR-21	Cultural and sacred	Cemetery	18 – 19 C	Pandovchii Agba	-	High
RHPP-CR-22	Cultural and sacred	Mausoleum – Xazrati Khujai Paron	Modern	Pandovchii Agba	-	High
RHPP-CR-23	Cultural and sacred	Mosque – no longer in use	Modern	Bulbuldara	-	Low
RHPP-CR-24	Cultural and sacred	Mazar – Vakhobiddin	Unknown	Zarda	-	High
RHPP-CR-25	Cultural and sacred	Cemetery	Unknown	Margzori Sir	-	High
RHPP-CR-26	Cultural and sacred	Cemetery – Oromgoh	Unknown	Sari Kosh	-	High
RHPP-CR-27	Cultural and sacred	Burial – Mazori Domullobacha	Modern	Bedikho, Rogun District	-	High
RHPP-CR-28	Cultural and sacred	Burial – Mazori Sangi Dushokha	Ancient	Bedikho, Rogun District	-	High
RHPP-CR-29	Cultural and sacred	Burial – Mazori sha χ id	Ancient	Bedikho, Rogun District	-	High

Site ID	Type	Sub-type	Historical Period	Location	*MASL*	Sensitivity (low / medium / high / very high)
RHPP-CR-30	Cultural and sacred	Burial – Mazori sha x̧ id	Unknown	Bedikho, Rogun District	-	High
RHPP-CR-31	Cultural and sacred	Burial – Mazori Chorma-zak chashma	Unknown	Bedikho, Rogun District	-	High
RHPP-CR-32	Cultural and sacred	Burial – Mazori Bibi-Otun	Ancient	Mehrobod, Nurobod District	-	High
RHPP-CR-33	Cultural and sacred	Tree – Chanor	Unknown (ancient)	Mehrobod, Nurobod District	-	High
RHPP-CR-34	Cultural and sacred	Burial – Mazori Ashoni Asrori	Unknown	Aligalaboni bolo, Rogun District	-	High
RHPP-CR-35	Cultural and sacred	Burial – unknown tomb	Unknown	Aligalaboni bolo, Rogun District	-	High
RHPP-CR-36	Cultural and sacred	Burial – unknown tomb	Unknown	Aligalaboni bolo, Rogun District	-	High
RHPP-CR-37	Cultural and sacred	Museum – Boqi Rahimzoda	Modern	Sangi Maliki, Rasht District	-	Low

Annex 20-2 – Gazetteer of Villages

Associated ethnographic survey / community consultation	District / city / jamoat	Village	Status of village	Description
2011 focus group discussions (for the 2014 ESIA)	Jamoat Khakimii, Nurobod district	Khakimii miyona	Will be resettled	• There are two cemeteries on the territory of the villages of Khakimii poyon, Khakimii miyona and Khakimii bolo. These will be relocated.
		Kofara	To be resettled	• There is a cemetery in each of these villages. As the villages are not within the inundation zone, it is unlikely that the cemeteries will be relocated. • There are no known holy places in these villages.
		Khasandara	To be resettled	
		Shahtuti poyon	To be resettled	
2011 focus group discussions (for the 2014 ESIA), 2023 ethnographic survey (for the present ESIA)		Khakimii bolo	Will be resettled	• There are two cemeteries on the territory of the villages of Khakimii poyon, Khakimii miyona and Khakimii bolo. These will be relocated. There is also a modern mosque in Khakimii bolo. • There is a holy place where the local population worships. People from Avlod Eshonov and Sayidzod also visit this holy place. Locals did not know whether this would be relocated. • The 17th to 18th century tomb of Oftobhuga, who, according to legend, was a herbal healer and religious scholar who came from the southern regions and founded the village of Khakimii bolo (*Khakim* meant '*healing*'). • There is another 17th to 18th century tomb in Khakimii bolo. • The 19th century tomb of theologian, Dumullo Olim, which is visited by pilgrims from all over Tajikistan, is located in this village. • Locals explained that sericulture (the cultivation of silkworms to produce silk) was an important occupation in the village during the Soviet era, mostly for women. The large number of mulberry trees planted in the village, whose leaves served as food for the worms, is testament to this. • A woman described amulets traditionally used in the village, including a bear's tooth used to protect against evil spirits. Various items, such as beads and seeds, were often hung in the cradle of a young child to ward off spirits.

				• Traditionally, women in the village would embroider a wall panel, dress and scarves before her wedding. Women continue to make clothes, carpets and decorations, such as ribbons for wedding bedspreads and cradles. Traditional hair decorations were also discussed, some of which involved bean and button decorations. • Other traditional crafts undertaken in the village included the production of hearths for cooking and pottery production, beekeeping and the breeding of Turkish partridges, which are reared for fighting. • Local informants also discussed how medicinal herbs were grown and used for treatment. Plantain, for example, is used in the village to treat stomach pain.
		Khakimii poyon	Will be resettled	• There are two cemeteries on the territory of the villages of Khakimii poyon, Khakimii miyona and Khakimii bolo. These will be relocated. There is also a modern mosque in Khakimii poyon. • There is an ancient cemetery in this village and a small burial place of 18th and 19th century date. • There are holy places Hucha Abdurazzok and Hucha Mir. Locals did not know whether these would be relocated. • One local explained that, in the past, newlyweds would dress in a national costume when being escorted to the groom's house. European veils are more commonly worn at present, however. Another informant described how the tradition of shaving the groom's head and presenting him with a turban on the wedding day (know as *sartaroshon*) was no longer observed in the village. A local woman described a former wedding tradition called *muysarbofon* where a carpet was laid in the middle of a courtyard, around which the bride and her friends sat. • Women in the village are increasingly going to university after school, with the director of the local school claiming that 80% of female graduates of the school have gone on to study at universities in recent years. • Traditional crafts undertaken by women in the village include weaving, embroidering and braiding. Women traditionally embroidered their own dowry, including dresses, pillows, towels and bedspreads. • An informant described as an 'artisan' explained how there are two types of embroider in the region; traditional and modern. Old motifs and patterns are used in the former, while modern patterns tend to depict objects, such as flowers, more realistically. According to this informant, young people in the village are no longer interested in embroidery as everything they need

				for a dowry can now be purchased at the market. The informant believes that the traditional folk craft is disappearing. • Whilst discussing traditional practices, one informant stated that ashes are still used in gardens as fertiliser. They also claimed that ashes were placed in dirty dishes in order to clean them. • A history teacher who was interviewed in the village explained that he made instruments and plays in the local folk style, while a physics and mathematics teacher plays the accordion at school events. The history teacher plays the dutar, setor, doira and flute, often at weddings. To make the musical instruments, he stores wood (usually apricot) underground in his garden for six months in order to reduce its acidity and make it less likely to crack. Cow skin is usually used on the surface of the instruments. According to this informant, the doira (or tambourine) is predominantly played by women, particularly at social gatherings. • One local told the legend about the Karategin Valley within which Khakimii poyon is located. The valley was supposedly frequently captured by Kazakhs, with locals inhabitants often robbed and killed. A fighter from the other side of the valley named Kara helped to fight off the Kazakhs, and the head Kazakh addressed Kara by saying “Kara – tegin”, meaning “Stop, Kara”. In an offer of peace, the Kazakhs gave the valley to Kara.
		Khumrogh (formerly Kumok or Qumoq)	To be resettled	• There is a modern mosque and cemetery. • There is a 16th to 17th century tomb of the great theologian Mir Sayyid Aliya Hamadoni. • There is another 16th to 17th century tomb. • An informant explained how many wedding traditions, including *sartaroshon*, *muysarbofon*, *domod talbon*, *kelintalbon*, are no longer performed today. • The informant described the process of making bread, such as *chahlak* and *tanur*, and crackers in hearths. • The rite of *gavhorabandon*, which is performed after a woman has her first child, was discussed. The woman’s parents buy a cradle (or *gakhvora*) for her as a gift. The cradle contains flour products, sweets and other gifts. At the ceremony, which is attended by close relatives, a woman close to the daughter will take the baby in her arms and asks, “shall I put it in the cradle?”, to which everyone replies “no”. This is repeated until, after the fourth time of asking, the woman puts the child in the cradle. The cradle is

				then covered with gifts, a prayer is read and people wish the child a long life. A lullaby is sung to the baby to end the ceremony. • Local women in the village said they wove carpets, mostly for themselves. One informant particularly enjoyed weaving *sherozi* carpets because the technique is more complex and the result more beautiful.
		Obiboriki bolo	Resettlement in progress	• There is a modern mosque and cemetery in this village. As the village is not within the inundation zone, it is unlikely that the cemetery will be relocated. • A spring was identified in this village. • An informant learned the craft of beekeeping from his father, and now has 20 beehives of his own. He claimed that the honey produced was particularly tasty because the village is at altitude and the air is cleaner. • Another informant in the village learned how to carve wood from his father. He makes dishes, spoons and cups. His father gave him his blessing to produce such items so he could feed his family. He is also a blacksmith and produces tools for his fellow villagers. Another blacksmith in the village also learned his craft from his father. He reads a prayer daily and dedicates it to the patron saint of blacksmiths, Hazrati Dovudu.
		Obiboriki poyon	Resettlement in progress	• There is a cemetery in this village. As the village is not within the inundation zone, it is unlikely that the cemetery will be relocated. There is also a modern mosque. • A spring was recorded in this village. • The village chairman told the survey team that there are no artisans left in the village, and all products they need are purchased from elsewhere in the district or in the city. • The chairman described a wedding tradition called *Ravganrezon*, where the bride is ushered to the sound of music into a courtyard in the village towards a tablecloth on which stands a large metal bowl containing sweets and a sieve. There is also a bowl of butter and flour. A young girl brings water for the bride to wash her hands with. The bride then holds the sieve and flour is poured, through which the bride must sift. Shen then dips three fingers into a bowl of oil. The sweets are then thrown to guests and the groom’s mother places a ring on her daughter-in-law’s finger.

2011 focus group discussions (for the 2014 ESIA), 2015 Ethnographic Study of Nurobod and Rogun	Nurobod district, Darband city, Jamoat Mehrobod (formerly Komsomolobod)	Mehrobod	Resettlement in progress	• In 1936 the urban village of *Shahrak* was renamed *Komsomolobod*. It was renamed *Darband* in 1995 and Mehrobod in 2021. • Carpet weaving is popular amongst girls in the village. The carpets they produce feature Iranian style ornamental motifs which the girls have copied. These include Sasanian motifs, patterns of Safavid carpets and miniatures of the 11th centuries. • Pottery production (including jugs, pots and dishes) and women's needlework are other developed crafts in the village. Traditional painted cradles (gahvor), which are crafted locally, can be found in the shops of the village. • There is a large cemetery in the centre of Mehrobod. People from this area, as well as the lower village, village Airport, are buried here. • There is a holy place (Hattie Bibi) and Sycamore tree (Chanor), which is thought to be over 1,000 years old, in the centre of the village. • The grave of a *Bibi Otun*, an influential female religious figure, is located within the village. According to locals, people visit this grave and rub dirt from it on wounded parts of their body to heal them. • One villager stated that this sacred place can heal diseases. They claimed, for example, that it can heal children 'who have not developed speech for a long time' as well as illness resulted from 'fright'.
2011 focus group discussions (for the 2014 ESIA)		Chanor	Completely resettled	• There is a cemetery which will be relocated. • There is a new cemetery located above the village in the mountain area.
		Kabudchar (Kabudjahr)	To be resettled	• There is one cemetery. As the village is not within the inundation zone, the cemetery will not be relocated.
		Sari pul	Completely resettled	• Shares a cemetery with Bulbuldara. As the village of Bulbuldara is not within the inundation zone, the cemetery will not be relocated.
2011 focus group discussions (for the 2014 ESIA), 2023 archaeological		Bulbuldara	To be resettled	• Shares a cemetery with Surkhob most. As the village of Bulbuldara is not within the inundation zone, the cemetery will not be relocated. • There is a holy place in this village.

survey (for the present ESIA)				• There is a mosque, built in the 1980s, which is no longer in use. • The head of the village library told the survey team that he has collected many books and ethnographic materials, including ceramic jugs and pots, wooden dishes and an iron ploughshare. He claimed that many of the now obsolete 20th century objects he owns, such as his spinning wheel and saw, are largely incomprehensible to the modern generation.
2011 focus group discussions (for the 2014 ESIA)	Jamoat Muchiharf, Nurobod district	Mujikharfi kalon	To be resettled	• Formerly shared a cemetery, which also had a sacred burial place, with Mujikharfi mayda. Part of the cemetery was destroyed by mudslides, and the two villages now have separate cemeteries. Locals did not know whether the cemetery would be relocated. • There is a holy place called Hazraty domulloi Ikrom. • There is another holy place whose name has been forgotten by local residents. Both holy places are regularly visited. • One villager stated that they begin all of their hashars (joint work) from holy sites and cemeteries in the village. This work includes painting fences, watering trees and cleaning and sweeping.
		Mujikharfi mayda	To be resettled	• Formerly shared a cemetery, which also had a sacred burial place, with Mujikharfi Kalon. Part of the cemetery was destroyed by mudslides, and the two villages now have separate cemeteries. Locals did not know whether the cemetery would be relocated.
		Zoroni kalon	To be resettled	• There is a cemetery. • There is a holy place (Hazrati devonai Tosh). • Locals did not know whether these sites would be relocated.
		Zoroni mayda	To be resettled	• There is a cemetery. Locals did not know whether this would be relocated.
2011 focus group discussions (for the 2014 ESIA)	Jamoat Samsolik, Nurobod district	Pandovchii sari dasht	To be resettled	• There is a cemetery in each village.
		Pandovchii dehi Hochi	To be resettled	
		Pandovchii Khochi and Bulbuldara	To be resettled	• Residents of Pandovchii Khochi and Bulbuldara bury the bones of their relatives in the cemetery in Bulbuldara (within jamoat Mehrobod) due to the proximity of the villages.

				• A resident of Pandovchii dekhi-koch/ Bulbuldara attributed the fertility of their lands and their good harvests of potatoes to the holy places in the area.
		Dehai Gulmon	To be resettled	• Shares a cemetery with Zarda.
2011 focus group discussions (for the 2014 ESIA), 2023 archaeological survey (for the present ESIA)		Zarda	To be resettled	• Shares a cemetery with Dehai Gulmon. • There is an old mazar named after *Vakhobiddin*.
2023 archaeological survey (for the present ESIA)	Jamoat Mehrobod, Nurobod district	Pandovchi Agba	To be resettled	• There is a 200-300 year old cemetery containing over 100 graves. • There is a modern stone mausoleum called '*XAzrati Khujai Paron*', which was built on the site of an older one. Locals said that a holy man is buried in the mausoleum.
2011 focus group discussions (for the 2014 ESIA)	Jamoat Humdon, Nurobod district	Kavlokho	To be resettled	• There is a cemetery in each village. • There is a holy mazar (Hazrati Chiltan) where locals from different villages and regions come for pilgrimage.
		Kh. Sherozi	To be resettled	
		Labi Jar	To be resettled	
2011 focus group discussions (for the 2014 ESIA), 2023 archaeological survey (for the present ESIA)		Sari Kosh	To be resettled	• The cemetery in Magzori Sir occupies ~40ha. Locals did not know whether these would be relocated. According to locals, a great priest is buried here. • There is an old cemetery, named after *Oromgoh*, in Sari Kosh.
		Magzori Sir	To be resettled	
Summer 2011 focus group discussions (for the 2014 ESIA), 2015 Ethnographic	Khakimii Jamoat, Nurobod district	Aligalaboni bolo	Will be resettled	• Shares a cemetery with Aligalaboni poyon. This is to be relocated to the higher mountain area. • There is a holy place (Hattie Emomy) which is fenced off.

Study of Nurobod and Rogun 2023 ethnographic survey (for the present ESIA)				• There is a monument (makbara) made by the local population. This mausoleum has an ancient history and was restored in the 20th century. • According to legend, Eshoni Emomi, who was a saint, founded this mazar 440 years ago. He was supposedly buried here, and two drops of his blood fell into the garden behind the mazard building during the burial, where red pears currently grow. As a result, nobody collects these pears. Locals did not know whether the monument would be relocated. • There is a stone in the courtyard at the entrance to the mazar on which, according to legend, the horse of the prophet Ali left his mark. • The mazar attracted many pilgrims, especially infertile women. The sand around the mazar also has healing properties according to locals. • One villager associated all of the good luck in their life with the 'spiritual support and care' received from these holy places. They and their family have always visited these places for pilgrimage. • The shrine of Aligalabon, who was a scholar of Islam, is located here, and it is believed that his descendants still live in the village. There are three tombs located in the village: two of them are of unknown scholars of Islam who were supposedly martyred and the third is the tomb of Eshan Asrari. Eshan Asrari's tomb is visited more often than the other two. • There are two teahouses. A scene depicting an eagle descending from the mountains to carry away a ram is depicted on the walls of one of them. • According to legend, all criminals and delinquents were forced to plant 1,000 mulberry trees as punishment, explaining the large number of trees in the village. According to another legend, Ali Galabon was a person who planted the trees in order to atone for his guilt. Residents made syrup and jam from the mulberries. • There was a group in the village who specialise making stretchers for the dead from willow branches tied together with twine. Single-chamber graves were prepared. The ancient ritual of eating food at the coffin was observed here approximately 20 years ago. • Dairy products were made by women in the village using the Kirghizia device. This practice was noted in many of the other villages surveyed. • Women embroidered mostly dresses, frieze strips for walls and men's waist scarves.
Summer 2011 focus group		Aligalaboni poyon	Completely resettled	• Shares a cemetery with Aligalaboni bolo. This is to be relocated to the higher mountain area.

discussions (for the 2014 ESIA)				
2015 Ethnographic Study of Nurobod and Rogun	Nurobod district	Chorsada	Completely resettled	• There was a bazar within the village. • A local who was interviewed owned a mill where he produced flour. • A local turner made sickles, hammers, horseshoes etc. • Women were mainly engaged in needlework and making various products, including pans for baking cakes and gold embroidery. • Stove/hearth making, which is widespread throughout the region, is traditionally done by women.
		Furudgoh	Completely resettled	• Shepherds grazed cattle in the mountains. Medicinal herbs were collected by villagers in the mountains. • Some villagers kept bees.
		Sari Pul	Completely resettled	• A modern wall painting depicting an eagle and a tiger was discovered in an abandoned house in the village. • Women were seen making a blanket (kurpa) for the dowry of a bride. • There is a single mosque. • There are two mazars (tomb / mausoleum), one of which, according to legend, was built after the death of a certain Samarkand man several hundred years ago. • Women traditionally made dairy products at the summer house in the village. • Women used spindles to spin wool, mostly to make warm clothes.
		Mahallai poyon	Completely resettled	• There is one mosque in the village. • Inhabitants engaged in beekeeping since the 1980s, and any surplus honey was sold. • Pottery and embroidery was traditionally undertaken by women only. • There was a carpenter in the village who learnt his craft from his father. He made and painted cradles, chests, tables, book stands, cutting boards, rolling pins etc., mostly from willow and plywood. The five-pointed stars

				and squares with crosses he painted on his work are typical designs in the mountainous regions of the country.
2015 Ethnographic Study of Nurobod and Rogun	Rogun District	Mirogh	Completely resettled	• This was the highest mountain village visited during the survey. • According to legend, it was established over a century ago during the reign of the Emir of Bukhara. • There is little land in and around the village, so the population never grew wheat. Instead they raised livestock, mainly cows and goats and sometimes sheep. • There is a mosque, although this was not in use at the time of the survey because the resettlement was underway. • At the time of the survey, women in the village were preparing to make thin cakes (*chapoti*) for the upcoming holiday of Idi Kurbon. According to tradition, the central dastarkhan (eating space) should be decorated with thin cakes, small loaves (*kulcha*) and pieces of fried dough (*orzuk*), festive memorial pancakes (*chalpak*) and cookies. Small livestock were slaughtered for the holiday and either fried meat or soup was cooked. Children were given chewing gum and candy. • There was a tradition in the village for the spring holiday Navruz to cook flour products using spring herbs. These were then stuffed with mountain plants. Gruel was prepared from the intestines of an animal and several types of legumes were made. During the survey, the villagers were seen congratulating each other on the new year and the beginning of arable work. • Cousin and cross-cousin marriages were common in the village. Such marriages were relatively inexpensive and allowed the women to keep their property. • Wedding celebrations were fairly modest. The groom would arrive at the bride's house where music would be played. The bride would bring gifts to her husband's house, including white halva, a bugget of fried pieces of orzuk dough, a bucket of eggs and pieces of large wedding bread. • Local women were traditionally engaged in needlework. One woman embroidered pillows, curtains, wedding veils etc.
		Talhakchasma	Completely resettled	• The village is known for its mazar Hazrati Khujai Gor, whom the local population revere as the grandfather of all ishans. According to legend, a

				saint named Eshoni Nematullohuja came here from the town of Pushtai Khryng in Sari Kosh. • Most of the inhabitants of the village were resettled in the Jilikul region in the mid-20th century by the government. However, many of them later returned. • Residents were engaged in forestry, cattle breeding and agriculture. • A carpenter made musical instruments (e.g. dutars), cradles, spoons etc. and engaged in woodcarving. The people of the village were considered to be very musical, with many families owning old instruments. • Hikmat Rizo, a famous folk hafiz / singer, came from this village. • Blacksmiths in the village made scythes, axes, horseshoes etc. • Although the traditional crafts of embroidery and pottery had mostly died out in the village, the population has preserved individual relics, such as a wall frieze made for a wedding and early 20th century ceramic products.
2023 ethnographic survey (for the present ESIA)		Lughuri poyon	To be resettled	• There is a modern mosque and cemetery and an 18th century tomb. • The owner of a mill was interviewed. The mill, which is believed to be over 100 years old, was inherited from the man's father. They make different types of flour, and in the autumn they make a special dish from boiled wheat and peas called *talkon*.
		Bedikho	To be resettled	• There are several burial sites in the village of Bedikho. One is the mausoleum of a young scientist who, during the establishment of Soviet power, supposedly tried to escape the rulers and took refuge in the village. However, he was caught by the authorities and killed. A further four burial sites were recorded in the village.
2015 Ethnographic Study of Nurobod and Rogun	Jamoat Sicharog, Rogun District	Sicharog	Completely resettled	• The Jamoat Sicharog includes several high-mountain villages. • According to legend, very few people lived in the village of Sicharog initially, and travellers were afraid to approach it because it was surrounded by impenetrable thickets and wild animals. The Emir of Bukhara began to exile prisoners here, mostly middle-aged and elderly men. The village was called *Degi sieh* for a long time, meaning *black cauldron*. • Villagers across the valley supposedly watched 30 charog lights being lit under a large walnut tree in Sicharog on Friday evenings, spread out at the

				entrance to the village. They therefore named this settlement Sicharog, which means *thirty lights*. • At the time of the survey, most of the villagers were related to Bobo Avgon (b. 1937). Village men mostly married their relatives. Cross-cousin marriage was particularly common. This meant that the inheritance would not go into the hands of a stranger, and that the wedding would not require large expenses. • As the 20th century progressed, parents increasingly remained to live with one of their married sons, usually he who was most able to provide for them. Any remaining brothers often formed their own households separately. • Women of the village mainly undertook household chores. Very few of them were engaged in traditional crafts, partially because ready-made goods can be purchased in the markets more easily. • However, one woman who was interviewed was still making hearths and plastering walls. Her house, like many others in the region, had a welcome post/pillar, where visitors are greeted. It was unpainted and stood in the centre of the room. • According to one local, women played an important role observing ritual actions during ceremonies (weddings, funerals, births of children) because they preserve and pass on traditions to the next generation through the female line. • According to tradition, circumcision usually takes place at the age of 5-7 years. Food is not cooked in the house following the death of a family member, but is instead brought by neighbours. Shurpo is cooked at the wake. • Navruz is the most popular holiday in the jamoat. Festive treats are prepared, including sumalak, and events such as folk wrestling are held. • Bobo Avgon was previously a carpenter and built his own house. He also used to make toys for his children and grandchildren and cradles decorated in styles traditional in the mountainous regions, with the use of geometric ornamental motifs in black and red. • Crafts such as woodworking and blacksmithing developed in the Jamoat in the late 20th century. • The locals mostly observed the rituals and customs of the inhabitants of Karategin, despite the Sarichosor origins of most of its inhabitants. • Locals used sleds to export manure, straw, grain etc.

				• There is one mosque of early-to-mid-20th century date in the village, called panchvakta (meaning 'five times prayer'). It had apparently been restored recently. This is a good example of local wooden architecture. • The village has a second, new cemetery in a high-mountain area. The old cemetery will be flooded. • The traditional use of hearths for cooking and boiling water in the ground in houses continued in this village, as it does across the whole region.
		Sech	Completely resettled	• The mazar Khuja Said is situated within the village, although the villagers interviewed did not know its history. • The villagers were engaged in agriculture and animal husbandry, and mainly kept goats. • The most common crafts were woodworking, metalworking and felting. • Wedding celebrations were usually held in the autumn after the harvest. To determine the bride's dowry, up to 40 people would be sent to the groom's house. The mothers of the bride and groom traditionally cut the wedding dress together (*tukkuzporakuni*). Wedding guests were invited by a special courier who presented them with a handkerchief. Two people would sing as the wedding procession approached the bride's house. The groom would then approach the house and would be presented with a robe or a piece of fabric. The exist of the bride from the house was accompanied by music, drums and dancing. They would then proceed to the groom's house. At most weddings there would have been a clergyman and two witnesses, usually uncles and brothers. The groom goes under the chodar (curtain) three times and exits from the other side. The newlyweds would then stand next to each other and step on each other's feet. It is believed that the one who manages to step on the partner's feet first will be the head of the family. These traditions are similar to those in other areas of Karategin.
		Tagi Agba	Completely resettled	• According to legend, the village was founded 120-140 years ago. According to one informant, the inhabitants of the village trace their origins back to the Shah of Iraq, Amir Oli Hassan, whose son supposedly married a local girl. • In the late 19th and early 20th centuries, there were large patriarchal families in the village, whose members lived in one large house.

				• The main occupation in the village was farming, mainly grain growing. There were also goof pastures around the village where cattle grazed. • The male population hunted mountain goats, bears and quails. Bear fat was used to help with diseases associated with inflammation of the lungs, gallbladder and in cases of female infertility. • Pottery, felting and embroidery were the most common crafts. Women made threads from sheep whool, from which they knitted socks and embroidered skullcaps etc.
		Tagi Kamar	Completely resettled	• Some locals claimed that the village's name originates from its position at a saddle / ledge (*Kamar*) in the mountains. • Part of the village's population was resettled in the Pakhtakori Surkh collective farm in the Jilikul district of the Vakhsh valley, where they lived until 1967. They later began to return and build houses in the village. • The principal occupation in the village was agriculture, mostly growing wheat, flax, barley, onions and carrots. • Men in the village hunted, mainly for quails. • As they do elsewhere in the region, women used earthen hearths to make bread. • Blacksmithing, felting and woodworking were the most common crafts in the village. One blacksmith made sickles, axes, hatchets, knives and horseshoes. The blacksmith's wife wore traditional Tajik silver and coral jewellery, which is becoming increasingly rare. • A skilled female embroiderer in the village made men's waist scarves, inserts for pillow cases and various decorative items. • A male carpenter in the village made musical instruments, which he also enjoyed playing. • Marriages were mostly between cousins. Most wedding rituals were held in the family circle with the participation of a small number of guests. Food played an important role in wedding ceremonies. Cake is broken and the white cloth is cut as part of one ritual where relatives and neighbours are informed of the engagement. Sweet water is given to everyone before the start of the wedding meal, to ensure that they have a "good outcome". In the husband's house he showers his bride with sweets and coins, representing prosperity and abundance. Participants in the festival must pick up the sweets and money in order to achieve this. It was said that a

				man tying a waist scarf indicated the onset of the time of marital intimacy in the family. • According to the villagers, it was common for large families to live in one spacious room in the late 20th century. Members of the family would gather and warm themselves during the winter. • There were beliefs associated with the central pillar of greeting (*sutuni salomga*). One informant's grandfather had told him that "in the absence of this pillar in the house, the owners would die an unworthy death". Almost all of the houses visited in the Jamoat Sicharog during the survey had such a pole. They provide strength to the structure of the building and protect it from destruction during earthquakes and other natural disasters. They also served as an indicator of the marital obligations of members of a large undivided family.

Annex 20-3 – Village Ethnography Data

Village Name	Theme	Present status
Khakimii bolo	**Practice (Occupation)** – Sericulture (the cultivation of silkworms to produce silk) during the Soviet era, mostly for women.	Large number of mulberry trees planted in the village, whose leaves served as food for the worms.
	Practice (Beliefs) – Amulets traditionally used. 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.	Often hung in the cradle of a young child. It is said that these particular amulets are used because a child should be fast and agile like a mountain goat, strong like a bear and long-lived like a tree.
	Medicine – Medicinal herbs were grown and used for treatment. Medicinal herbs, such as rose hips, sea buckthorn and mulberry, are collected by villagers in the mountains.	Plantain is used in the village to treat stomach pain. The *kallazardak* plant (meaning 'yellow head') is used to help treat indigestion.

Village Name	Theme	Present status
	Crafts – Women continue to make clothes, carpets and decorations, such as ribbons for wedding bedspreads and cradles. Traditional hair decorations were also discussed, some of which involved bean and button decorations.	Women would embroider a wall panel, dress and scarves before her wedding. Many ceremonies and rites which were traditionally undertaken on the second day of a wedding now therefore take place immediately after the bride crosses the threshold of her new husband's house behind a curtain (chodar).  **A Wedding *Chodar* (Ashurmadova, 2023)**

Village Name	Theme	Present status
	Crafts – Production of hearths for cooking and pottery production, beekeeping and the breeding of Turkish partridges. Despite the prevalence of modern cooking appliances, the traditional clay hearth, often dug into the ground, remains an important domestic item.  **A Typical Hearth (Ashurmadova, 2023)**	Turkish partridges are reared for fighting. Hearths are often made at home, although they can be bought ready-made. Three varieties of hearth were noted in the villages: two for cooking and one for boiling water.

Village Name	Theme	Present status
Khakimii poyon	**Practice (Rituals and Ceremonies)** – In the past, newlyweds would dress in a national costume when being escorted to the groom's house.	European veils are more commonly worn at present. Women mostly wear modern clothes rather than traditional dresses.  **A Modern Women's Outfit (Ashurmadova, 2023)**
	Practice (Rituals and Ceremonies) – Shaving the groom's head and presenting him with a turban on the wedding day (know as *sartaroshon*).	No longer observed

Village Name	Theme	Present status
	Practice (Rituals and Ceremonies) – *Muysarbofon* is the tradition where a carpet was laid in the middle of a courtyard, around which the bride and her friends sat.	No longer observed
	Traditional Construction Styles and Techniques – Houses are usually made of clay, with bricks only used in the construction of mosques, shops, and schools. Foundations are generally made of cement and crushed stone and ceilings are covered with logs and boards. Cardboard is often placed on top and covered with a mixture of soil and hay. Sticks and slate are added for the roof. Traditional outbuildings and stone-built farm sheds used for storing hay for livestock were also identified.	Wicker hedges / fences are widely used in the villages. Thin sticks and branches of various wild shrubs are interwoven with vines to build these fences.  **Wicker Hedge / Fence (Ashurmadova, 2023)**

Village Name	Theme	Present status
	Crafts – Women undertook weaving, embroidering and braiding. Women traditionally embroidered their own dowry, including dresses, pillows, towels and bedspreads. There are two types of embroider in the region: • Traditional - Old motifs and patterns • Modern. Patterns tend to depict objects, such as flowers, more realistically. Patchwork sewing remains widespread with women sewing geometric shaped pieces of fabric together to produce items such as blankets and mattresses. Patchwork products still form part of dowries to brides in the region.  **A Patchwork Pillow (Ashurmadova, 2023)**	The traditional folk craft is disappearing. According to an informant, described as an 'artisan', young people in the village are no longer interested in embroidery as everything they need for a dowry can now be purchased at the market. The dowry for a wedding traditionally consisted of two goats or cows. Other gifts might include carpets, mattresses and fabric. Local markets offer a wide variety of factory-made products, reducing the need for people to produce them at home. The ethnographers noted that many traditional handicrafts are threatened with extinction, with younger generations less interested in preserving traditions which are no longer seen as sources of income. Women in the village are increasingly going to university after school, with the director of the local school claiming that 80% of female graduates of the school have gone on to study at universities in recent years.

Village Name	Theme	Present status
	Crafts – Making and playing traditional musical instruments, like *dutar, setor, doira* and flute. This comprises the storage of wood (usually apricot) underground for six months to reduce its acidity and make it less likely to crack. Cow skin is usually used on the surface of the instruments. According to this informant, the *doira* (or tambourine) is predominantly played by women, particularly at social gatherings.  **A Local displaying his Collection of Handmade Musical Instruments (Ashurmadova, 2023)**	A history teacher plays the *dutar, setor, doira* and flute, often at weddings. He makes instruments and plays in the local folk style, while a physics and mathematics teacher plays the accordion at school events.
	Practice (Beliefs) – The valley was supposedly frequently captured by Kazakhs, with locals inhabitants often robbed and killed. The legend about the Karategin Valley, within which Khakimii poyon is located, is that a fighter from the other side of the valley named Kara helped to fight off the Kazakhs, and the head Kazakh addressed Kara by saying "*Kara – tegin*", meaning "Stop, Kara". In an offer of peace, the Kazakhs gave the valley to Kara.	
Khumrogh (formerly	**Practice (Rituals and Ceremonies)** – Wedding traditions called *sartaroshon, muysarbofon, domod talbon, kelintalbon*	No longer performed

Village Name	Theme	Present status
Kumok or Qumoq)	**Practice (Rituals and Ceremonies)** – The rite of gavhorabandon, involves a woman's parents buy a cradle (or gakhvora) which contains flour products, sweets and other gifts. At the ceremony, attended by close relatives, a woman close to the daughter will take the baby in her arms and asks, "shall I put it in the cradle?", to which everyone replies "no". This is repeated until, after the fourth time of asking, the woman puts the child in the cradle. The cradle is then covered with gifts, a prayer is read and people wish the child a long life. A lullaby is sung to the baby to end the ceremony.	Performed after a woman has her first child.
	Practice (Rituals and Ceremonies) – The reading of an *azon* (call to prayer) in the ear of a new-born baby. Circumcision of boys typically takes places when they are 5-7 years old.	
	Foods – The process of making bread, such as *chahlak* and *tanur*, and crackers in hearths. *Nonichavi*, which are barley flour flatbreads, have traditionally been widespread in the villages.	 **Flatbreads (Ashurmadova, 2023)**

Village Name	Theme	Present status
	Foods – During the Muslim festivals of Ramadan and *Idi Kurbon*, cattle are slaughtered and either fried meat or soup is cooked. Children are also given sweets for the holidays.	
	Foods – 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.	
	Practice (Rituals and Ceremonies) – Following the death of a family member, food is not cooked inside the family house, but is instead brought by neighbours.	*Shurpo* (soup) is served at funerals.
	Crafts – Local women wove carpets, mostly for themselves. One informant particularly enjoyed weaving *sherozi* carpets because the technique is more complex and the result more beautiful.	
Obiboriki bolo	**Practice (Occupation)** – An informant learned the craft of beekeeping from his father. He claimed that the honey produced was particularly tasty because the village is at altitude and the air is cleaner.	The informant now has 20 beehives of his own
	Practice (Occupation) – An informant in the village learned how to carve wood from his father. His father gave him his blessing to produce such items so he could feed his family.	He makes dishes, spoons and cups.
	Practice (Occupation) – A blacksmith in the village learned his craft from his father. He reads a prayer daily and dedicates it to the patron saint of blacksmiths, Hazrati Dovudu.	
Obiboriki poyon	**Crafts**	The village chairman informed that there are no artisans left in the village, and all products they need are purchased from elsewhere in the district or in the city.

Village Name	Theme	Present status
	Practice (Rituals and Ceremonies) – *Ravganrezon*, a wedding tradition where the bride is ushered to the sound of music into a courtyard in the village towards a tablecloth on which stands a large metal bowl containing sweets and a sieve. There is also a bowl of butter and flour. A young girl brings water for the bride to wash her hands with. The bride then holds the sieve and flour is poured, through which the bride must sift. She then dips three fingers into a bowl of oil. The sweets are then thrown to guests and the groom's mother places a ring on her daughter-in-law's finger.	
Bulbuldara	**Crafts and Practice** – The head of the village library has collected many books and ethnographic materials, including ceramic jugs and pots, wooden dishes and an iron ploughshare.  **Ethnographic Objects Collected by the Head of the Library in Bulbuldara (Filominova, 2023)**	He claimed that many of the now obsolete 20th century objects he owns, such as his spinning wheel and saw, are largely incomprehensible to the modern generation.

Village Name	Theme	Present status
Lughuri poyon	**Foods and Practice** – The owner of the historical mill in Lughuri poyon (**RHPP-AR-12**) informed that they make different types of flour, and in the autumn, they make a special dish from boiled wheat and peas called talkon. Villagers interviewed in Khakimii bolo said that they travel to the mill in Lughuri poyon to grind their grain since the mill in their village had been destroyed.	The mill, which is believed to be over 100 years old, was inherited from the man's father. It has been used by at least three generations of the same family.
Mehrobod (formerly Komsomolobod)	**Foods** – women and girls in the village cook tuppa soup, barik soup, pilaf soup, wheat soup and sambusa. Traditionally, girls were expected to know how to cook and embroider before they got married.	
	Crafts – girls traditionally prepared their own wedding accessories, including embroidered shirts, skirts, scarves, blankets and curtains. A local shoemaker, who worked in a shoe factory in Dushanbe in the 1970s, trained local youths in his trade. A woman in the village told the team that her grandmother taught her the art of flower cutting.	Wedding equipment is usually bought from the market now. The youths who were trained in shoemaking have since moved to work in Russia where there are better opportunities. This woman taught her children her craft, and how to prepare wedding dresses.

Village Name	Theme	Present status
	Practice (Rituals and Ceremonies) – traditionally, the bride and groom often had little say in who they married and would only meet each other on the day of the wedding. Another local described a wedding tradition called *sumpertoi*, where the groom sits in the middle of a square with a lock around his neck whilst a senior member of the family shaved the groom's head cleanly with a blade. Relatives and friends of the groom would put money in his hand, and the collected money was either given to the barber or to the groom's family. If a man becomes a widower and remarries, it is said that he should pour a bucket of cold water on his former wife's grave in order to cool her soul and allow her to sleep peacefully. Another ritual performed during dry spells involved villagers preparing food in large pots and sprinkling each with water. It was believed that this would make it rain.	Today, couples do not marry without meeting, and both parties must give their consent to the marriage. This ritual is still performed today.
Aligalaboni bolo	**Traditional Construction Styles and Techniques** – In new houses, a straight log, called "dstak", is placed on top of the house with a horn on it, for good luck.	This is still practiced today.
	Crafts – Produce and embroidery of small items for personal use, such as dresses and waist shawls. Some people prepared their own wedding furniture. Chahlaksoz is the craft of oven making is also practiced in the village.	Embroidery, needlework, quilting and crocheting was widely known and practiced by the community. Large traditional *suzani* bedspreads are less commonly made.
	Foods – Commonly prepared dishes include tuppa oshi, barik oshi, pilaf oshi, soup, mastoba, wheat stew, herb sambusa, oak leaf sambusa, sambusa with meat and pumpkin, empty mint sambusa, lagman, shirkadu, kadubiryan, fried potatoes and breakfast dishes, gandiboch, sumanaki jahlaki.	

Village Name	Theme	Present status
	Practice (Rituals and Ceremonies) – They have some wedding ceremonies that are still practiced for the prosperity of the couple. After three days of the wedding, the bride kneads dough and bakes bread in the oven.	
	Practice (Beliefs) – It is considered a great honour to for an artist to learn his craft from someone, and to teach your skills further. It is believed that making pies and chappals and distributing them to neighbours or children will make the spirits of the elderly happy. If there is ash on the roads, it must be removed or not walked over, as it is believed that it has negative properties. If a person says that he stepped on ash, they perform traditional treatments.	
Bedikho	**Crafts**	Embroidery and needlework was widely known and practiced by the community.
	Medicine – Medicinal herbs like Spand, kiyom, zelol, parpi, thach, lemongrass, mint, chamomile, subinak, bugma and bitter gourd are still used.	
	Practice (Beliefs) – According to legends, the first inhabitants of the village came from Sari Khosor of Baljuvan district. At first, the village was called Dilkhoh, however, during the Soviet era, the word Dilkhoh was misunderstood and named by the Bedis.	
Roghuni poyon	**Foods** – Chahlaki potatoes – soaked in brine and put in the *chahlaki* (type of sugar syrup that has a different taste).	This is still prepared today.
	Practice (Occupation) – Since many generations, tobacco cultivation is being carried out in greenhouses in the village.	This is still practiced today.

Village Name	Theme	Present status
Chanor	**Crafts**	Several artisans including a master plate cutter, woodcutter, cattle breeder, labor veteran and a language and literature teacher are well known in the village.
	Practice (Beliefs) – The name Chano represents the four sycamore trees planted here for the first time. The villagers help celebrations, especially Nowruz and for rain, in the shade of those trees. There were great *chantors* in the village, where people gathered to pray. It is believed that no food must be cooked in the house of the deceased for three days to avoid misfortune.	

Village Name	Theme	Present status
	Practice (Rituals and Ceremonies) – Several practices are undertaken during the wedding ceremony: A *chapoti* (bread), said to be a symbol of healing, is distributed. *Elakdaroron* - on the wedding day the groom accompanies the bride from the house to the table where, a basket and a sieve were placed. They lifted the sifter three times in turn and put it on the ground, and candy is eaten mainly with the intention of opening one's own or one's children's fortune. *Chador* - The mother of the bride wears a chador made of fabric. *Khusur Salam* - The bride and groom and the groom's relatives, go to the bride's house to exchange gifts. *Dstarkhuonandoz* (table setter) - a woman sets the table for the party, and the mother, aunt or sister of the bride gives her a cloth or scarf for this. *Dstovgir* (hand washing) - a woman before bringing food, washes the hands of the bridegroom's bride's mother, aunt or sister. *Kandov* - Before the food is brought, a teapot full of sugar is brought to the *mrovahs* (bridesmaids), which symbolizes that the bride and groom will have a sweet life. *Kashk* - The first meal - crushed wheat, beef belly, red, white beans and other grains, white rice, boiled overnight in a pot with oil, brought to the bride's guests. In the past, they brought up to 7 types of national dishes to *mrovas*: *"Shirrugan", "Shirbat", "Shirbirinj", "Oshi barik", "Gushtbiryan", "Shurbo", "Oshipalav*" and others.	
	Practice (Beliefs) – The territory of the village was mainly a road towards Kulob, between the mountains. The name Rogun, which is derived from the word "rogh".	

Village Name	Theme	Present status
Khumrogh (formerly Kumok or Qumoq)	**Crafts** – The art of embroidery: zardevory, round, embroidered wedding veil, taksari, mirror face, crown shiroz, foot shiroz day, wearing foot shiroz in the store, weaving a tour for men's hand scarf with embroidery crown are still in practice.	
	Foods – Commonly prepared dishes include otalai kochi umoch, umoch with milk, dalda, fatirmaska, kurutob, shakarob, syrchoi, milk rice, orbiryan, sit, oshi barik.	

Annex 20-4 – M-Vector Household Data

		Gender of the Head of Household			District					Have you already been relocated?		
		Male	Female	Total	Rogun	Nurobod	Faizobod	Tursunzoda	Danghara	Yes	No	In the process of
L1 Are you aware of any cultural heritage sites (i.e., religious sites, local shrines, traditionally sacred places, historical / archaeological sites) in your village of origin?	Yes	38%	20%	35%	39%	21%	86%	83%	66%	58%	19%	19%
	No	62%	80%	65%	61%	79%	14%	17%	34%	42%	81%	81%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
L2 Was your household directly consulted regarding cultural heritage sites (religious sites, local shrines, traditionally sacred places)? (before relocation)	Yes	81%	74%	81%	54%	78%	97%	97%	45%	84%	71%	80%
	No	19%	26%	19%	46%	22%	3%	3%	55%	16%	29%	20%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
L3 Have these sacred/cultural places been recorded with your permission? Have you been offered any further consultation or related support for the relocation of, maintenance of or access to, these places?	Yes, the places were recorded and appropriate compensation/ relocation or management strategies proposed	71%	64%	70%	51%	58%	94%	97%	28%	84%	36%	55%
	Yes, the places were recorded but no consultations on their relocation or management have taken place yet	7%	9%	7%	18%	12%	3%	1%	0%	2%	18%	14%

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		Gender of the Head of Household			District					Have you already been relocated?		
		Male	Female	Total	Rogun	Nurobod	Faizobod	Tursunzoda	Danghara	Yes	No	In the process of
	No, and no one has contacted me yet regarding places that are important for our local cultural heritage	22%	27%	22%	31%	30%	3%	2%	72%	14%	45%	30%
	Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
L4 In general, regarding your village of origin, do you think that the management of cultural heritage sites has been well organised?	Yes, I am satisfied	79%	80%	79%	61%	63%	97%	98%	94%	90%	50%	73%
	Yes, but more could have been done	6%	0%	5%	22%	7%	0%	0%	2%	4%	13%	1%
	No, information / consultation programme was not sufficient	8%	11%	8%	16%	14%	0%	1%	2%	5%	15%	11%
	I don't know	7%	9%	8%	2%	16%	3%	1%	3%	2%	22%	15%
	Total	100%	100%	100%	100%	100%	100%	98%	100%	100%	100%	100%

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