GEORGIA URBAN ENERGY LTD

PARAVANI HYDROPOWER PROJECT

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT REPORT
NON TECHNICAL SUMMARY

Prepared by SRF Gamma

Tbilisi, 2011

TITLE PAGE

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1. INTRODUCTION

It is the policy of the Republic of Georgia to develop the hydropower resources of the country. In 2007, the World Bank assessed many possible hydropower developments and found that developing a hydropower plant (HPP) on the Paravani River in southeast Georgia was the best project from an economic and environmental standpoint. Georgia Urban Energy Ltd (GUE) is the privileged investor for the Paravani HPP project and has signed an agreement with the Government of Georgia to develop the project. The Paravani HPP project includes an 87 megawatt (MW) hydropower plant and a transmission line to connect the HPP to the national grid. The project will be implemented in Aspindza, Akhaltsikhe and Akhalkalaki municipalities of Samtskhe-Javakheti region (Figure 1).

Figure 1. Location of the project

Georgian law required GUE to evaluate the potential impacts of the project on people and the environment. This was done in two Environmental & Social Impact Assessments (ESIAs), one in 2009 for the HPP and one in 2010 for the transmission line. These ESIAs were made available for public review and there were public meetings where anyone could make comments and recommendations. In early 2011, after the ESIAs were prepared by GUE and reviewed by the Ministry of Environment Protection and Natural Resources, other HPPs were proposed for the Paravani River upstream of the Paravani HPP project. A preliminary assessment of the cumulative impacts of all the Paravani River projects was then conducted and is presented in a separate Technical Annex.

GUE has approached the European Bank for Reconstruction and Development (EBRD) and the international Finance Corporation (IFC) for financing. These lenders have required GUE to prepare this Non-Technical Summary, a Stakeholder Engagement Plan, and an Environmental and Social Action Plan. Following disclosure of these documents, and the cumulative impacts Annex, to the public, GUE will hold further consultations with stakeholders.

This Non-technical Summary (NTS) is a summary of both ESIAs - for the HPP and the transmission line – and a separate Annex that addresses cumulative impacts. It summarizes the project and the most important impacts the project could have on people or the environment, including major actions that GUE will take to avoid, reduce, or control impacts. More detailed information on the project, baseline conditions, potential impacts, and mitigation measures may be found in the ESIAs.

This document, together with the ESIAs, the Stakeholder Engagement Plan and Environmental and Social Action Plan will be publicly available and can be reviewed at the following places:

- Aspindza municipality - 3 Tamari Street, Aspindza;
- Akhaltsikhe municipality – 18 Merab Kostava street, Akhaltsikhe;
- Akhalkalaki municipality - 11 Cherents street, Akhalkalaki;
- Georgia Urban Energy Office – 37d Chavchavadze street, Tbilisi;
- SRF Gamma Office – 9 Merab Alexidze Street, Tbilisi.

This Non-technical Summary, Stakeholders Engagement Plan, Environmental and Social Action Plan, Safety leaflets and Resettlement/Compensation Plan will be available in English and Georgian. The NTS, Safety Leaflet, Grievance Procedure and grievance form will also be translated into Russian. The documents will be available on the internet at the following sites (URLs): the GUE's Paravni HPP project site (http://www.paravanihpp.com), EBRD's site (http://www.ebrd.com) and IFC's disclosure site (http://www.ifc.org/disclosure).

2. PROJECT DESCRIPTION

The Paravani HPP project includes the following several main components

Weir and hydropower plant. This component of the project includes:

- Construction of a five-meter-high weir and a small 0.5-hectare reservoir on the Paravani River about 56 km downstream from Lake Paravani. The weir will be near the confluence with the Korkhistkali River, about 150 meters downstream from the Korkhistskali bridge. The weir and reservoir will be in Akhalkalaki municipality and will be beside the tarred road to Akhalkalaki. The weir will be about 0.5km from Korkhi village and 3km from Diliska village, both of which are on a plateau several hundred meters higher than the weir.
- Excavation of a 13.8 km tunnel that will take water from the reservoir to the powerhouse. Up to 90 percent of the average flow in the river will go into the tunnel and at least 10 percent of the average flow will continue to flow in the Paravani River channel to the Mktvari River.
- Construction of a penstock and powerhouse beside the Mktvari River about 1.5km upstream from the confluence with the Paravani River. This location is in Aspindza municipality about 700 meters from Khertvisi village. Water from the tunnel will go through turbines in the powerhouse to electricity, then will flow into the Mktvari River.

The location of the weir and hydropower plant, camps, settlements and the tunnel route are shown on Figure 2.1. Construction will take up to 4 years.

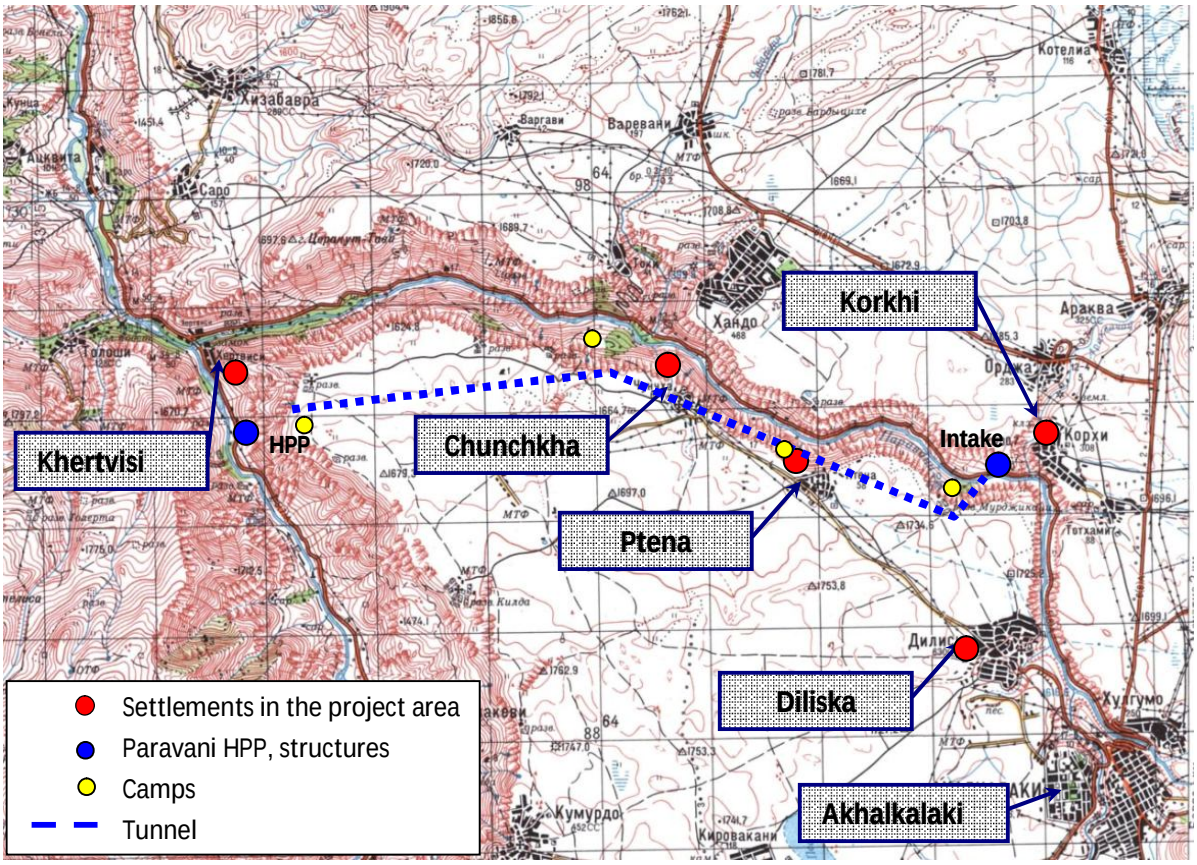

Figure 2.1. Location of the Paravani weir/intake and powerhouse (HPP), nearby settlements and tunnel route

Transmission line. This component of the project is the construction and operation of a 35km long transmission line Aspindza and Akhaltiskhe municipalities (see Figures 3a and 3b). This line will run from the powerhouse to a substation near Agara, where electricity from the HPP will enter the national grid. The line will include 147 towers that are an average of 240 meters apart. Most of the line will run beside existing power lines, so the land is already disturbed.

Settlements near the transmission line are shown on Figures 2.2.(a) 2.2.(b). Construction of the line will take up to 12 months.

Access roads and camps. Two new roads will be constructed: a 1250m section at the weir/intake and a 250m road at the power plant site will be new. Three sections of existing roads will be reconstructed and improved: a 750m access road to tunnel portal 1, a 250m access road to tunnel portal 2, and a 1000m access road in the powerhouse area. All roads will be earthen.

In addition, a total of 28.8 km of roads will be needed for construction of the transmission line, about 200m for each of the 147 towers. To the extent possible, existing roads will be used. Again, all roads will be earthen.

Four temporary construction camps (or "fly camps") will be established for equipment and materials maintenance and storage, and to accommodate workers who do not live nearby: near Chunchkha (tunnel access II), near Ptena (tunnel access I), at the weir/intake site, and in Khertvisi Village near the powerhouse.

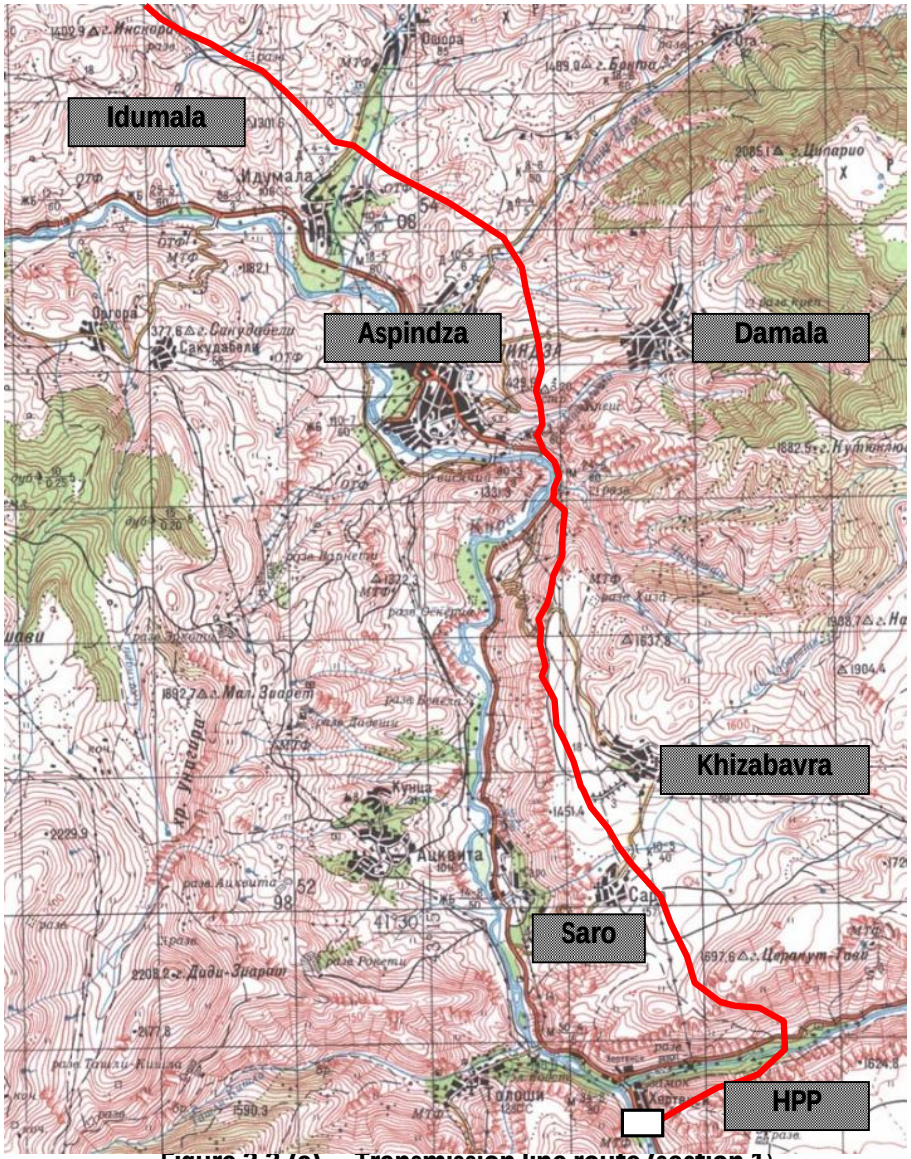

Figure 2.2.(a). Transmission line route (section 1)

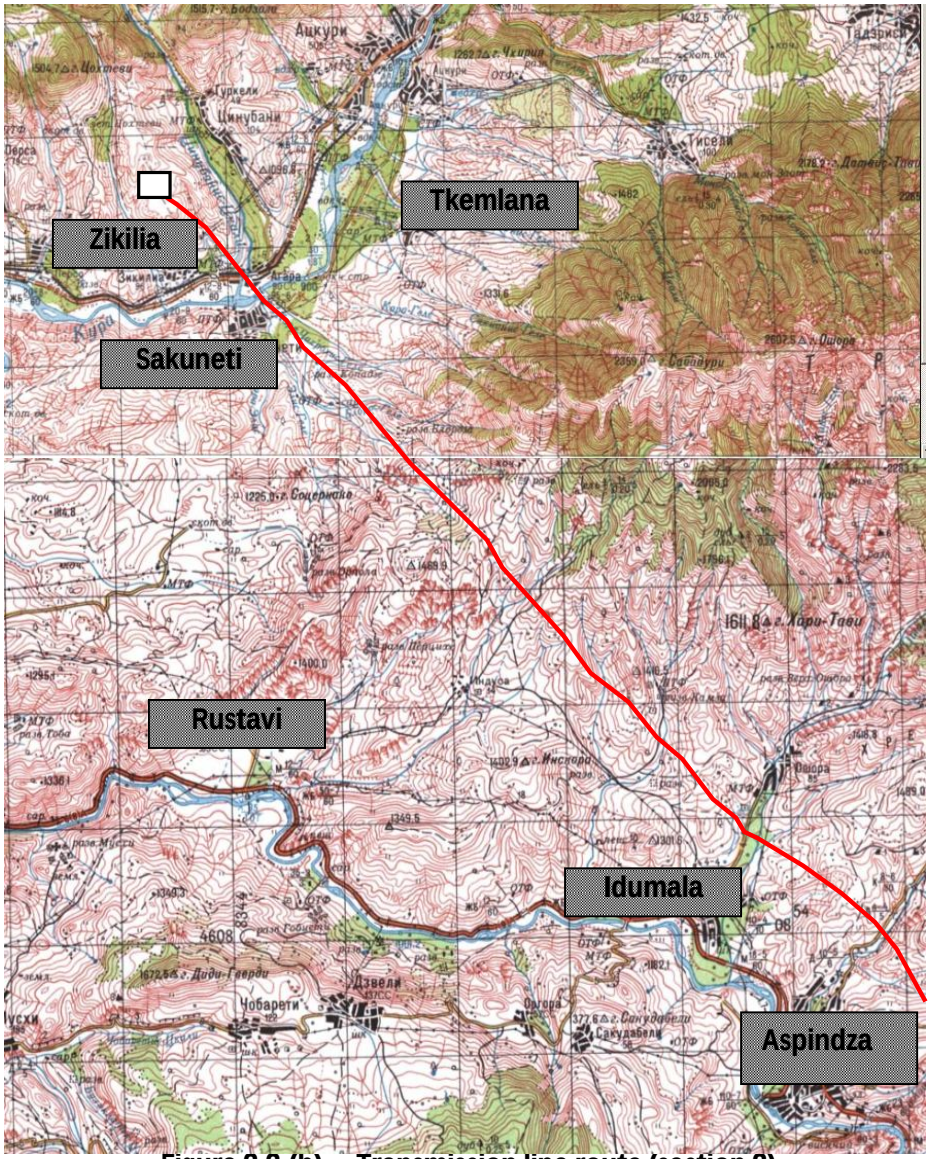

Figure 2.2.(b). Transmission line route (section 2)

Power will be provided from the local grid. The fly camps will use low-power generators. Spring or bottled water will be used for drinking. Car washing and concrete production will be done on the main camp site equipped with wastewater treatment facility. The fly camps will use bio-toilets.

During operations, sanitary wastewater at the powerhouse will be treated before being discharged into the Mtkvari River. Wastewater at the weir site will be stored and delivered to powerhouse area for treatment.

A total of 200 staff will be employed during construction, about 100 from the local area. During operations, 20 staff will be employed plus an additional 10 security staff, with 15-20 from the local area.

3. POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

Without proper controls, the Project could cause significant adverse effects on environmental resources and possibly on people. This section describes the main impacts that are predicted to occur during construction and during operation, and also lists many of the key actions GUE will implement to avoid or control the impacts. GUE will be required to take these actions to avoid or control the impacts in permits from the Ministry of Environment Protection and Natural Resources and/or in the lending agreements with EBRD and IFC. The table below shows the environmental and socioeconomic resources that are evaluated in the full ESIA. All are not described here, only the more important ones.

Environmental	Social and economical environment
Air	Demography
Surface and ground water	Infrastructure (roads, power supply)
Soil	Economic conditions
Vegetation/flora and fauna	Health and safety
Land use	Cultural heritage

3.1 Construction

Most potential impacts would occur during construction, and actions to be taken by GUE will prevent many of the impacts and reduce the significance of the ones that cannot be prevented.

Air quality and noise. Dust clouds could be caused by vehicle traffic, earthworks (including blasting), and other activities that disturb the ground surface. Dust would settle out of the air quickly, and could affect only those villages nearest the roads. During dry periods, GUE will apply water to road surfaces when dust clouds become visible. Small amounts of other pollutants will be emitted from the diesel generators at the fly camps. These generators will be well-maintained and will meeting all Georgian emission standards, so there should be no problem with air quality.

The primary sources of off-site noise would be from the operation of vehicles and heavy equipment and from blasting. Most settlements are not close to the construction sites, so noise will not be a major issue. All vehicles and equipment will be kept in good working order, which should reduce noise, and vehicles will obey speed limits. Blasting will take place only during daylight hours and only in a few places will blasting be at the surface of the earth and thus loud enough to be heard at any distance away from the explosion.

Surface water quality. Construction could pollute surface water in several ways if proper controls are not used.

- Pollution from accidentally spilled fuel/oil from vehicles and building machinery. This will be controlled by maintaining vehicles and equipment properly and by training staff who will handle fuel and oil. In addition, crews will have materials to clean up or contain small spills, which will prevent major impacts. Fuelling operations will not take place near water. Finally, any equipment that is used in or near water will be inspected to ensure there are no fuel or oil leaks.
- Increase of water turbidity when construction works are performed near or in the riverbed at the weir/intake location, which could affect fish and other organisms downstream. To some extent, this cannot be avoided although it will be controlled to the extent possible. The construction contractor will be required to develop an erosion control plan that will include such best practices as silt screens, hay bales, flocculent blocks, turbidity booms, and particle catchment curtains.
- Pollution by runoff and sedimentation due to erosion caused by land clearing for roads, fly camps, explosives storage area, power plant, grading for transmission line tower pads, etc. Best practices will be used to prevent and control erosion, with special care when activities are near water. There will be an erosion control plan that specifies the practices that will be used
- Pollution from sanitary wastes at construction sites. A biological treatment facility will be used at the main construction camp in Khertvisi. At all fly camps and other construction sites, wastes will be collected in storage ponds and taken to the treatment plant. Water treated to the standard approved by the Ministry of Environment Protection and Natural Resources water will be discharged to the Mtkvari River. River water quality will be monitored four times each year.
- Pollution of the river by wastewater from tunneling. This wastewater will be drained to a settling tank(s) and the clear supernatant will be discharged to the river.

Surface water flow. The only change in the flow of the Paravani River would be while the weir structure is being constructed. While this is happening, flow will be diverted around the construction zone. No spoil from tunnelling will be allowed to enter the river and there is no risk of river blockage. There will be no effects on the Mktvari River.

Soil. As mentioned above, an erosion control plan will include requirements to prevent loss of soil erosion. To reduce compaction, vehicles and equipment will stay on travel routes. In addition, soil could be polluted by spills of fuel or oil from vehicles and equipment, or from spills of other materials stored and used during construction. Drivers and others will be trained to clean up any small spills, and all vehicles and work sites will have materials to absorb and clean up accidental spills.

At all construction sites, topsoil will be removed and stored in piles that will be covered with grass or otherwise protected until the soil is used to restore the land when construction is complete.

Biodiversity. Animals will be temporarily disturbed during construction. The main sources of impact will include traffic, vehicles/machinery and people operating on site. It should be taken into account that the weir and the HPP sites are located near existing roads and therefore the animal life in these locations is limited. No rare or endangered animal species are known to live or visit the weir site, the powerhouse area, or along the transmission line route. Animals that are driven away by the noise

and presence of machinery and people will likely go only short distances and will be able to return to their traditional habitats when construction is complete.

Turbidity or other pollution in the Paravani River could affect fish, which could include trout (vulnerable, endangered), Persian gudgeon, khramulya and Kura barbell. The controls described above should prevent most impacts. To prevent impacts during fish spawning, no construction will take place in or near the river during spawning season unless actions will not cause increased turbidity.

All vegetation will be removed from construction and reservoir sites, including about 40-60 asp and willow trees at the weir/reservoir site. No species of rare or endangered plants are known to occur in any area to be affected by the project. After construction works are finished, the sites will be reinstated to their original form and condition except for the weir and reservoir area and the powerhouse area. Except for these areas construction sites will be re-vegetated with native plant species.

Nuisance impacts on people. Any potential impacts would be temporary and minor. Increased traffic during construction may generate additional noise, dust, and exhaust emissions, affect overall traffic flows, and damage road cover. To reduce the impact, vehicles will maintain strict speed restrictions, all vehicles and equipment will be maintained. As much as possible, traffic routes will be selected to avoid unsuitable roads, residential areas, schools etc. Night-time traffic will be kept to a minimum in populated areas.

Land acquisition and use/resettlement. No involuntary resettlement (physical displacement) will be required for construction of the weir and intake. A single property nearest to the HPP site (house and a homestead land) was acquired several years ago, soon after GUE was awarded the project development rights.

Land will be purchased at each of the 147 tower sites on the transmission line route, and GUE will need to purchase the right to use other land along the route. The route will be changed if needed in order to bypass sensitive areas and to avoid the need to relocate people. GUE will pay owners for temporary use of their land and for any damages to crops and/or property during construction. All compensation will comply with Georgian law and lenders' requirements. All land purchases and compensation will be guided by a documented land acquisition and compensation program that meets the requirements of Georgian law.

Community health, safety and security. The Contractor will ensure protection of public by introduction of site security to prevent unauthorised access to active construction sites, the explosive storage areas, and tunnel adits. Similar precautions will be taken when stringing the transmission line wire. Warning signs will be provided where appropriate. State security service will guard the sites.

Transport safety practices will be adopted with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Traffic safety procedures, including driver competency standards, speed restrictions and identification of preferred routes, will be implemented to minimize potential impacts.

Local community benefits. Besides helping to achieve Georgia's goal of increasing the use of renewable hydropower, the project will have a positive socio-economic impact. About 200 people will be employed for the four years of construction of the tunnel, weir, and powerhouse. In addition, about 100 people will be employed during construction of the transmission line, but for a shorter period. GUE's goal is for at least 60 percent of all workers to be from the local area. The goods and services needed during project activities will be purchased from the project region, which is likely to trigger development of small service businesses in the area. In addition, the local community will benefit

from improved transportation infrastructure within the project area as several access roads used by local villages are being upgraded by GUE for project purposes.

Worker safety and working conditions. Labour and working conditions will comply with Georgian labour code and Lender requirements. All construction contractors will have health and safety programs to protect workers. GUE will review and approve these programs and will be responsible for overseeing contractor performance.

Each company involved in construction will provide personal protective equipment – hard hats, safety boots, work gloves, eye protection, etc. – for their workers, as needed to protect them from hazards. In addition, all workers will be trained in proper safety rules and procedures. Monitoring and management of explosives and occupational health and safety during tunnelling will be carried out. Relevant OHS guidelines will be strictly kept to. The staff will be trained in EHS issues. Only authorised staff will be allowed to handle explosive materials.

Cultural heritage. This region is rich in cultural heritage monuments, with 11 in the vicinity of the project. Khertvisi castle in about 1.5km from the HPP site. No cultural heritage monuments are available near the intake area. Distances from the transmission line corridor to the closest monuments are:

Name	Distance, m	Name	Distance, m
Khertvisi castle to transmission line	2400	Our Lady church, Khizabavra	890
Khertvisi castle to powerhouse	1500	Khizabavra catholic church	950
Kvarsha church	500	Chikhoreshi church remains	500
Remains of Kvarsha settlement	340	Khvarishi church	500
Saro churches	300 and 700	Aspindza castle	800
Ancient cyclopean building	700		

With consideration of the scale and type of construction works there is no risk of physical damage to any of the monuments. The remains of an old terrace will be removed in order to construct the power house, whilst other sections located next to the project site will be reinforced.

A qualified expert conducted an archaeological survey of the HPP sites and the transmission line route and found there are no archaeological monuments that could be directly affected by project infrastructure development. In case of unexpected archaeological discovery, construction will be stopped and expert archaeologists consulted.

The initial section of the transmission line has been routed to be as far as possible from the Khertvisi castle; instead of passing the castle, the transmission line route climbs steeply up the plateau wall and crosses the plateau, thereby avoiding the more sensitive valley bottom in front of the castle.

3.2 Operation

Air quality. No dust or air emissions are expected during operation of the project other than minor dust from traffic on the roads. All vehicles will be well-maintained in order to reduce emissions of other pollutants.

Noise and vibration. Other than noise from turbines in and near the powerhouse, the only noise during operation will be a buzzing sound emanating from the transmission lines. This sound will not

be loud, but may be heard right under the line and at a short distance (up to 15m) to the side. Only minor noise will be generated by (traffic, machinery or people) during maintenance of facilities.

Water quality. Sewerage and grey water at the powerhouse will be treated in a biological treatment facility, ultra-filtration unit, and settling unit near the powerhouse. In addition, sanitary wastewater from the weir/intake area will be collected in tanks and taken to the treatment facility. An estimated 550 m^3 of treated water will be discharged to the Mtkvari River each year under a permit issued by the Ministry of Environment Protection and Natural Resources.

Sediment will be trapped behind the weir during operation and settle out of the water. Sediment will be silt and sand washed from upstream. If sediment is not removed, it would fill the reservoir and block the intake. Therefore, it will need to be removed periodically, probably once or twice each year. To clear the sediments, the gate on the weir will open and the sediments will be flushed down the river. Flushing will lead to a short-term (2-3 hours) increase of water turbidity downstream of the weir, and will be undertaken during high flow periods to minimize the potential impact on aquatic ecosystems.

Water will not be held in the reservoir for a significant amount of time, so should not become warmer.

Under a monitoring programme agreed with the Ministry of Environment Protection and Natural Resources, water quality (suspended particles; biological oxygen demand, total nitrogen, total phosphorus and total petroleum hydrocarbons) in the Mtkvari River will be monitored four times each year to verify that there is no pollution of the river.

Wastes. Solid waste generated during operation will be limited to domestic and maintenance-related waste. Solid domestic waste will be temporarily stored in tight containers to avoid scattering around and attraction of scavengers/insects. Waste will be removed to an approved landfill. Waste transformer oil will be removed for regeneration at the nearest treatment facility.

Surface water flow. The average annual flow of the Paravani River at Khertvisi is 18.7 m^3/second (with 16.5 m^3/sec estimated at the intake) , the average maximum and average minimum daily are 83.2m^3/sec and 9.42m^3/sec, respectively. The maximum amount that can be diverted into the tunnel for power generation is estimated as 25 m^3/sec. At least 10 % of the average annual flow at the intake will not be diverted for power but will be left to run down the channel to the Mktvari. It is expected that the plant will be able to operate at full load (25 m^3/sec) during three months of the year (April, May, June). The flow will be permanently monitored to ensure sanitary flow (at least the 10 percent of average annual flow) is maintained at all times.

Downstream of the weir/intake there are two trout fish farms (Figure 3.2.1): the first is 1.7 km downstream and the other is 8km downstream. It is estimated the first one will take only about 3.3 m^3 of water each day, which is negligible. The second one uses ground water, and the amount it discharges into the Paravani is also negligible. No other users are known.

Some local stakeholders have been concerned that the discharge of water from the tailrace at the powerhouse into the Mtkvari River will increase the flow in the river at the Mtkvari/Paravani confluence (i.e. near Khertvisi Village) and cause increased risk of flooding at the orchards/cultivated plots located nearby. This is not believed to be a significant risk but flows in the Mktvari will be observed to verify this. If negative impacts are observed, GUE will work with authorities and affected people to develop the most appropriate measures of impact avoidance.

a)

b)

Figure 3.2.1. Fish farms

Biodiversity (flora and fauna). No impact on vegetation/flora during operation of the transmission line is expected. There are no high trees within the transmission line corridor, so tree felling and cutbacks will not be required. No herbicides will be used for management of growth in the RoW corridor.

There also will be no project impact on land animals. The weir will be designed so that fish can pass, which will reduce the impacts on fish. However, the decrease in river flow between the weir and the Mktvari river could adversely impact fish and other aquatic organisms. In order to maintain existing water quality and biological resources in the downstream Paravani River, adequate sanitary flow (or "ecological flow") will be maintained at all times, even if less water is sent through the tunnel and less electricity can be generated. As mentioned earlier, flow rates will be monitored continuously.

No impact on aquatic life in the Mtkvari River is expected. The only effect in this river would be the discharge of most Paravani River water into the Mktvari from the powerhouse site instead of from the Paravani River itself, so there will be up to 25 m^3 more water in the Mktvari for a distance of about 1.5km.

The transmission line could potentially affect birds, which could collide with towers or wires and be killed or injured. Any impacts are expected to be minor and very local. The proposed line is located within a bird migration corridor, but the height of the transmission line will be significantly lower than the height of the migrant birds flight, so there should be limited or no impact. There should be no risk of electrocution for large birds because lines will be spaced far enough apart that birds cannot contact two lines. Walk-overs and drive-by inspections of the line will be conducted several times during at least the first two years, including during migration seasons. If dead birds are detected along the line, the use of devices to drive away birds (spinners, etc.) will be considered.

Soil. There should be limited or no impact on soil during operation.

Socio-economic benefits. The project will have several positive effects. The project will generate renewable energy for the grid both for local use and export.

- A major positive impact for municipalities will be the property tax paid by the company (1% of the property value).
- A total of about 30 people will be employed, including security staff. GUE is searching for students from the area for future employment. Several individuals have been identified after GUE contacted with the Georgian Technical University department of energy.

- GUE is planning to implement social programs in the project region. The company has already upgraded several roads and may improve others. Different possibilities under discussion include arrangement and/or amelioration of water supply and wastewater systems, possibility of using the tail water for the needs of the local community, support to fish farming, and construction of watermill.

Community health, safety and security. No community health, safety and security risks are expected from operation of the project. Traffic will be low, transformers equipped with emergency spill collector reservoir capable to retain maximum volume of oil is case of emergency. The site will be guarded and staff equipped with fire fighting equipment.

The function of the weir will be diversion and not accumulation of the water. It will be only five metres high with a small inundated area of 0.5 ha and a small volume of retained water. Thus, failure of the weir would not release a large amount of water that could affect people, even if the nearby villages were not several hundred metres higher than the river. Even so, the design of the weir is taking into account the seismicity rating of the area.

Community health and security risks linked to the transmission line will be associated with noise, risk of electrocution/shock, and impact of electromagnetic field. Power lines can induce voltages and currents on conductive objects, such as metal roofs or buildings, fences, and vehicles, that are under or very near the line. When a person or animal comes in contact with a conductive object a perceptible current or small secondary shock may occur. Such shocks cause no harm to the person although they may be considered a nuisance. This effect occurs only at close range because the electric field rapidly becomes weaker as the distance from the line increases. Electric fields can be shielded and weakened by buildings, trees and other objects that conduct electricity. Similar to electric fields, magnetic field strength attenuates rapidly with distance from the source. However, unlike electric fields, it can not be easily shielded by objects or materials.

The power line will not be located closer than 50 m to residential buildings. Warning sites will be attached where appropriate (towers, substation area). Community members will be informed about safety measures and activities prohibited in vicinity to the towers and under the transmission line. There will be no limit on agriculture and grazing on land under the line.

Electromagnetic fields are found near power lines. Above certain levels, these fields can trigger biological effects in the body. However, 'biological effect' does not necessarily equal 'health hazard'. Despite of a wide range of studies and scientific knowledge available in this area, there are gaps in knowledge about biological effects and further research is needed. Current evidence is controversial. To avoid any potential negative impact on health the line will be designed so to avoid crossing the residential area and all safety requirements taken into account. Allowable distance between the line and any building must be at least 25m with height of the building and/or the relief taken into account.

As a precaution electromagnetic field will be measured in houses located in 100m from the line (if any) after commissioning and later on, as requested by occupants. If the levels are higher than allowed, shields will be installed to ensure adequate safety of the residents.

Labour and working conditions. All staff will be trained in occupational health and safety and equipped with appropriate personal protective equipment. All working conditions and labour relations will comply with Georgia law and lenders' requirements.

Visual appearance of landscape. To mitigate visual impact of the building on tourists its colour and height will be designed so to merge with surroundings. The project of the HPP component was agreed with the National Agency for Cultural Heritage Preservation (NACHP) of Georgia. According to the joint decision of the Ministry of Culture, Monument Protection and Sport of Georgia and NACHP Council the height of the support wall parallel to the road was recommended to be visually reduced by 'split' into several layers. Another condition was the use of facing materials providing maximum merging into the historically established area. The colour of the walls and the roof will be additionally agreed with the NACHP.

The transmission line will run beside other lines for most of its length, so there will be very little change in appearance of the landscape.

4. CUMULATIVE IMPACTS

Paravani HPP is currently the only HPP on Paravani River certain to proceed, though old studies indicate potential for up to four more HPPs upstream, three of which (Arakali 18 MW, Abuli 12.5 MW, Akhalkalaki 14.5 MW) may be developed by a Turkish firm according to recent press releases. All would be run-of-river schemes with limited storage. A Cumulative Impact Assessment was publically disclosed in 2010 for HPPs on the Mtkvari River and its tributaries in Samtskhe-Javakheti (DG Consulting, 2010), including all the HPPs listed above.

Without design information and ESIAs for the newly announced projects, it is not possible to produce a more meaningful assessment than already exists. However, based on existing data it seems highly likely that the key cumulative risks involved would be:

- Changes to hydrology/flow characteristics in the 'by-passed' sections of the river;
- Changes in water quality associated with construction (sedimentation) and operations (sediment load, temperature);
- Changes in aquatic habitat related to barriers to migration (new weirs, weir walls, and turbine halls) and diminished water availability in by-passed reaches.

In mitigation, a minimum sanitary flow will be released to sustain downstream ecological function and volume of releases will be monitored prior to, during and after construction of the weir. Monitoring of the health of the aquatic ecosystem has also been recommended, to confirm that the sanitary releases are sufficient and to track actual ecological impacts. Paravani HPP weir design will be reviewed to ensure adequate fish passage at all times and reduce fish mortality, and this is recommended for all upstream schemes. The results of Paravani HPP monitoring will be a key input to recommended future cumulative impact studies for Paravani River HPPs.

Consideration of cumulative impacts is given in Annex A.

5. STAKEHOLDER ENGAGEMENT

There are many organizations and people (together, they are the "stakeholders") who are interested in the Paravani HPP project. These include residents of the nearby area, government agencies who regulate or have jurisdiction over the projects, authorities who receive taxes from the project and its employees, businesses that will sell supplies or services to the project, nongovernment organizations, and others.

To date, GUE has actively engaged stakeholders in the ESIA process, including at least two sets of public meetings and many private meetings. Stakeholder engagement is guided by a Stakeholder Engagement Plan that was prepared to meet EBRD and IFC requirements. It summarizes engagement and issues raised to date and calls for regular communications with key stakeholders throughout the planning, construction, and operation phases of the project.

GUE has developed and will implement a programme that will allow anyone to submit complaints or comments on the project and/or GUE's performance. This "grievance mechanism" will require that all complaints and comments be addressed within a certain time period, and that reports on the programme be submitted to EBRD and IFC each year.

ANNEX A – CONSIDERATION OF CUMULATIVE IMPACTS

Introduction

The combination of multiple impacts from the proposed Paravani HPP project and future projects in the project area could result in more and/or more significant impacts than from the Paravani HPP project alone. For IFC- and EBRD-financed projects, the project impact assessment should evaluate these cumulative impacts to the extent feasible at the time of project development.

Recent Cumulative Impact Studies covering the Project Area

A Cumulative Impact Assessment (CIA) covering the Paravani HPP project area was recently completed and publically disclosed in connection with the Mtkvari HPP (DG Consulting, 2010). The study, undertaken according to IFC/EBRD cumulative impact requirements, focused on HPPs known to be planned in the Mtkvari (Kura) river basin in Georgia's Samtskhe-Javakheti region. It covered the Mtkvari River and its tributaries in this region, including the Paravani and Uraveli Rivers. Paravani HPP was included in this assessment, together with a proposed cascade of three HPPs upstream on the Paravani River (the Arakali, Abuli and Akhalkalaki HPPs). A fourth, much smaller (Poka) HPP was also included. The cumulative analysis provides a basic description of each project, describes the baseline environmental and socio-economic conditions of the study area and presents an analysis of key potential cumulative impacts. It also recommends cumulative impact management and monitoring actions and monitoring requirements, and contains suggestions for basin-wide management actions to be taken by agencies of the Government of Georgia.

Scope of this Annex:

This Annex does not repeat the basin-wide cumulative assessment work already undertaken for the Mtkvari HPP, as there is little new information available. The aim is instead to focus on the Paravani River, for two main reasons. First, the potential adverse effects of the Paravani HPP will be far more significant for the Paravani River than for the Mtkvari River to which it is a tributary. Second, the Government of Georgia announced in late February 2011 that an agreement has been signed with a Turkish firm to construct three new HPPs upstream on the Paravani River, making these projects a more realistic prospect than before. . Now, up to four1 back-to-back HPP projects could be developed on the Paravani River over the course of the next 5-10 years. The full implications of this development have not yet been explored in detail. Based on the limitations and assumptions listed below, the Annex aims to present:

- A qualitative review of expected cumulative impacts associated with all of the proposed Paravani HPPs, focusing on the most important ones.
- A set of monitoring requirements for the Paravani HPP which will provide a solid baseline for monitoring and managing potential cumulative impacts in future; and
- Recommendations for additional work if and when key design, environmental and social, and scheduling information becomes available for the other proposed Paravani HPPs.

1 There could technically be five if Poka HPP is included, but given its small (0.5 MW) size and the fact that agreements have already been signed for the much larger Paravani, Arakali, Abuli and Akhalkalaki HPPs, its development seems unlikely.

Proposed HPPs on the Paravani River

Up to five HPPs may eventually be built on the Paravani River, according to USAID-funded prefeasibility studies undertaken by Winrock and available on the Georgian Ministry of Energy website. Table A1 summarizes key characteristics of each one, as reflected in these prefeasibility-level studies. Some characteristics may change during the feasibility study and detailed design stages, and not all of these HPPs will necessarily be built. Of these, the Paravani HPP is the most advanced, whilst the proposed Poka HPP is the least advanced.

Table A1: Proposed Hydropower Projects on the Paravani River, southern Georgia

Name	Rated capacity (MW)	Barrier type	Power tunnel (km)	Status
Poka	0.5	5 m weir	6	Pre-feasibility. No MOU signed, no ESIA.
Arakali	18.2	39 m dam	7	Pre-feasibility, MOU signed February 2011, no ESIA to date. These 3 projects could be developed as a 45MW HPP-cascade.
Abuli	12.5	36 m dam	7	
Akhalkalaki	14.5	28 m dam	4	
Paravani	87	5 m weir	14	Feasibility/ESIA completed, permits approved, construction due to start shortly.

Note: HPPs are listed above in geographical order, from Lake Paravani (Poka) to the Mtkvari River (Paravani).

Key Limitations

- Neither feasibility studies / detailed designs nor Environmental & Social Impact Assessments (ESIAs) are available for any of the developments except the Paravani HPP;
- For that reason it is not known if, when, and over what period these HPPs may be constructed, and also whether the cascade HPPs might be constructed all together or one at a time.
- Minimum sanitary (environmental) flows have not been calculated for the remaining four proposed HPPs (i.e. besides Paravani HPP).
- These limitations make it impossible to conduct a detailed cumulative impact assessment; therefore, instead, this Annex provides a qualitative overview of the key aspects and associated mitigation options.

Key Assumptions

- All of the proposed HPPs are assumed to be run-of-river schemes involving diversion of most of the Paravani Rivers flow through power tunnels to drive turbines, before returning the diverted waters downstream.
- These run-of-river HPPs will not use water and therefore will not reduce overall flow in the Paravani River.
- Planned impoundments will be relatively small, as no major water storage is anticipated. Therefore there should be no major physical or chemical changes to water quality (as might be encountered in large dam environments). There would be a limited need for resettlement and/or land purchases, and limited impacts on biodiversity due to inundation.

- All of the proposed HPP schemes will include some form of safe fish passage, so that fish migration up and down the Paravani River (between Lake Paravani and Mtkvari River) will not be significantly hindered.

Anticipated Cumulative Impacts in the Paravani River Valley

Based on the findings of the Mtkvari Cumulative Impact Assessment and others conducted recently in Turkey under similar (HPP cascade) conditions, it is considered unlikely that any of the following environmental and social aspects will pose significantly adverse cumulative impact risks in the Paravani River Valley:

- Air emissions and dust would be temporary and unlikely to impact a large area.
- Solid domestic waste & waste water would be generated mainly during construction.
- Excavation and demolition/construction wastes would be site-specific and not cause cumulative impacts. Noise and vibration would be site specific and very local.
- Disruption of terrestrial fauna and flora would occur at each small reservoir and transmission lines may affect some habitat. This would be determined during the environmental studies.
- Cultural heritage impacts can generally be avoided, and the Paravani valley is less sensitive than Mtkvari Valley.
- Land acquisition should be limited due to small reservoirs. Scale of land acquisition for transmission lines would depend on selected route. This would be determined during the environmental and social studies.

Whilst all of these aspects will involve some degree of site-specific impact, the nature of these cumulative impacts is likely to be *additive*, i.e. equal to the sum of the individual project impacts.

There are other aspects, however, where there could be *interactive* cumulative impacts – i.e. combined impacts of potentially greater significance than the sum of individual project impacts - are likely to occur as a result of multiple HPP development. These are all related to the river itself, which forms an uninterrupted contiguous ecosystem all the way from Lake Paravani to the confluence with the Mtkvari River.

- **Changes in hydrology / flow characteristics.** There will some parts of the river where up to 90 percent of the average water flow will be taken out of the channel and passed through tunnels or channels before being placed back in the channel below the powerhouses.

- **Changes in water quality:** In-stream construction of a series of weirs/dams across the length of the Paravani River, will result in temporary increases turbidity levels during construction (cloudy water). Also, in the by-passed reaches, decreases in flow depth and velocity will reduce sediment loads downstream of each weir/dam site, which could lead to temperature changes and/or increased erosion or other changes to the channel.

- **Changes in aquatic habitat** associated with these changes in hydrology and water quality, mainly impacting the by-passed river reaches between the weir/dam and tailrace outlet of each respective scheme. If all of the proposed schemes are built, most of flow of the Paravani River will be diverted away from five river sections totaling 38 km in length. Reduced flow volume in these bypassed reaches will lead to reduced water depth and therefore reduced habitat quality for fish and other aquatic organisms. Important behavioural signals for

aquatic species may be disrupted due to potential changes in natural flow patterns. Where impoundments are created, habitat quality may increase for some species. The physical barriers (dams and weirs) to be constructed if the planned HPPs proceed, represent a potentially significant barrier to the natural up- and down-stream movement of aquatic species, particularly fish. Fish also can be carried into power tunnels and associated turbine halls and this can kill if not carefully managed.

Mitigation and Monitoring Measures

1. **Hydrology**: A minimum environmental ("biological" or "sanitary") flow has been calculated for the Paravani HPP, representing 10 % of the annual average flow rate. The Paravani HPP weir is being designed in such a way that it is possible to always guarantee the release of this minimum flow into the by-passed reach, and this will be carefully monitored to ensure compliance. Similar minimum flows will need to be established for each of the additional HPPs in future, and mechanisms will need be introduced to ensure compliance.

2. **Water quality**: Water quality will be monitored before the Paravani HPP is constructed in order to determine the baseline water quality. Water Quality will also be monitored during the construction and operational stages to identify the impact of this HPP and possibly of other ones if they are constructed.

3. **Aquatic habitat**: During the Paravani HPP ESIA, biologists determined that the minimum environmental flow to be released downstream would be sufficient to maintain the aquatic habitat in the Paravani River. To confirm this, a monitoring program will be implemented before and during construction and throughout operation, both upstream and downstream of the HPP project. . The monitoring will focus on the health of the aquatic ecosystem in the project area, how this is impacted by scheme development and what measures may need to be taken to maintain ecosystem health. To address barriers to fish movement, the weir design will be revised in collaboration with a fish expert to ensure that all key species will be able to move up- and downstream and that the minimum environmental flow allows sufficient volume for fish to pass at all times. It is also recommended that a similar exercise be undertaken in future for each of the other HPPs that are proposed. Finally, fish screening will be addressed by a fish expert and design team in order to minimize fish mortality by the turbines. Implementing these measures will enable the Paravani HPP operators to minimize and monitor the potential adverse impacts on aquatic ecology and to contribute to future efforts to quantify the cumulative impact(s) on aquatic ecology. It is recommended that similar care is exercised in future at each upstream HPP site in order to ensure key aquatic taxa are preserved in the Paravani River in future.

Need for further studies

Once feasibility studies and ESIA reports become available for the upstream HPPs, it is recommended that a more detailed assessment of cumulative impacts be undertaken to minimize adverse cumulative impacts. Such a study would ideally be commissioned by the Georgian Government, with input from individual HPP project sponsors. Monitoring data collected by the Paravani HPP sponsors as part of the recommended monitoring scheme should be made available as a shared resource, in order to better understand and preserve the complex ecosystem interactions involved.

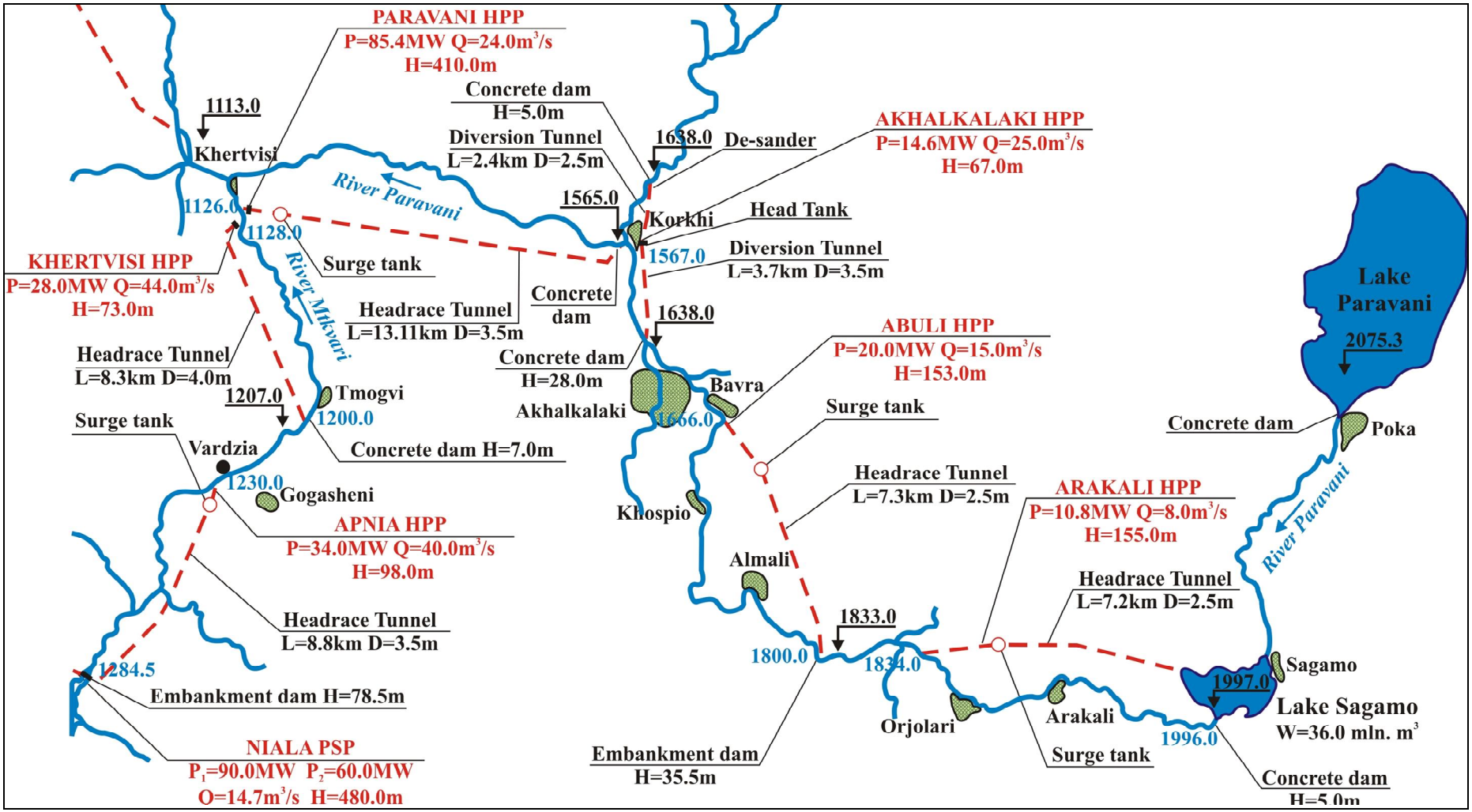

Figure A1. Map with indication of potential HPP sites