

# Draft Initial Environmental Examination

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November 2017

GEO: Urban Services Improvement Investment  
Program – Tranche 3  
(Improvement of Kutaisi Water Supply System  
Sub-project)

Prepared by United Water Supply Company of Georgia LLC of the Ministry of Regional  
Development and Infrastructure for the Asian Development Bank

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## ABBREVIATIONS

ADB	- Asian Development Bank
CA	- Cross section area
CC	- Civil Contractor
DC	- Design Consultant
DREP	- Division of Resettlement and Environmental Protection
EA	- Executing Agency
EIA	- Environmental Impact Assessment
EIP	- Environmental Impact Permit
EMP	- Environmental Management Plan
EMS	- Environmental Management Specialist
ES	- Environmental Specialist (at DREP)
GoG	- Government of Georgia
GRC	- Grievance Redress Mechanism
IA	- Implementing Agency
IEE	- Initial Environmental Examination
IP	- Investment Program
IPMO	- Investment Program Management Office
kg	- Kilogram
km	- Kilometre
lpcd	- Litres per Capita per Day
M	- meter
MFF-IP	- Multitranches Financing Facility Investment Program
mg/l	- milligram per litre
mm	- millimetre
MoENRP	- Ministry of Environment and Natural Resources Protection
MoRDI	- Ministry of Regional Development & Infrastructure
UWSCG	- United Water Supply Company of Georgia
SC	- Supervision Consultant
SSEMP	- Site Specific Environmental Management Plan
WS	- Water Supply
WSS	- Water Supply & Sanitation
<b>WWF</b>	- <b>World Wildlife Fund</b>

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## EXECUTIVE SUMMARY

1. It is proposed to improve the water supply system in Kutaisi under the Asian Development Bank (ADB) funded Urban Services Improvement Investment Program. This Investment Program, implemented in seven towns, will develop the water and sanitation services, which will improve quality of life and optimize the social and economic development. The Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) and the United Water Supply Company of Georgia (UWSCG) is the Implementing Agency (IA) of this Program. The WSS program will be implemented from mid-2011 and likely to be completed by 2019. A first phase of the Kutaisi sub-project, financed under Tranche 1, focuses in water supply measures and is implemented in 2013 – 2015. Phase II, financed under Tranche 3, and with a start of implementation in 2014 will complete the rehabilitation and extension of the water supply system. Since the water supply subproject is unlikely to have significant adverse impacts, it is classified as environment Category B, and accordingly an Initial Environmental Examination has been conducted. This is a summary of the IEE Report.

2. Kutaisi, the capital of Imereti region, is the second largest Georgian city and the political, economic, and cultural centre of Imereti region. Imereti region, with a total area of 6,515.8 km<sup>2</sup>, is strategically located on the main East-West transit corridor between the Caspian and the Black Sea. It is the most populated region in Georgia, with more than 702,700 inhabitants (based on 2002 data). It consists of 12 administrative-territorial units – the city of Kutaisi and eleven districts (Baghdati, Vani, Zestaphoni, Terjola, Samtredia, Tkibuli, Khargauli, Khoni, Tskaltubo, and Chiatura). Kutaisi, which is about 240 km to the west from the capital City of Tbilisi, lies at the River Rioni, the main river in western Georgia draining to the Black Sea.

3. The service level of water supply is low with partial coverage, high system losses, and insufficient pressure in the system. With the government initiative to develop Kutaisi, the water demand is likely to grow slightly. This subproject will expand the system and improve the service standards, with a daily supply of potable water in adequate quantity (205 lpcd). The subproject is designed to meet the projected demand of 2040. This will be achieved by: (i) restructuring of water supply network if required (ii) exchange / reconstruction of old transmission pipes (iii) and construction of new reservoirs.

4. The Kutaisi WS system improvement sub-project is relatively large in scale and maintenance as compared to other project towns. Sataplia Nature Reserve is located 9 km north-west from Kutaisi. None of the components will encroach into this reserve and most of the activities are planned along the existing roads. Further any disturbance will be limited to construction period. The identified impacts are mostly short-term, localized and can either be easily avoided or mitigated.

5. Most of the predicted impacts are associated with the construction process. Impacts mainly arise from the generation of dust from soil excavation and refilling; disturbance of residents, traffic and activities in the town; increase of silt load in the river; loss of top soil, removal of trees, and from the disturbance to wildlife due to trenches. These are common impacts of construction, and following methods are suggested for their mitigation: (i) Utilizing surplus soil for beneficial purposes; (ii) Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc); (iii) Providing prior public information; (iv) conducting no construction in the river bed in fish breeding season; (v) restoring the top soil after construction, (vi) avoiding tree cutting through location alignment changes, and (vii) to avoid safety hazards construction site will be secured at critical segments.

6. The water supply sub-project is likely to have several positive benefits during operation. The citizens will be provided with a constant supply of better quality water, which will improve the quality of life.

7. To ensure that all the mitigation measures as suggested are implemented, a program of environmental monitoring is prepared. The Division of Resettlement and Environmental Protection (DREP) of UWSCG will oversee and be responsible for implementation of mitigation and monitoring measures. Provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

## **POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK**

8. This section discusses the national and local legal and institutional framework within which the environmental assessment is carried out. It also identifies project-relevant international environmental agreements to which the country is a party.

### **A. ADB Policy**

9. Superseding the previous safeguard policies (the Involuntary Resettlement Policy, 1995, the Policy on Indigenous Peoples, 1998, and the Environment Policy 2002), ADB, has adopted a comprehensive Safeguard Policy Statement in 2009 (SPS, 2009). This Statement describes common objectives of ADB's safeguards, lays out policy principles, and outlines the delivery process for ADB's safeguard policy. It applies to all ADB-financed and administered projects, and their components including investment projects funded by a loan, grant or other means.

10. Aiming on promotion and sustainability of project outcomes by protecting the environment and people from projects' potential adverse impacts, the objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

11. The objective of environmental safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. All ADB funded projects are screened at initial stages of preparation and categorized according to significance of the project's potential environmental impacts. Projects are assigned to one of the following three categories:

**Category A** - Projects likely to have significant adverse environmental impacts, which are irreversible, diverse or unprecedented and may affect an area larger than the location subject to physical works. An Environmental Impact Assessment is required.

**Category B** – Projects with adverse environmental impacts that are less significant than those of Category A projects, are site-specific, generally not irreversible, and in most cases can be mitigated more readily than for Category A projects. An Initial Environmental Examination (IEE) is required.

**Category C** - likely to have minimal or no adverse environmental impacts; EIA is not required.

12. The Kutaisi WS subproject has been classified as environmental assessment category B (some negative impacts but less significant than category A) according to the criteria laid down in the checklist for water supply projects of the ADB's Environmental Assessment and Review Framework (November 2010) that was especially prepared for the environmental assessment of the Georgia Urban Services Improvement Investment Program.

13. *ADB Review and Approval.* For Category B projects the Draft IEE report is reviewed by ADB's Operational Department (in this case Central & West Asia Department) and after addressing their comments, if any, the EA then officially submits the IEE reports to ADB. Completed reports are made available on the ADB website.

## **B. Georgian Law**

### **i. Framework Legislation**

14. The basic legal document is "The Constitution of Georgia", which was adopted in 1995. While the Constitution of Georgia does not directly address environmental matters, it does lay down the legal framework that guarantees environmental protection and public access to information with regard to environmental conditions.

15. Article 37, Part 3 states that "any person has the right to live in a healthy environment, use the natural and cultural environment. Any person is obliged to take care of the natural and cultural environment." Article 37, Part 5 states that "an individual has the right to obtain full, unbiased and timely information regarding his working and living environment."

16. Article 41, Part 1 states that "a citizen of Georgia is entitled to access information on such citizen as well as official documents available in State Institutions provided it does not contain confidential information of state, professional or commercial importance, in accordance with the applicable legal rules.

17. The **Law of Georgia on Environmental Impact Permit (2007)** defines the full list of activities on the territory of Georgia subject to mandatory ecological expertise. The Law defines the legal aspects of issuing an environmental permit, undertaking the ecological expertise, informing the public and participating in the given procedures. Under the Law, the environmental permit is the authorization to realize the planned activities. Under the Law, an environmental permit is issued by the Ministry of Environmental Protection and Natural Resources of Georgia based on the review/expertise of the application of an applicant for the environmental permit. The aim of the Law is to ensure the protection of a human health, natural environment, physical assets and cultural heritage during the activity.

18. The **Law of Georgia on Environment Protection (1997)** regulates the legal relations between the state establishments and physical or legal entities in the field related to the use of territorial waters, air space, including continental shelf and special economic zones, environmental protection and natural resources on the territory of Georgia. The Law regulates the standards of the environmental protection and issues of environmental management; it describes the economic sanctions, standards and issues of environmental impact, different issues of protection of the natural eco-systems and biodiversity, and global and regional management issues. In addition to the above-mentioned, the Law considers the major principles of waste management. The law defines the ecological requirements for the waste (Article 34). According to the provision of the given Article, an entrepreneur is obliged

to reduce the origination of industrial, domestic and other types of waste, ensure their treatment, utilization, placement or burying by considering the environmental, sanitary-hygienic and epidemiological standards and rules. The Law defines the requirements for the placement of toxic, radioactive and other hazardous waste and prohibits their discharge in the surface water sources.

19. **Law of Georgia on Licenses and Permits (2005)** defines the list of activities needing licenses or permits, including so called "Environmental permit". It also defines the requirements for the license or permit issue. The Law, together with the normative by-laws, regulates such organized activity or action, which relates to an indefinite circle of entities, is characterized by increased hazard to the human life or health, affects particularly important state or public interests or is related to the use of a state resource. The given Law regulates the field regulated by a license or permit; it gives a thorough list of licenses and permits, and establishes the rules to issue the licenses and permits, makes amendments to them or abolish them. Under the Law, a state regulation of the activity or action through a license or permit is undertaken only when the given activity or action is directly associated with the increased hazard to the human life or health or fields of state or public interests. The state regulation is undertaken only when the issuance of a license or permit is a real means to reduce the hazard in question or consider state or public interests. The aim and major principles of regulating the activity or action via licenses or permits are as follows:

- Provision and protection of human life and health;
- Safety and protection of a human's residential and cultural environment;
- Protection of state and public interests;

20. **The Law of Georgia on State Ecological Expertise (2007)**. Under the given Law, the ecological expertise is a necessary measure for making decision on the issuance of environmental and/or construction permit(s). The aim of the ecological assessment is to protect the ecological balance by considering the requirements of environmental protection, rational use of natural resources and principles of sustainable development. A positive conclusion of the ecological expertise is mandatory for obtaining an environmental and/or construction permit. In addition, the holder of environmental and/or construction permit is obliged to comply with conditions specified in the ecological expertise conclusion. The process of ecological assessment is regulated by the Ministry of Environmental Protection and Natural Resources.

21. The procedure to be observed during ecological expertise, as well as the requirements on forming the expert commission is prescribed in the Provision on the Rule for Carrying out Ecological Expertise, which is approved by the Minister of Environment and Natural Resources Protection of Georgia. The full list of the activities, subject to mandatory ecological expertise for decision making on issuance of environmental permit or building permit, is specified by the Law of Georgia on Environmental Permit.

22. The state ensures protection of the environment and, correspondingly, protection of water as its main component in **The Law of Georgia on Water (1997)**. All residents of Georgia are liable to ensure the rational and sustainable use and protection of water. They have to prevent its contamination, pollution and depletion. The dumping of industrial, household and other garbage and wastes in water bodies is prohibited according to this act. The disposal of industrial, household and other effluents into water bodies is permitted on the basis of a license by the Ministry. With the objective of protecting the Black Sea and preserving its ecological system, all natural and legal persons (including foreigners) are obliged to take measures for preventing pollution of the sea with wastewater from the sources of pollution located on the land. The use of a surface water body for discharging industrial, communal-household, drainage and other wastewater is allowed only under a water use license

issued on the basis of the Ministry-approved multipurpose water utilization plans and water management balance-sheet.

23. The **Law of Georgia on Cultural Heritage (2007)**. Article 14 of the Law specifies the requirements for 'large-scale' construction works. According to this Article, a decision on career treatment and ore extraction on the whole territory of Georgia, as well as on construction of an object of a special importance as it may be defined under the legislation of Georgia, is made by a body designated by the legislation of Georgia based on the positive decision of the Ministry of Culture and Monument Protection of Georgia. The basis for the conclusion is the archeological research of the proper territory to be carried out by the entity wishing to accomplish the ground works. The entity wishing to do the ground works is obliged to submit to the Ministry the documentation about the archeological research of the territory in question. The preliminary research should include field-research and laboratory works. In case of identifying an archeological object on the territory to study, the conclusion of the archeological research should contain the following information: (a) a thorough field study of the archeological layers and objects identified on the study territory by using modern methodologies, (b) recommendations about the problem of conservation of the identified objects and planning of the building activity on the design territory, on the basis of the archeological research

24. The aim of the Law of Georgia on Public Health (2007) is as follows: Promotion of the introduction of a good health and healthy lifestyle of the population; Creation of the environment, which is safe for a human health; Promotion of the protection of the reproductive health of a family; Prevention of infectious and non-infectious diseases. The Law defines the rights and obligations of the population and legal entities in the field of public health. Aiming at establishing the environment safe to the public health, the Ministry sets the qualitative standards for the environment safe for a human health (atmospheric air, water, soil, noise, vibration, electromagnetic radiation), including maximum permissible concentrations and rates of harmful impact. The standards are mandatory. Every person on the territory of Georgia is obliged not to carry out the activity, which causes a hazard of the infectious and non-infectious diseases to spread and helps the origination of the risks to human health; protect the sanitary and epidemiological standards; to supply the information to the public health department about all emergencies caused by the violation of the sanitary norms in the production or technological process, etc. The observance of the standards is controlled by appropriate state structures. The responsibility for the internal and external audits rests with a certified, independent laboratory.

25. **Environmental Assessment and Review Framework (November 2010, EARF)** was established for the Asian Development Bank funded Georgia Urban Services Improvement Investment Program (or the Investment Program). This is prepared to adequately address the ADB Safeguard Policy Statement (2009) requirements and is to be endorsed by the Georgian government. Projects have to be assigned to Categories A, B, and C. General mitigation measures are listed for anticipated impacts.

### **C. Licenses & Approvals Required**

26. Environmental assessment of various activities and development projects in Georgia is governed by the Law on Environmental Impact Permits (EIP). This Law notifies the list of the activities and projects, which are subject to ecological expertise and require Environmental Impact Permit. The Law also makes the public participation mandatory in the process of environmental assessment, ecological expertise and decision making on issuance of an environmental impact permit. Under this Law, various projects/activities have been divided into four categories based on their size, importance and potential environmental impact, and sets out permitting process for each category.

27. None of the components of the proposed water supply improvement subproject in Kutaisi are notified in the Law on EIP and therefore environmental impact permit is not required.

28. The requirements related to EIA studies and the EIA report are set forth in the Order N31 of 15 May 2013 of MoENRP.

29. The **Law of Georgia “On the Red List and Red Book” (2003)** regulates the legal relations in the field of developing the Red List and Red Book, protecting and using the endangered species, except the legal issues of the international trade with endangered wild animals and wild plants, which within the limits of the jurisdiction of Georgia are regulated by virtue of the Convention ‘On the international trade with the endangered species of wild fauna and flora’ concluded on March 3 of 1973 in the city of Washington. According to Article 10 of the Law, any activity, including hunting, fishing, extraction, cutting down and hay-mowing, except particular cases envisaged by the present Law, Law of Georgia ‘On animal life’ and legislation of Georgia, which may result in the reduction in number of the endangered species, deterioration of the breeding area or living conditions, is prohibited. The Red List of Georgia was approved by the Presidential Decree No. 303 ‘On approving the Red List of Georgia’ (May 2, 2006).

Table 1: Other National Environmental Legislations and Applicability

<b>Framework Legislation</b>	
1995	Constitution of Georgia (as amended 04.10.2013) Reg. No - 010.010.000.01.001.000.116
1996	Environmental Protection (as amended 26.12.2014) Reg. No - 360.000.000.05.001.000.184
<b>Permitting Legislation</b>	
2005	Licensing and Permitting (as amended 18.09.2014)
2017	Environmental Assessment Code (01.06.2017) will enter into force from January 2017 (see para 36).
2007	Environmental Impact Permit (as amended 26.12.2014) Reg. No - 360.160.000.05.001.003.078
2007	Ecological Expertise (as amended 25.03.2013) Reg. No - 360.130.000.05.001.003.079
2013	Regulation on EIA (as amended 15.05.2013 by the Decree No 31 of MoENRP)
<b>Specific Environmental Laws</b>	
1994	Soil Protection (as amended 26.12.2014) Reg. No - 370.010.000.05.001.000.080

1996	System of Protected Areas (as amended 30.04.2014) Reg. No - 360.050.000.05.001.000.127
2007	On Status of the Protected Areas (as amended 30.04.2014) Reg. No - 360.050.000.05.001.003.060
2014	Waste Management Code 26.12.2014 Reg. No -360160000.05.001.017608
1996	Minerals (as amended 26.12.2014) Reg. No - 380.000.000.05.001.000.140
1997	Wildlife (as amended 26.12.2014) Reg. No - 410.000.000.05.001.000.186
1997	Water Protection (as amended 26.12.2014) Reg. No - 400.000.000.05.001.000.253
1997	Transit and Import of Hazardous Waste within and into the Territory of Georgia as amended 11.03.2011) Reg. No - 300230000.05.001.016218
1998	Pesticides and Agrochemicals as amended 08.05.2012) Reg. No - 340120000.05.001.016723
1999	Atmospheric Air Protection as amended 5.02.2014) Reg. No - 420.000.000.05.001.000.595
1999	Forest Code as (amended 6.09.2013) Reg. No - 390.000.000.05.001.000.599
2003	Red List and Red Data Book of Georgia (as amended 6.09.2013) Reg. No - 360.060.000.05.001.001.297
<b>Other Relevant Laws and Normative</b>	
2005	On Fire Protection and Safety 24.06.2005 Reg. No - 140.060.000.05.001.000.355
2006	On Regulation and Engineering Protection of Coasts of Sea, Water Reservoirs and Rivers of Georgia – 27.12.2006 Reg. No - 330.130.000.11.116.005.130
2007	On Cultural Heritage (as amended 26.12.2014) Reg. No - 450.030.000.05.001.002.815
2007	On Public Health (as amended 29.05.2014) Reg. No - 470.000.000.05.001.002.920
2013	Technical regulations applicable to the European Union and the Member States of the Organization for Economic Cooperation and Development, as envisaged by the Annex to the Resolution, shall be enacted in Georgia. Approved by the Government Decree № 50 Reg. No - 300.160.040.10.003.017.214.

2014	Technical Regulations: "on Drinking Water Standards". Approved by the Government Decree № 58 Reg. No - 300160070.10.003.017676
2014	Environmental Technical Regulations. Approved by the Government Decree № 17 Reg No - 300160070.10.003.017608

30. Some of the **International Treaties and Conventions** Ratified or Signed by Georgia are provided in the list below.

- Short List of the Ratified or Signed Conventions:
- Ramsar Convention on Wetlands (1996);
- United Nations Framework Convention on Climate Change (UNFCCC) (1994);
- Kyoto Protocol (1994);
- Kyoto Protocol (1999);
- Basel Convention on the Control of Transboundary Movement of Hazardous Waste and Their Disposal (1999);
- Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) (1999);
- Convention on Biological Diversity (1994);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1996);
- Convention on Long-range Transboundary Air Pollutants (1999);
- Stockholm Convention on Persistent Organic Pollutants (2006);
- Convention on the Conservation of European Wildlife and Natural habitats (2008);
- The Vienna Convention for the Protection of the Ozone Layer (1995);
- Montreal Protocol on Substances that Deplete the Ozone Layer (1995).

## ii. Administrative Structure in Georgia

31. Ministry of Environment and Natural Resources Protection of Georgia (MoENRP). MoENRP has the overall responsibility for protection of environment in Georgia. The Department of Permits of MoENRP is responsible for reviewing EIAs and for issuance of the Environmental Permits. MoENRP is the main state body pursuing state policy in the sphere of environment. Their functions for regulating economic or development activities with regard to environmental protection include:

- Issuing permits for project development (Environmental Impact Permit)
- Setting emission limits and issuing surface water intake and discharge consents
- Responding to incidents and complaint

32. For the projects, which do not require Construction Permit, the Environmental permit is being issued by the MoENRP on the ground of State Ecological Examination. State Ecological Examination is carried out by MoENRP upon official submission of Environmental Impact Assessment (EIA) prepared by project developers.

33. For projects requiring Construction Permit, no special permit is issued by MoENRP (according to “One window principle”, only one permit shall be issued for each activity). The Construction Permit is issued by the Ministry of Economy and Sustainable Development of Georgia, but the issuance of the Permit is subject to the consent of the MoENRP in a form of Conclusion of Ecological Expertise, as well as the Ministry of Culture (Centre of Archaeological Studies, Department of Monuments protection). Consent of the MoENRP in such cases should be issued according to the same procedures (EIA, public consultations; SEE etc.) as for issuing Environmental Permit.

34. The Ministry of Economic and Sustainable Development as an administrative body issuing a permit ensures the involvement of the MoENRP as a different administrative body in the administrative proceedings initiated for the purpose of permit issuance, in accordance with Georgia’s Law on Licenses and Permits.

35. As a rule, EIA permitting conditions contains requirement for informing MoENRP regarding fulfilment of the EIA permit conditions. This basically means giving information regarding implementation of Environmental Management and Monitoring Plans.

36. The **Ministry of Culture and Monument Protection of Georgia** is responsible for the supervision of the construction activities in order to protect archaeological heritage. In case if construction is to be carried out in a historic sites or zones of cultural heritage, consent of the Ministry of Culture is also required for issuing construction permit (If such is necessary).

## DESCRIPTION OF PROJECT

### 1. Type of the Project

37. The proposed Urban Services Improvement Investment Program is intended to optimize social and economic development in selected urban areas (provincial capitals and secondary towns) through improved urban water and sanitation services. This ADB funded Multitranchise Financing Facility Investment Program complements the government’s emerging vision for the WSS sector, formulated in its sector development strategy and road map, policy framework and reform implementation plan, and a business climate that encourages increased donor investment. This support will also complement on-going donor efforts to improve and expand Georgia’s urban WSS services. ADB identifies support to developing the country’s municipal infrastructure a key contributor to enhancing sustainable economic growth, with the cross cutting themes of governance, regional cooperation and environmental protection. ADB’s support can contribute to: (i) sector reforms; (ii) strengthening the link between financing local infrastructure projects and decentralization reforms; (iii) stimulating local economic development; and (v) improving the quality of life of urban population

38. The Investment Program focuses on investments in improvement of basic urban infrastructure (i.e. water supply and sewerage). Besides, it will also provide policy reforms to strengthen urban governance, management, and support for urban infrastructure and services. This Program will be implemented in tranches over a period of 8 years beginning in 2011. The Executing Agency (EA) is the Ministry of Regional Development and Infrastructure (MoRDI), Government of Georgia; and the Implementing Agency (IA) is the United Water Supply Company of Georgia, a wholly-owned company of Government of Georgia under MoRDI.

39. The Kutaisi WS improvement project has been classified as environmental assessment category B (some negative impacts but less significant than category A). According to ADB procedures, the impacts of the subproject were assessed by the Initial Environmental Examination, conducted according to ADB Safeguard Policy Statement (2009). According to Georgian Legislation an Environmental Impact Assessment does not need to be conducted for the project measures under Tranche 3.

40. This IEE relates to the water supply subproject only.

41. This is an urban water supply improvement sub-project. It involves the rehabilitation of the part of the network that was not included under Tranche 1, the construction of one new reservoir (New East), the construction of two small collector reservoirs for the pumping stations at Partkhanakanebi and Mukhniari, the extension of TV Tower Reservoir (second chamber) and the rehabilitation of Kvitiri and Mukhnari pumping stations.

42. KUT-01 project requires the crossing of Rioni River for the transmission line from Mukhiani pumping station to the New East Reservoir.

43. The draft design envisages the conveyance of the raw potable water from the right bank of the Rioni River, where Vartsikhe HPS dam is situated, upstream, about 6km, to the left bank territory of the Rioni River adjacent to the water pumping station, through a water supply pipe, which presumably will be conducted through the aqueduct, which is perpendicularly crossing the Rioni River course. It is envisaged that the several piles of the aqueduct will be constructed directly into the course of the Rioni River.

44. on Environmental Impact (2008) the project does not require EIA and obtaining of Permit on Environmental Impact.

45. Following 'Environmental Considerations in ADB Operations' of September 2009, the Project can be considered to be a Category B project requiring an Initial Environmental Assessment (IEE). The Project will not require an acquisition of land and resettlement activities will not become necessary at all. There is no protected area located closely and ecologically sensitive habitats will not be affected

### **3. Need of the Project**

46. The service level of urban water supply and waste water treatment at present is not satisfactory in Georgia. Services are not available to the entire population and the serviced areas suffer with inefficient service levels. Systems are old and inefficient. The situation is no different in the program town of Kutaisi. The WS project is needed because the present water supply infrastructure in Kutaisi is inefficient and inadequate to the needs of the growing population and tourists.

### **4. Location**

47. Kutaisi, the capital of Imereti region, is the second largest Georgian city and the political, economic, and cultural centre of Imereti region. Imereti region, with a total area of 6,515.8 km, is strategically located on the main East-West transit corridor between the Caspian and the Black Sea. It is the most populated region in Georgia, with more than 702,700 inhabitants (based on 2002 data). It consists of 12 administrative-territorial units – the city of Kutaisi and eleven districts (Baghdati, Vani, Zestaphoni, Terjola, Samtredia, Tkibuli, Khargauli, Khoni, Tskaltubo, and Chiatura). Kutaisi, which is some 240 km to the west from the capital City of Tbilisi, lies on the river Rioni, the main river in western Georgia draining to the Black Sea. The total population of the City amounts to 192,500 (2010). Regional location of Kutaisi is shown in **Map 1**.



**Map 1: Location of project town**

## Location of Aqueduct

48. Project Aqueduct crossing area is located in the lower part of Kutaisi, between Nikea Street and the railway line in Kutaisi. At Project Bridge crossing place the Rioni River right terrace is 304 meter height and Characterized with straight relief, which is located with various buildings and Nikea Street. The left side terrace of the river is 5-8 meters height, on which the local motorway road is located.

## 5. Existing Situation

49. The United Water Supply Company of Georgia<sup>1</sup> (UWSCG) provides water supply in Kutaisi. Owing to its location, there are numerous well fields. These well fields are the main source of water supply to the town. These sources at present provide 36,489 m<sup>3</sup>/day.

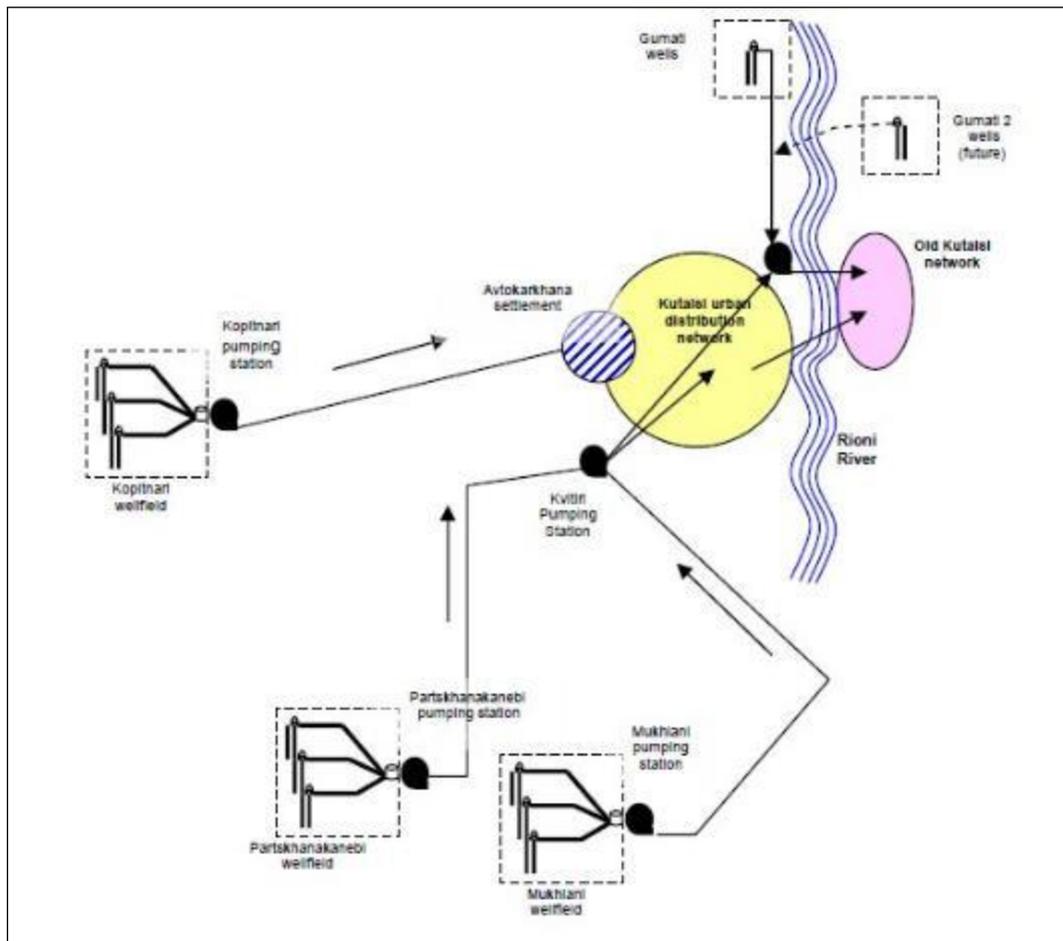
50. Partskhanakanebi Well field is the largest single source of supply for Kutaisi. It lies near the village of the same name, about 15 km south-south west of the outskirts of the city, among farmland and river floodplains. The pumps produce 1,250 m<sup>3</sup>/h (347 l/s). Mukhiani Well field is near to Partskhanakanebi, only 3 km further to the east. Four pumps each of Russian manufacture, rated at 1,000 m<sup>3</sup>/hour (278 l/s). Kopitnari well field was developed in 1970. The well field itself has a total of 22 wells, of which 16 are currently in operation. They are each rated at 120 m<sup>3</sup>/hour though it is doubtful whether they actually deliver that flow. The village of Gumati is situated on the right (west) bank of the Rioni River some 4 km up- stream (north) of Kutaisi. At present four of the original seven wells from Gumati well field remain operational. They are of various sizes (25, 25, 60 and 160 m<sup>3</sup>/hour), and yield in total an estimated 200 m<sup>3</sup>/hour.

51. The present water supply system covers about 95% of the population in urban areas. Due to old systems water losses are very high.

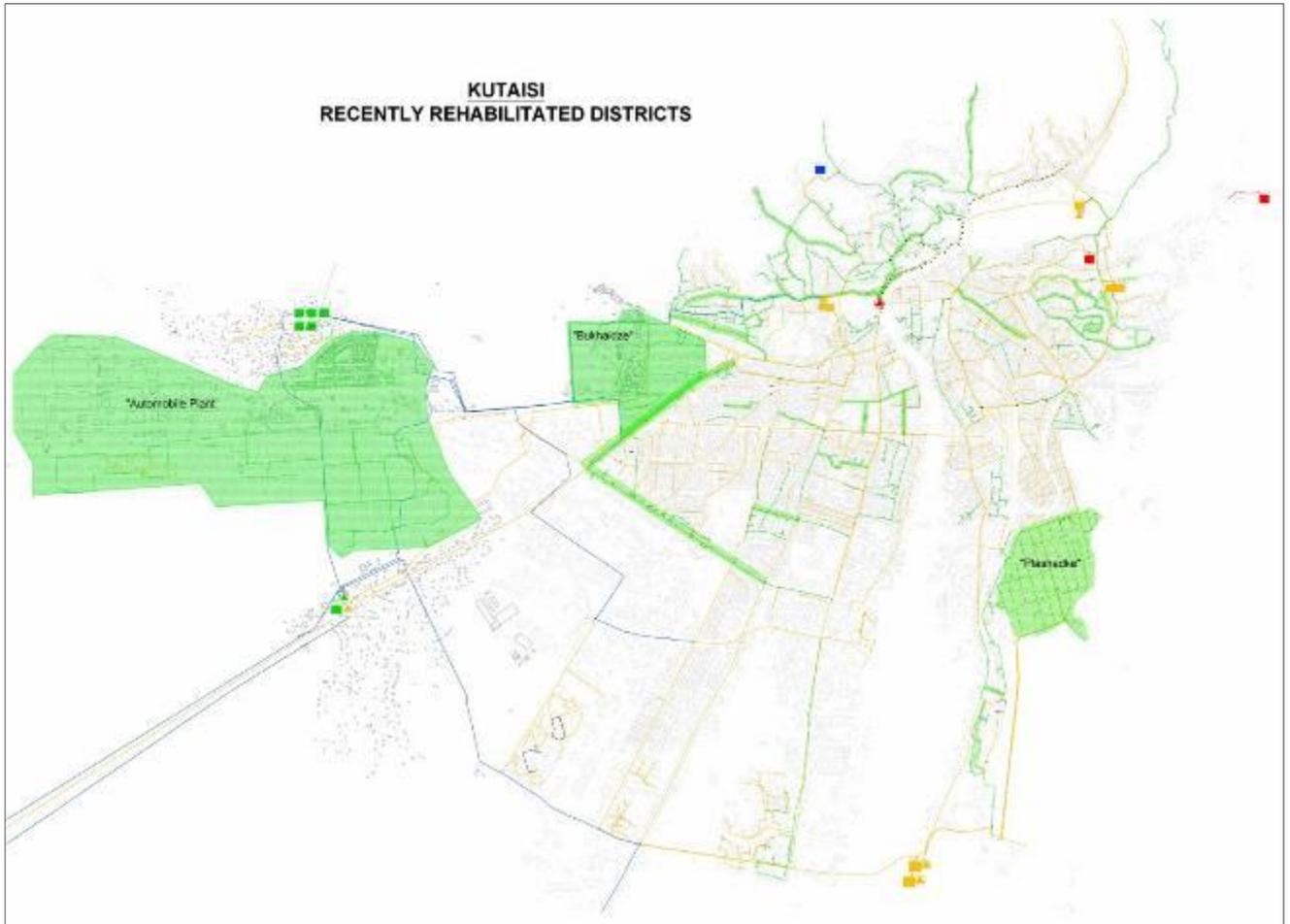
52. The present sub-project is designed to improve the service standards of water supply in Kutaisi – daily supply of potable water in adequate quantity (205 lpcd) at requisite pressure. In addition water has to be provided for industrial purposes (2,300 m<sup>3</sup>/d).

53. The chemical quality of the groundwater is good and the samples meet all of the standards applicable to Georgia except for the bacteriological tests, where the failure rate is relatively high.

54. The proposed complete WS infrastructure improvement works will be located in and around the town. There are three main components of the project: (i) restructuring of water supply network if required (ii) exchange / reconstruction of old transmission pipes and (iii) construction of new reservoirs and pumping stations.



**Fig. 1 Existing Water Supply at Kutaisi**



**Map 2: Water Supply Network and recently rehabilitated districts (green colour)**

55. Above map shows water supply network within Kutaisi. Old pipes that need replacement will be exchanged by new ones. To overcome deficiencies in supply, the network will be restructured where necessary.

## **6. Project Description**

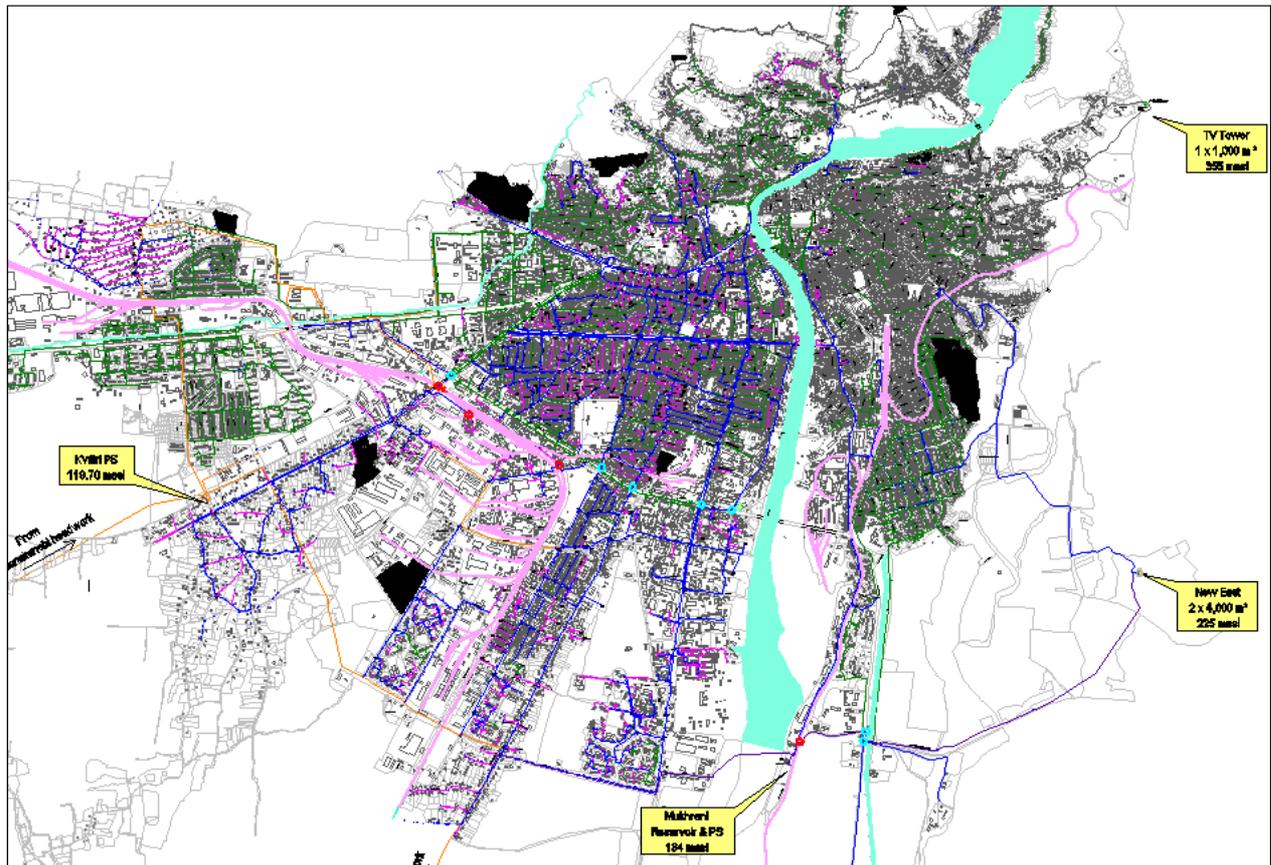
56. A feasibility study was conducted to improve the water supply system in Kutaisi to meet the design year demand (2040) and the project is formulated for implementation under the proposed ADB funded Investment Program. Works are proposed to be implemented through multi tranche funding.

57. The proposed water supply infrastructure improvement works have been elaborated based on the development goals identified in the Feasibility Study. The following measures are foreseen under Tranche 3. They are Phase II of the extension and rehabilitation of the water supply system.

- (i) the rehabilitation of the part of the network that was not included under Tranche 1.
- (ii) the construction of one new reservoir (New East) that will be located East of the Kutaisi, at a distance several hundred meters from the closest population.
- (iii) the construction of two small collector reservoirs for the pumping stations at Partskhanakanebi and Mukhnari

- (iv) the extension of TV Tower Reservoir (second chamber)
- (v) the rehabilitation of Kvitiri and Mukhnari pumping stations.

58. The following map illustrates the measures of Phase II that are part of Tranche 3. Blue lines present new pipes to be laid. Yellow boxes describe the new reservoirs and collector reservoirs.



**Map 3: Measures in Water Supply System Phase II**

59. The following tables summarize the investment measures.

60. Table 2: Summary of Investment Measures

Reservoir	Supplied from	Volume	Max Water Level	Height	Service Area / PS / Reservoir	Details
<b>Phase II</b>		[m <sup>3</sup> ]	[m]	[m]		
Collector Partskhanakanebi	Partskhanakanebi well field	1 x 1,000	65	4.00	Kvitiri PS	square
Collector Mukhnari	Mukhniani well field	2 x 1,000	134	4.00	New East Reservoir	square
New East	PS Mukhnari	2 x 4,000	225	4.00	east part, east of the river	circular
TV Tower	PS Kldiashvili	1 x 1,000	355	4.00	higher zones, east of the river	circular
<b>Total [m<sup>3</sup>]</b>		<b>12,000</b>				

Table 3: New reservoirs and collector reservoirs

Technical Description	
Kvitiri PS	Centrifugal Pumps for Water Supply system
	Equipment: control and measure instruments for monitoring and remote control, fittings, connection pipes, valves
	Technical data:
	Total head: 103 m
	Hgeo: appr. 86 m
	Qmax = 913 m <sup>3</sup> /h (3 operation, 1 standby)
	min. overall efficiency: 70%
Mukhnari PS	Centrifugal Pumps for Water Supply system
	Equipment: control and measure instruments for monitoring and remote control, fittings, connection pipes, valves
	Technical data:
	Total head: 108 m
	Hgeo: appr. 94 m
	Qmax = 620 m <sup>3</sup> /h (2 operation, 1 standby)
	min. overall efficiency: 70%

Table 4: Rehabilitation of pumping stations

Start of Transmission Main	End of Transmission Main	Existing Material	Existing Diameter [mm]	New Material	New Diameter [mm]	Length [m]
Crossing point of Mukhiani Main	Mukhnari PS	Steel	400	DCI	500	2,950

Table 5: Replacement of transmission main

Start of Transmission Main	End of Transmission Main	Material	Diameter [mm]	Length [m]
PS Mukhnari	New East reservoir	DCI	500	4,180
New East reservoir	Network	DCI	500	4,800

Table 6: New transmission mains

Pipe Diameter	Pipe Length	Pipe Diameter	Pipe Length
OD 50	2,454.50	OD 225	5,907.00
OD 63	23,701.00	OD 250	2,171.20
OD 75	14,755.20	OD 280	9,455.70
OD 110	10,319.90	OD 315	1,517.60
OD 125	32,488.20	OD 355	5,100.10
OD 140	3,707.20	OD 400	4,351.60
OD 160	1,420.80	OD 450	2,854.40
OD 180	23,156.00	OD 500	795.60
OD 200	2,773.30	OD 630	10,335.50

Table 7: New distribution pipes

## 7. Construction Activities

61. Main components the subproject are the restructuring of water supply network, the exchange / reconstruction of old transmission pipes, the construction of new reservoirs, two collector reservoirs and the rehabilitation of two pumping stations.

62. Construction practices of these works are described below:

- (i) Pipe Laying. Existing old, malfunctioning or leaking pipes will be replaced. Pipelines will follow existing roads and existing alignments. Trenches will be dug using a backhoe digger, supplemented by manual digging.
- (ii) Excavated soil will be placed alongside, and the pipes will be placed in the trench. Pipes will be joined, after which excavated soil will then be replaced on beneath and sides. The trench will be refilled with excavated soil and sand and compacted manually. The depth of trench will be 2 m – 3 m depending on topographical conditions. Minimum width of the trench will be between 0,8 m. After construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material.
- (iii) Construction of Reservoir. This work will involve excavation for foundations, placing of reinforcement rods in wooden shutters and pouring of concrete in voids to form foundations, floor, walls and roof. Cement mortar plaster will be applied to walls (outside and inside), floor and roof for smooth finish. Inlet and outlet pipes and fixers/valves will be installed. Excavation for foundation will be done by backhoe digger or manually, where required. Concrete will be mixed in concrete mixer and needle (pen) vibrator will be used for compaction of concrete around the reinforcement. The quantity waste/surplus soil generated from this activity will be insignificant and can be used within the site to level the ground surface.
- (iv) Construction of Aqueduct. The construction phase consists of: Diversion of the river Rioni (depending on the discharge of the river on the date of construction); Construction of the piles for the footings of the aqueduct; Construction of the footings of the aqueduct; Construction and assembly of steel carrier system on the footings,

63. *Source of construction materials.* In Kutaisi, sand is sourced from River Rioni and aggregate is sourced from licensed crushers. Construction waste/debris is normally used for levelling low lying areas in the town. No additional IEE will be required as material extraction will be limited to licensed sites and facilities only.

64. *Transportation routes.* As illustrated in Map 3, transportation routes to the structures will pass through populated areas. Only New East Reservoir will be accessed from the highway Tbilisi – Kutaisi and a small dirt road. For mitigation measures please refer to the subsequent chapters.

## 8. Implementation Schedule

65. Construction works of Phase II are scheduled to start in 2014. The construction period will be three years.

## 9. Operation of Improved Water Supply System

66. Water supply infrastructure will require repair and maintenance activities like detection and repair of leaks. Since good quality pipes are being used breaks are very rare, and

leaks will be mainly limited to joints between pipes. Repair work will be conducted in the same way the pipe was laid, after locating the leaking section.

## DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

### 1. Physical Resources

#### a. Ambient Air

67. City of Kutaisi is located in the humid subtropical region of the West Georgia. The major climate peculiarities of this region are mainly explained by its location at the east shore of the Black Sea, near the north boundary of the subtropical zone.

68. The average annual humidity in Kutaisi is 70% with lesser rate of 64% in the winter. Precipitation is also quite high with the annual quantity exceeding 1580 mm. The maximum precipitation falls in the winter months with average monthly rate of 170 mm, while the minimum rainfall period includes May and August, with monthly rates of 42 mm and 95 mm respectively. The climate conditions in the city and its environs are characterized by relatively dry and hot summer, moderately warm winter and frequent and strong east background winds.

69. Average annual days with the background winds is 114 (with maximum frequencies in winter and summer). Wind velocity achieves 40 m/s. In the West Georgia such winds just in a few hours may cause temperature rise of 10-20 degrees and humidity drop of 5- 10%. The long term annual wind distribution is as follows: east winds 53%, west winds 34%, various other directional winds 13%.

70. Due to its location at the east part of Kolkheti Lowland, Kutaisi climate significantly differs from the weather conditions attributed to the cities situated at the east Black Sea coast that is well evidenced from its temperature pattern. Specifically:

- Average annual temperature is 14.5 °C
- The warmest month is August with average temperature of 23.6 °C
- The coldest month is January with average temperature of 5.2 °C
- The temperature variation magnitude is of 18.4 °C evidencing the lack of large contrasts between seasons.

71. In the specific years the maximum air temperature reaches 41.0-42.0 °C (10-year return period), and the minimum temperature drops to -17.0 °C (50-year return period). Below is provided information on average monthly temperatures and winds derived from the data of the closest meteorological station.

Average annual air temperature:

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
°C	5.2	5.8	8.4	12.9	17.9	21	23.2	23.6	20.5	16.4	11.5	7.5	14.5

Average minimum monthly air temperatures:

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
°C	2	2.5	4.4	8.4	12.7	16.2	18.7	19.3	15.9	12.1	8.2	4.6	10.4

Absolute minimum air temperatures for each month:

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
°C	-17	-13	-10	-5	2	9	11	11	5	-2	-10	-13	-17

Average maximum monthly air temperatures:

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
°C	9	9.9	13.3	18.9	24.1	27	28.4	28.9	26	21.8	15.9	11.4	19.6

Absolute maximum air temperatures for each month:

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
°C	21	25	32	35	37	40	41	42	40	35	30	25	42

72. The full scale assessment of the ambient air quality in Kutaisi has not been performed since the end of 1980s. That time the industries located within the city area were significantly more active compared to present.

73. The major components of the industrial emissions comprised suspended particles, sulphur anhydride, carbon oxide, nitrogen oxides, hydrocarbons, hydrogen sulphides, smoke, etc.

74. It should be noted that the meteorological conditions prevailed in Kutaisi largely determines the level of the air emission impact.

75. As noted above, the possibilities for any comprehensive observations over the ambient air quality was significantly restricted during the recent years. In result no information on the average concentrations of hazardous pollutants in the outdoor air was available. Therefore the population based method recommended for such situations was applied for estimating the likely concentrations of air pollutants within the city area (see Table ??). As for 1 January 2012 Kutaisi population is 196,500, the reference estimated concentrations applicable to the urban settlements with population range of 250-125 thousand shall be used.

Table 8: The reference values of background concentrations (mg/m<sup>3</sup>)

Population (thousand)	Dust	Sulphur Dioxide	Nitrogen Dioxide	Carbon Oxide
<b>250-125</b>	<b>0.4</b>	<b>0.05</b>	<b>0.03</b>	<b>1.5</b>
125-50	0.3	0.05	0.015	0.8
50-10	0.2	0.02	0.008	0.4
<10	0	0	0	0

## 2. Topography and Soils

76. *Topography.* Despite its small area, Georgia presents one of the most varied topographies within its geographical boundaries. Kutaisi lies at an elevation of 125-300 meters (410-984 feet) above sea level. To the east and north-east, Kutaisi is bounded by the Northern Imereti Foothills, to the north by the Samgurali Range and to the west and the south by the Kolkheti Lowland.

77. Similar to the other natural features, the overburden soils occurring around Kutaisi are also distinguished by their diversity. The topsoil types developed in specific parts of the city environs depend on the prevailed geological structure, terrain, climate and vegetation cover. The major surface soil types distributed around Kutaisi comprise alluvial, subtropical podzol, yellow, carbonated humus-rich and podzol topsoils.

78. The alluvial soils are extensively distributed south and south-west of Kutaisi. The non-carbonated alluvial soils are mainly observed on the river terraces developed in the left part of the city.

79. The subtropical podzol soils are common in the upper part of Kolkheti Lowland, as well as within the hilly zone. The level of podzolization of the terrace topsoils varies depending on their age.

### 3. Surface water

80. The Rioni River is the largest river in the Western Caucasus and the largest tributary to the Black Sea. Rioni River is draining approximately 20% of the country. It starts from the main summit of Caucasus Mountains, at the bottom of the Mountain Fasi (2620asl). The mouth of the river is situated at Poti, where it flows into the Black Sea. The length of River Rioni is 327 km, the average slope – 7.2%. The catchment covers 13,400 km<sup>2</sup> and the average height of the watershed is 1,084 m. Main tributaries of the river Rioni are as follows:

- Jojora – length 140 km
- Kvirila – length 140 km
- Khanistkali – length 57 km
- Tskhenistskali – length 176 km
- Nogela – length 59 km
- Tekhuri – length 101 km
- Tsivi – length 60 km.

81. The River Rioni is fed with water from icy mountains, snow and rain water. Snow and rain water contribute the most to its flow. The river floods mainly in spring to summer (March – end of August), with the maximal peak in May/early June as the result of snow melt and rains. The second period of flooding is the end of September to October – this is a result of heavy rains. The average flow of the Rioni in Kutaisi is 132.7 m<sup>3</sup>/sec. The project area, Kutaisi, is situated in the flood plains of Rioni River Basin. The River flows through Kutaisi town.

82. The Rioni River is polluted with industrial and municipal wastewaters. As the wastewater treatment plant, Patriketi, is not operating, all the wastewaters are discharged straight to this river. Faecal masses from Choma district are also polluting river Rioni as this district is not connected to the sewage network. The Rioni is polluted with industrial and municipal waste. The majority of the industrial sources of pollution are not operating at present, however they were polluting the river for years with industrial waste and oils. Industrial plants were not equipped in any pre-treatment facilities and they used to discharge industrial waste directly into the river. There are no recycling facilities for used oils, they are still discharged to the river. Water quality data of Rioni River are not available. Basically the water quality of Rioni River is supposed to be bad and its quality should be tested prior to use as construction water to make sure that it meets the required quality.



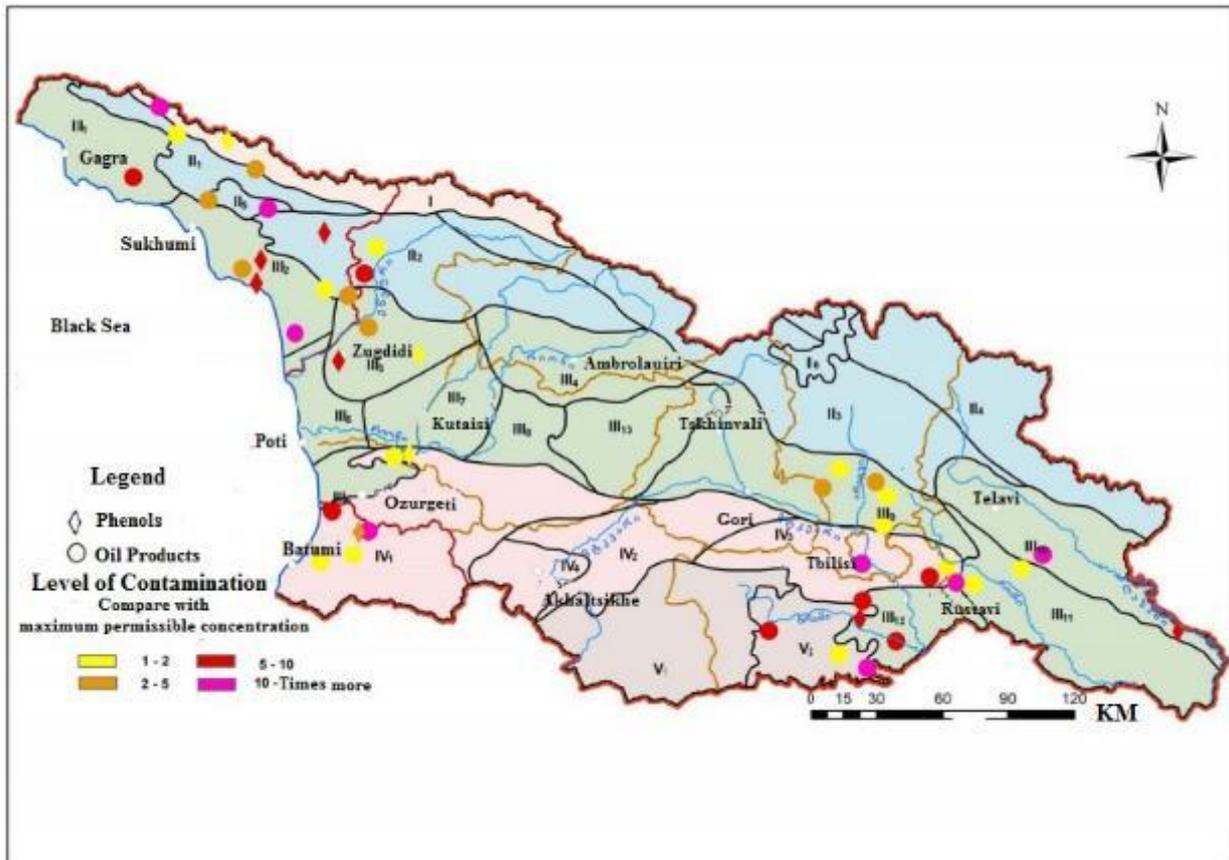
**Map 4: River Network in Western Georgia**

#### **4. Groundwater**

83. Groundwater occurring within Kutaisi mainly is of infiltration type, i.e. the rainfall water leaking into the ground down to the impervious layers. Such water moves along the impervious layers and often is released out of surface in a form of springs. The depth of aquifers from the ground surface mainly varies in a range of 2-10 m. In addition the area hosts the juvenile (magmatic) waters.

84. According to the hydrogeological zoning of Georgia, Kutaisi is included into Tskaltubo porous, fractured, fractured-karstic and karstic artesian basin occupying its east part within the basin feed limits. Based on the Hydrogeological Zoning Layout of Georgia, with respect to the natural groundwater patterns, the area belongs to the annual feed type, abundant feed subtype and drained regional class.

85. The major water extraction facilities providing water supply of Kutaisi include Parskanakanebi, Mukhiani-Kachara and Kopitnari well fields located at the east part of Kolkheti Lowland, on the Rioni-Gubistskali interfluvial plain.

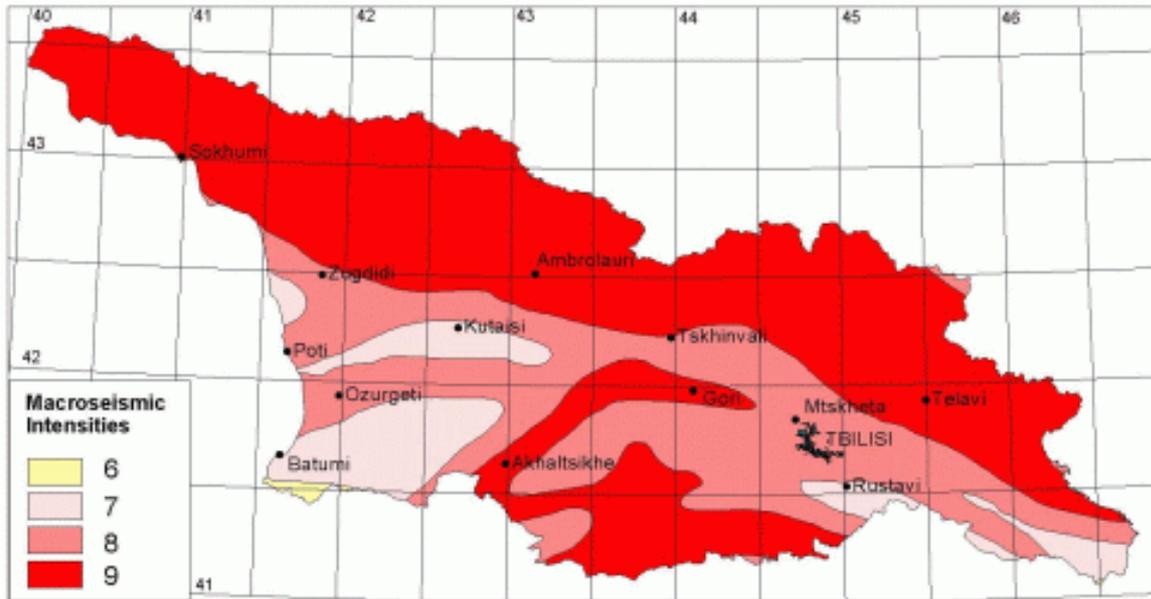


**Map 5: Hydro-geological Zones**

## 5. Geology/Seismology

86. According to geotectonical zoning, Kutaisi area belongs to the west molasses depression (Rioni Intermontane Trough) of the Transcaucasian Intermontane Lowland. The overburden mainly consists of the Neogene-Quaternary molassas deposits overlaying the slightly dislocated Cretaceous and Paleocene strata. Within the study region, the Neogene is represented by 4 horizons: Loamy deposits horizon (sandstones, clays, marls), Chockrak horizon (conglomerates, sandstones, limestones and marls), Karagan horizon (sandstones, marls and limestones) and Sarmatian horizon (clays, sandstones). The Quaternary deposits are extensively distributed within Rioni River basin, where the recent deposits of the lower and upper Quaternary period are identified. The lithological structure of the early and late Quaternary alluvial deposits comprise the pebbles and cobbles with pebble-sandy, sandy, clayey and loamy filler. The recent late Quaternary elluvial-delluvial deposits overlay the pre-Quaternary deposits, which in turn as a rule are built by clays and loams along with the rubble. The thicknesses of such elluvial-delluvial formations vary in the range from 1m to 20m with maximum reached at the zone of development of the clay-marl and sandstone deposits. Thickness of the Holocene layer is 40-50 m generally including the alluvial, alluvial-marine and biogenic deposits.

87. The area is mainly covered by alluvial deposits lithologically represented by coarse grained soils and sandy and loamy-clayey material.



**Map 5: Seismic Zones of Georgia**

88. Soil. Most of the underlying sediments are covered by top soil. Top soil means the upper part of the earth cover (depth 0.3 – 0.5m). It is aerated and contains roots. The top soil is underlain by alluvial clay and sand deposits.

89. From geological point of view Project Aqueduct crossing place is presented with little 1-3 m. capacity quaternary and River sedimentary rocks with riprap inclusion, hard plastic loam and sand and with cobbles filled with sands and boulders, Below which are the main rocks (3-4 m. capacity hard cracked and hard exhausted, thin layer marl stones and Several dozen meters of capacity little cracked and little exhausted lime stones).

## 6. Flora

90. Kutaisi is located in the east botanical region of Kolkheti Lowland. In the past Kutaisi environs, as well as the largest part of Imereti Region was covered with forests. Up to the middle 19th century, when an inexorable tree felling commenced, a thick forest was growing along Kutaisi-Tskaltubo motor road.

91. Currently the plains and hilly zones surrounding the city mainly are completely forestless and occupied by agricultural lots. However some forest fragments still have been maintained within the city boundaries and at its approaches. From these, the major one is Sagoria Forest expanded over 480 Ha, where the dominating tree species is an oak.

92. The secondary forests have been occasionally developed after felling the relict forests east and north of Kutaisi, including the forest growing at the left bank of Tskaltsitela River, near village of Godogani where the major tree species comprise oak, hornbeam, black locust (*Robinia pseudoacacia*), etc.

## 7. Protected Areas

93. The Project impact zone does not intervene into any protected area. The closest protected areas are Ajameti and Sataplia State Reserves, which are respectively 18-20 km and 12-15 km apart from the Project area.

## 8. Fauna

94. For today the areas of Kutaisi and its environs have extensively been reclaimed and

the densely populated settlements have been established thus significantly restricting the wildlife ranges and minimizing the number of wild animals. However, it should be noted that in the past these areas were deemed to provide the best hunting sites. The following wildlife species occur in the areas adjacent to city:

- Rodents: mouse, hare, squirrel, etc. From Chiroptera species: bats, etc.;
- Insectivores: hedgehog, Colchis mole, etc.;
- Birds: frequently occur lark, crow, rook, owl, oystercatcher, sparrow, cuckoo, starling, blackbird;
- Reptiles: lizard, grass snake, whip snake, rat snake and numerous tortoise species;
- Amphibians: common toad, green toad, marsh frog, tree frog, etc.;
- Invertebrates: insects, locust, flies, butterflies, beetles, etc.

95. Due to the heavy human impact lasting for decades, the area is very poor with respect to fauna diversity and occurrence. Only the species characteristic to urban settlements were recorded during audit conducted around the area.

## **9. Aquatic Biodiversity**

96. To determine the extent of the impact of the construction of the aqueduct's piles on the fish species of Rioni River, baseline investigation of Ichthyofauna was performed by the ichthyologic team of "Gama-Consulting", LLC in in 20-30.10.2017, including the field survey and analysis of the literature sources.

### **Survey Methodology**

97. The Rioni River, especially in the upper reach of the Vartsikhe HPS dam, is joined by the following rivers: the Kvirila and Khanistskali. The ichthyofaunal investigation included the desk works, visual inspection, field surveys, consultation with stakeholders (survey of local residents and amateur fishers) and laboratory processing of the obtained material. The survey methodology is fully compliant with methods widespread in international practice. More detailed information about the Consultations carried out with local residents and fishermen are presented in para 194-199 of the proposed IEE andl also in Appendix 3.

98. The condition of the fish stock of different species in a body of water is estimated by the general mass of the recently caught fish; by quantitative ratio of age group; by the age at the first and massive puberty in population; by the determination of direct impact of growth rate on puberty; by the effectiveness of the weapons used during fishing and by the seasonal time of fishing.

99. During field and laboratory surveys, the "Gama-Consulting", LLC, ichthyologic field teams followed those widely recognized methods, which are described in:

- Pradvin I.F. – Guide to the Study of Fish (mainly freshwater). Publishing House "Food Industry", Moscow, 1966.
- Konstantinov A.S. – General Hydrobiology. Publishing House "Higher School", Moscow, 1986.

100. It should be emphasized also that during the survey no key species, namely Sturgeon was captured, due to the migratory nature of the fish. To determine presence of Sturgeon in Rioni River additional consultations were held with the key Stakeholders, including Mr.Archil Guchmanidze, National Sturgeon Expert. As Mr.Guchanidze explained, no sturgeon was captured since 1984, in the upper part of the Vartsikhe HPP canal, neither by fishermen nor by scientists during surveys.

### **Visual Inspection**

101. Visual inspection means the identification of the habitat of individual ichthyofaunal species (geomorphology of the course of the survey river, general hydrologic characteristics,

habitat hypsometry, relief, riverbed hypsometry, visual and landscape background), based on which Gama-Consulting has theoretically identified the possible denizen species in the design sections of the Rioni, Kvirila and Khanistskali Rivers. The proposed method of preliminary examination is actively employed in numerous countries of the world.

### Field Survey

102. The field survey includes the full biological analysis of the fish found at a specific location by “Gama-Consulting” (length, mass, sex, puberty stage, scale labelling and storage for laboratory analysis for determining age and growth rate), study of their foodbase, hydroflora and hydrofauna; identification of water macro invertebrates and edible insects; study of their, as fish and as invertebrate animal, dwelling – ecologic surrounding;

103. During the field surveys, “Gama-Consulting” had test catches with cast net (weight 7.0 kg, loop size 14 mm). The catching was done at trial points, at the section of 50 and 100m. Only sports/amateur fishing weapons were used during the survey; therefore, their usage does not require the special permit or license. The survey parameters include the study of all biotic and abiotic factors associated with fish ecological niche.

104. During the catching of the fish with cast net, each individual specimen is registered in field log including their external parameters and internal physiological condition; the scale samples are labelled and stored in a special polypropylene container for later laboratory studies

### Laboratory Study

105. As a rule, the part of the material caught while fishing at every field survey is returned to the river in a live condition (catch-relieve principle); while the other part is transported to the laboratory for further studies, in particular age, puberty stage, sex, condition factor, meristic and plasticity traits, as well as, content of food digestive tract are determined and observed. Laboratory studies are conducted in accordance with widely accepted standard methodologies.

### The list of fish species found in design section by Gama Consulting.

#### **Colchian Common barbel**

**Species:** Colchian Common barbell

**Latin name:** *Barbus tauricus rionica*, Kamensky, 1899

**Type:** freshwater

**Habitat:** benthic-pelagic

**Food type:** half-predatory

106. Settlement Area: Asia Minor, Black Sea Rivers up to the Sarkis River. In Georgia it is found in Chorokhi, Choloki, KintriShi, Supsa, Rioni, Khobi, Enguri, Kodori, Bzipi, Psousa and their estuaries. In the lake Amkeli, and in Tkibuli and Lajanuri water reservoirs. Length – 55 cm, weight – 1.5, usually smaller ones are found. It is fatty, delicious freshwater fish. It dwells in stone and sandy places.

107. Living environment and behavior: in the river, it goes higher, at trout’s dwellings together with Transcaucasian barb. It prefers rapid, clear, stone and sandy riverbeds. It migrates at short distances; it spends winter in river coastal groves and riverbed pits. Reproduction: it reaches puberty from the age of 3-4; spawns twice; it is reproduced from May to August; it spawns earlier in the downstream, than middle and upstream; it spawns in shallow waters, at stone and sandy places; water temperature 12-18°C. Fertility depends on the age and body size; it spawns up to 2000-15000 roes in the rivers and up to 30000 in the lakes. Roes develop into larvae within a week. Nutrition traits: it feeds on benthos, clams, chironomids, crabs, and animal and plant detritus, river crabs, and some on small fish and

their caviar. Due to scarcity, it is not used in fisheries. X

#### **Transcaucasian Spirilin**

**Species:** Transcaucasian Spirilin

**Latin name:** *Squalius cephalus* (Linnaeus, 1758) = *Leuciscus cephalus orientalis* Nordmann, 1840

**Type:** freshwater

**Habitat:** benthic-pelagic

**Food type:** half-predatory

108. The body is prolonged, and is covered by large scales. It has a big head. In some samples, head's length is longer than the highest body height, in some samples head's length and body height are equal and in some - smaller. Its back is dark, sides are dark grey, and its abdomen is white. As usual, there is a dark smudge behind the gill. Its length is 50 cm, weight – 1.5 kg. Generally, they are small.

109. Settlement Area: The rivers: Mtkvari, Khrami, Aragvi, Alazani, Iori, Chorokhi, Kintrishi, Supsa, Natanebi, Rioni, Khobi, Enguri, Kodori, Bzipi; in the lakes: Jandari, Paravani, Saghamo, Bazaleti, Paliastomi, Bebesiri; water reservoirs: Khrami, Tbilisi, Sioni.

110. Living environment and behavior: freshwater; it dwells in stony-sandy places; Nutrition traits: it feeds both on animal and plant food; Reproduction: it reaches puberty from the age of 2-3; it spawns from May to August; spawns reach up to 15 000 -150 000; it is not used in fisheries; IUNC – requires caring (LC).

#### **Caucasian Stone Loach**

**Species:** Caucasian Stone Loach

**Latin name:** *Barbatula barbatula caucasicus* Berg, 1899

**Type:** freshwater

**Habitat:** benthophagous

**Food type:** pelagic

Length – 9cm, weight – 5 grams

111. Settlement Area: It is found almost in all water reservoirs and rivers in Georgia Living environment and behavior: freshwater; it dwells in lakes and water reservoirs, in silty and stone-sandy places; Nutrition traits: it feeds on planktons, benthos and algae; Reproduction: it spawns from June to September; its spawns reach up to 2000-3000 It is endemic to the Caucasus

#### **Caucasian Chub**

**Species:** Caucasian Chub

**Latin name:** *Alburnoides bipunctatus fasciatus* (Nordmann, 1840)

**Type:** freshwater

**Habitat:** benthic-pelagic

**Food type:** pelagic

Length – 13 cm, weight – 60 grams;

112. It mainly dwells in mostly shallow rivers, and small branches; it adapts well to lake conditions. It has a high body, compressed from sides; it is covered with easily loosing scales. There is a ridge behind the abdomen scale. It has a dark green back, while the sides are silvery. There is a double stripe alongside the lateral lines sometimes explicit, sometimes dim. There are dark patches scattered on sides, mainly in upper parts. Sometimes, the points of breast, abdomen and anal scales are of red shade.

113. Settlement Area: In the Chorokhi river and its confluents (Tkhinaristskali, Charistskali, Acharistskali, Machekhela); in the rivers: Chakvistskali, Kintrishi, Supsa, Rioni (at whole length), Churia, Tikori, Enguri, Ghalidzga, TimuSi, Dghamishi, Mokvi, Okumi, Kodori (with its confluents), Gumista, Tetriskaro, Shavtskali, Bzipi, Psou; in the lakes: Paliastomi,

Nabada, Amtkeli; in Tkibuli water reservoir; in eastern Transcaucasia.

114. Reproduction: it spawns from May to August; its spawns reach up to 2000-6000

115. Nutrition traits: it feeds on planktons, benthos and partly on algae; It is not used in fisheries; it competes with fishery fishes in terms of food and reproduction; IUCN – it is not assessed (NE).

**Photos of fishies of the project area:** *Squalius cephaus* (Linnaeus, 1758) (=Leuciscus cephalus orientalis Nordmann, 1840), *Barbus tauricus rionica* Kamensky, 1899, *Alburnoides bipunctatus fasciatus* (Nordmann, 1840), *Barbatula babatula caucasicus* Berg, 1899.



**Table 9.** Detailed Description of Obtained Individual Species (age, length, weight, sex and puberty stage, fishing coordinates).

Fishing point N	Date	Location coordinates and surrounding territories	Fish species	Amount	Length (cm)	Weight (gram)	Sex and Puberty Stage	Age
№1	20.10.2017	X= 310160.86; Y= 4677806.46; H=1180.8.9.	<i>Squalius cephaus</i> (Linnaeus, 1758) =Leuciscus cephalus orientalis Nordmann, 1840)	5	17	49	♂ <sub>3</sub>	3+
					12	20	♂ <sub>3</sub>	3+
					11	14	♀ <sub>3</sub>	2+

Fishing point N	Date	Location coordinates and surrounding territories	Fish species	Amount	Length (cm)	Weight (gram)	Sex and Puberty Stage	Age
					11	18	♂ <sub>3</sub>	2+
					11,5	15	♀ <sub>3</sub>	2+
			Barbus tauricus rionica Kamensky, 1899	1	8,5	6	♀ <sub>2</sub>	2+
			Alburnoides bipunctatus fasciatus (Nordmann, 1840)	1	11	12	♀ <sub>3</sub>	3+
			Barbatula babatula caucasicus Berg, 1899	2	10	10	♂ <sub>2</sub>	2+
					10	12	♂ <sub>2</sub>	2+

**Table 10:** The list of the fish found in the design section by IUCN Category

Name	Latin Name	Category Assessment	Distribution within the design section (+, -)
Transcaucasian Sprilin	Alburnoides bipunctatus fasciatus (Nordmann, 1840)	IUCN – it is not assessed (NE).	+
Colchian barbell	Barbus tauricus rionica Kamensky, 1899	IUCN -VU	+
Caucasian Chub	Squalius cephalus (Linnaeus, 1758) =Leuciscus cephalus	IUCN – needs caring (LC).	+
Caucasian Stone Loach	Barbatula babatula caucasicus Berg, 1899	-	+

116. Out of 41 fish species found in the Rioni River, only the ones given in the above table are observed and confirmed in the design section. As for the sturgeon species, their distribution zone is now believed to be outside the project premises.

117. The distribution area of the sturgeons is the lower reach of the Vartsikhe HPS, in particular from the estuary of the Rioni in the Black Sea to the discharge point of the consumed water from the Vartsikhe HPS cascades into the River Rioni's course.

118. From the mentioned point to the dam, the only obstruction for the sturgeon spawn migration is the scarcity of ecological flow in the lower reach of the dam. In order to exclude

the mentioned factor, fishery industry subordinate to “Sakshavzghvatevzmsheni” for the artificial description of the sturgeon was commissioned in 1983. This fishery had to annually convey the roes (several millions) of the sturgeons into the upper reach of the Vartsikhe HPS dam.

119. Such works were conducted until the end of the 80s, and from the 90s the industry went bankrupt and was transferred to the private property. The private owners were not obliged whatsoever to conduct the abovementioned specific works.

120. The negative impact on the Ichthyofauna of Rioni River and corresponding mitigation measures are described in Table 17.

## **9. Economic Development: (e.g.)**

### **a. Industries**

121. Assuming its production potential, Kutaisi is the second industrial city in Georgia after Tbilisi. The large and small scale businesses operating in the city provide significant contribution to economical development of the country. The major industrial sectors include electric power engineering, mechanical engineering, chemical industry, consumer goods industry, food industry, wood processing industry, production of non-metal minerals, etc. Due to the known events developed during the last 10-15 years, the most of city’s large production facilities stopped. However, in the recent year such trend has been reversing that is evident by opening of the new small scale businesses.

### **b. Infrastructure facilities**

122. *Urban Services.* UWSCG provides water supply and sewerage services in the town. Well fields are the main source of water supply. It is estimated that some 70% of the inhabitants of Kutaisi are connected to the wastewater network. While this connection rate is higher than in many towns and cities in Georgia it still means that a significant number of people have to use sanitation methods. Some of the unconnected areas are the relatively sparsely populated steep areas in the higher parts of the city where the topography would make it difficult and expensive to provide sewerage. There is no wastewater treatment facility; the collected wastewater is disposed into River Rioni without any treatment. Storm water drainage is available in part of the town. Solid waste management system is not well developed; waste is collected and disposed in low-lying areas.

### **c. Transportation**

123. Kutaisi is a transportation hub. It is located at the junction of the dense railway and road conduits. The city is connected to the main Georgian railway by two independent tracks constructed from Rioni and Brotseula (each of approximately 8 km length). These routes connect Kutaisi to all industrial centres and important economical regions of Georgia. Specifically the city is crossed by so called “Georgian Military Road” connecting the east and west parts of the country. Kutaisi has the international (in Kopitnari) and local (in Vehicles Factory Settlement) airports. Kopitnari Airport can serve as a backup for Tbilisi International Airport. The motor roads connect Kutaisi with north (Svaneti, Lechkhumi, Racha) and south (through Zekari pass) regions of Georgia. The total length of city road network is 312 km.

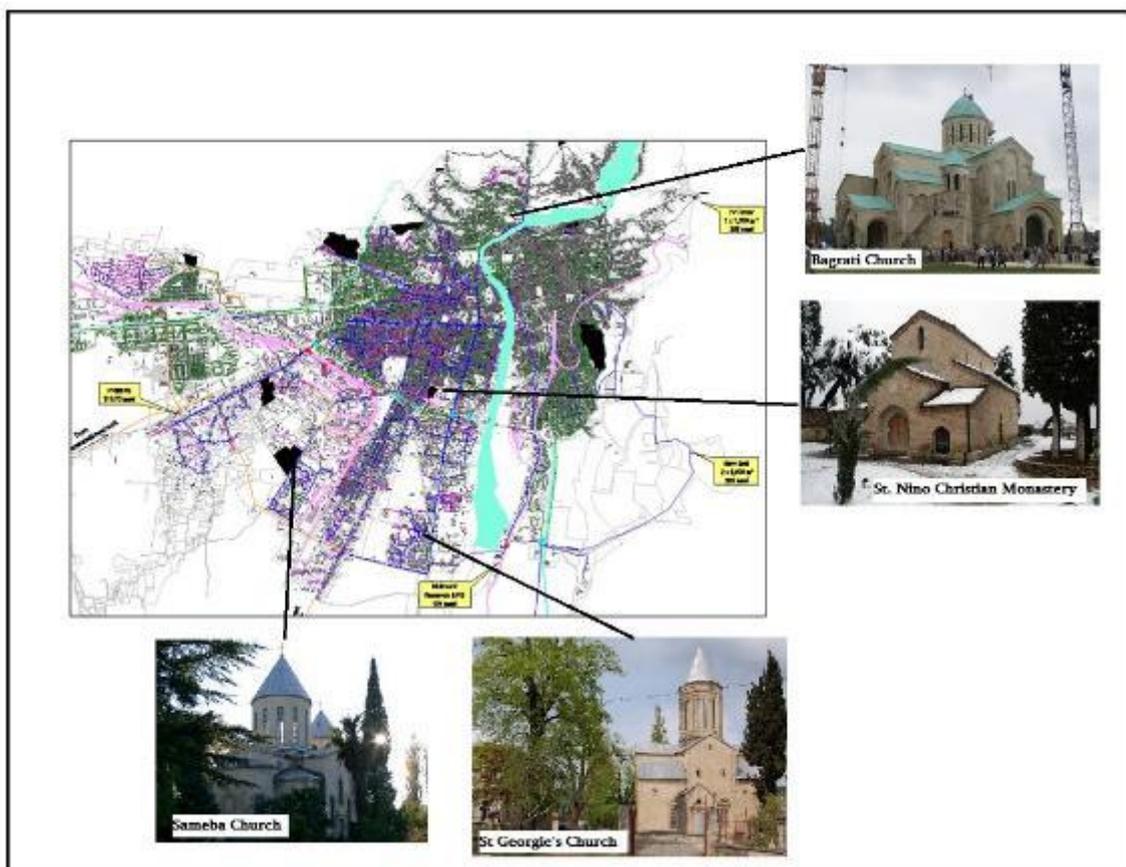
#### d. Electric Power Sources

124. Kutaisi and its environs provide favourable conditions for developing the large scale power generation projects. At present two medium hydro power plants (Rioni HPP and Gumati HPP) operate in the city. Construction of the new Namakhvani HPP with designed installed capacity of 450 MW and the estimated investment cost of 800 mln US dollars is planned within several tens kilometres from Kutaisi in the close future.

#### e. Mineral Resources and Tourism Facilities

125. *Mineral Resources.* The major natural mineral resources available near Kutaisi are provided from the limestone, spongolite and chalcedony deposits located north-east of the city. In addition there are many Cretaceous basalt outcrops, as well as the agate, quartz sand and sandstone deposits. Also, the pottery clay deposit is located at the right bank of Rioni River, at the so called "Gora" site. Other important minerals are available at Gelati coal, Gumbrini bentonite clay, marvel, Eklari limestone and other deposits. The fireproof clay deposits have been discovered near Rion-Sormoni and Jvarisa. Such clays can withstand the temperatures up to 1500-1700 degrees.

126. *Tourism.* Kutaisi and its surroundings have a high tourism development potential. The area is rich with historical and architectural monuments, e.g. Bagrati Church, Gelati and Motsameta Monasteries, Geguti Palace, Sataplia and Navenakhevi Grottos, etc. However, it should be noted that the local tourism infrastructure is weakly developed. Implementation of this Project will positively contribute to the development of the tourism industry. The following figure represents main historical monuments that are located at the vicinities of the project area



**Map 6: Historical Monuments that are located at the vicinities of the project area**

## 10. Social and Cultural Resources:

### a. Population and Communities (e.g. numbers, locations, composition, employment)

127. According to 2002 census Kutaisi population amounted to 185,965 that grew to 196,500 based on the current data. Number of households (families) is 5,748. The major ethnical minorities are Russians and Ossetians composing 2% of total population. There are several compact settlements housing more than 10,000 internally displaced persons (IDPs) who may be deemed as the permanent city residents. Such settlements occupy hotel Tbilisi, kindergarten Imereti, Gumati public boarding school, hotel Zeskho, etc. The table below shows population dynamics for Kutaisi and Imereti Region during 2003-2013.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Imereti	694.9	690.2	689.0	700.1	697.6	694.2	693.5	700.4	704.5	707.5	703.9
Kutaisi	184.7	183.8	184.5	190.1	189.7	188.6	188.6	192.5	194.7	196.8	196.5

### b. Healthcare Facilities

128. The city has well-developed network of the outpatient and inpatient healthcare facilities of both general and specialist profiles. The ambulatory network comprises 5 adults and 4 children polyclinics. The inpatient healthcare facilities include the Regional Clinical Hospital, O. Chkhobadze Medical and Social Rehabilitation Centre, Imereti Regional Centre for Infectious Pathologies, Rehabilitation Care Hospital, City Church Hospital, Church-Run Hospital, Kutaisi Second Maternity Hospital, Obstetrics and Gynaecology Hospital, Regional Oncology Centre.

129. From 2005 the city is provided with free-of-charge ambulance service ("03").

130. The city has the technical and professional base for providing healthcare services, which are made available through the State run programs or under the applicable charges.

### c. Education Facilities

131. Kutaisi always was important contributor to development of the Georgian national culture. Currently several theatres operate in the city. Kutaisi has rich scientific potential, including institutions of the Georgian Academy of Science, as well as three universities, one library and 6 museums. There are 45 public schools in the city.

### d. Socio-Economic Conditions

132. The total housing stock of Kutaisi is around 61,000. One third of this stock comprises detached (single-family) houses, while the remaining portion consists of multi-storey apartment blocks. The multi-storey buildings are in poor condition and require repair. Detached houses are in a better state and mainly have small yards.

133. The average household size is estimated as follows:

- Detached houses – 3.77 members;
- Apartment blocks – 2.66 members.

## ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### 1. Summary of Activities and Anticipated Impacts

134. This paragraph provides a brief description of anticipated site-specific impacts related to the construction phase of the sub-project “Improvement of Kutaisi Water Supply system”.

**Table 11: Summary of Activities and Anticipated Impacts**

#	Construction Phase. Potential Impacts During Construction Works	Risk	Sites
1	Dust, Noise, Vibration	High Risk	<p>During excavation of water pipe trenches, particularly in the densely populated parts of the city.</p> <p>During transportation of loose materials (cement, sand) during construction of service reservoirs, pumping stations and collector reservoirs.</p> <p>During construction of Kvitiri collector reservoirs and rehabilitation of the pumping stations, since the worksites are located within the densely populated district.</p>
2	Pollution of surface water during construction and rehabilitation works	Low Risk	No Project site is located in proximity to River Rioni bank. Installation of the new pipes is planned only at the one 200-250 section along David and Konstantine Mkheidze street.
3	Impacts on Archaeological Sites	Low Risk	<p>Despite Kutaisi and its surrounds are rich with historical sites no damage to the cultural heritage and archaeological sites shall be expected. The Project scope envisages replacement of the existing pipes only at the sites, which have already been subjected to excavation.</p> <p>In addition, construction of a new and rehabilitation of the existing infrastructures will be conducted at the sites, which have already experienced extensive human impacts.</p>
4	Impacts on traffic	Low Risk	Kutaisi is characterized with busy traffic that will be significantly hindered due to temporary occupation of the carriageway during construction works within the city will significantly impede the traffic. Even some narrow streets may be fully closed to traffic for certain time during rehabilitation works.
	Impact on aquatic ecology	Medium Risk	<p>There is medium risk of short term changes in aquatic ecology of the River Rioni during the construction of Aqueduct over the Rioni River.</p> <p>Construction of the aqueduct in winter period will have minor impact on the ichthyofauna found within the design</p>

#	Construction Phase. Potential Impacts During Construction Works	Risk	Sites
			section.
5	Landslides, slumps, slips and other mass movements.	Moderate Risk	No large scale earthworks are scoped under the Project. Despite this, assuming hilly terrain and dense population of Kutaisi, the landslide processes may be provoked during rehabilitation works at some sites with the high gradients.
6	Impacts on terrestrial flora and fauna	Low Risk	All Project sites are located within the area experiencing the severe human impacts. Therefore, no influence on flora and fauna shall be expected during implementation of the Project.
7	Pollution risk for ground waters	Moderate Risk	No major spills of fuel and lubricates at construction sites due to leakages are expected. The spills, which are likely to cause ground-water contamination may occur during fueling the construction machinery at the construction sites and/or construction camps.
8	Pollution risk for air quality	Moderate Risk	Air pollution may occur in densely populated districts with very narrow streets.
9	Poaching by construction workers	Low Risk	Rioni River
10	Hazardous Construction Wastes	Low Risk	Small quantities of hazardous wastes will be generated as a result of vehicle operations and the maintenance activities.
11	Impact on existing infrastructure	Low Risk	Electric power transmission systems, existing water supply and drainage channel systems and channels
12	Poor sanitation and solid waste disposal in construction camps and work sites (sewerage, sanitation, waste management)	Low Risk	Camp will not be used as living facilities because it is expected that majority of the employees would be local persons.  The construction camp would be equipped with a bio toilet and other necessary infrastructure.
13	Construction Related Impacts at the Quarrying Sites	Moderate Risk	The exploration of the borrow pits should be conducted by the licensed companies or the Contractor has to obtain its own license. However, potential impact of the increased quarrying activities on river bed and flood-plain landscape, ichthyofauna and ground-water should be considered.

## 2. Air Quality

### a. Noise and Dust Caused by Construction Activities and Emissions of Harmful Substances into the Atmosphere Air

#### Construction Phase

135. Noise and emissions of harmful substances are typical impacts of construction. Air quality will be affected during construction by emissions from vessels, equipment, and land vehicles in work activities at work locations.

136. During the pipe replacement stage the rehabilitation works are to be carried out in Kutaisi streets. The noise and dust generated in course of excavating the trenches will cause nuisance of the local residents with higher impacts in the districts housed by one, two and three storey buildings. Such districts are densely inhabited and characterized by narrow streets further increasing the effects of the construction noise and dust impacts.

137. Similar concerns apply to Mukhrani pumping station located within the densely populated district, where construction of the new small capacity collector reservoir and rehabilitation of the existing pumping units are planned. Noise and dust generation shall be expected at this facility during excavation works (for construction of the collector reservoir) that will have negative impact on the local residents.

138. As for other facilities (at New East Reservoir, Parskanakanebi collector reservoir, TV Tower Reservoir and Kvitiri pumping station), the noise and dust generated during construction/rehabilitation works will not affect the population since these facilities are located sufficiently far (from 500 m to several kilometres) from the settlements.

139. Construction of the New East Reservoir and Mukhrani and Parskanakanebi collector reservoirs will inevitably involve transportation of construction materials. This can cause a number of impacts on local population.

#### Mitigation Measures

140. These impacts can be reduced by a variety of measures, many of which are common in most urban construction. These include:

- Require adherence to engine maintenance schedules and standards to reduce air pollution.
- Use of defined, well planned haulage routes and reductions in vehicle speed where required;
- Periodically water down temporary roads on site;
- Cover trucks carrying cement, gravel, sand or other loose materials;
- Wet or cover trucks carrying stone/ sand/ gravel;
- Haul materials to and from the site in off peak traffic hours;
- Halting work during excessive winds.
- Immediately replacing defective equipment and removing it from the work site
- No truck movements in inhabited areas between 22:00 and 6:00.

#### Operation Phase

141. No permanent dust emission sources will exist during operation phase. It is expected that in small quantities dust will be generated only during maintenance works.

142. Kvitiri and Mukhrani pumping stations will act as the permanent noise pollution sources. The nearest residential building is detached from Kvitiri pumping station on 500 m, and thus the noise generated by its equipment will have no impact on the population. Certain

impact shall be expected during operation phase of Mukhrani pumping station since this facility is located within the densely population district.

### **Mitigation Measures**

143. Mukhrani pumping station is surrounded by one and two storey houses with heights not exceeding 7-8 meters. As elsewhere in Kutaisi, the yards around such houses are encircled by concrete and wood fences inherently providing good barrier for restricting noise level. If necessary (subject to excessive noise levels confirmed by appropriate measurements) the concrete barrier will be constructed around the pumping station.

144. The standard approaches shall be employed to reduce the dust and noise pollutions during maintenance works as follows:

- Periodically water down temporary roads on site;
- Immediately replacing defective equipment and removing it from the work site
- No truck movements in inhabited areas between 22:00 and 6:00.

## **3. Water Quality**

### **a. Contamination of Surface Water**

#### **Operation Phase**

145. During implementation of the Project the risks of surface water contamination are very low. No Project site is located in proximity to River Rioni bank. Installation of the new pipes is planned only at the one 200-250 section along David and Konstantine Mkheidze street.

146. Notwithstanding the above, the surface water may be contaminated due to improper placement of the excavated soil, poor management of construction camps, improper storage of construction materials and leakage of fuel and lubricates from construction machinery.

### **Mitigation Measures**

147. The following mitigation measures shall be implemented despite low risks of surface water contamination:

- Where works are in progress, erosion control and sedimentation facilities including sediment traps and straw bale barriers or combinations thereof will remain in place;
- Lubricants, fuels and other hydrocarbons will be stored at least 100m away from water bodies.
- Topsoil stripped material shall not be stored where natural drainage will be disrupted.
- Solid wastes will be disposed of properly (not dumped in streams).
- Guidelines will be established to minimize the wastage of water during construction operations and at campsites.
- During construction, machinery and transport will be used by the contractor, both have potential of causing contamination to under ground and above ground water assets. There is need to compile temporary drainage management plan before commencement of works.
- Proper installation of temporary drainage and erosion control before works within 50m of water bodies should be done (along David and Konstantine Mkheidze street).

#### **Operation Phase**

148. Contamination of surface water during operation phase is not expected except very low risks of such contamination during performance of planned or necessary maintenance works.

#### **b. Underground Water**

149. Potential impact arises from implementation and maintenance of contractors' yard, transport, maintenance of vehicles and handling and storage of lubricants and fuel. The required provisions for contractor's yard are described in the chapter on impacts and mitigation measures concerning quality of soils.

150. Basically, the construction of the water network during construction and operation has no impact on the ground water.

151. The replacement of an old, depleted network with new pipes will reduce the abstraction at the source as the leakage rate will considerably improve.

#### **4. Soils Quality and Topsoil Management**

152. During the construction, impacts soils are mainly due to earthworks and the operation of the contractor's yard.

153. The works for the transmission mains comprise material excavation, pipe laying and backfill of material including compaction. Material will be stored temporary alongside the trench and refilled after pipe laying. Therefore impacts associated with earthworks for trench laying are of temporary nature. Excavated soil will be placed alongside the trench, and the pipes will be placed in the trench manually. A sand layer of 30 cm thickness will be laid on top of the pipe, after which the trench will be refilled with excavated material and compacted manually. The excavation is expected to generate surplus material. Surplus material will be used as embankment fill as far as possible.

154. Construction of the New East Reservoir, and two new collector reservoirs at Mukhrani and Partskanakanebi, as well as extension of the existing TV Tower Reservoir and trenching works conducted at certain sites may lead to disturbance or loss of topsoil. Therefore the Contractor shall implement the following measures:

- The top soil of about 1 ft depth (0.3 m) shall be removed and stored separately during excavation work, and after the construction of the main trunk the same soil shall be replaced on the top, in unpaved areas;
- Subject to advance consent of local self-governance authorities, the excess topsoil remained after construction of the New East Reservoir, two new collector reservoirs at Mukhrani and Partskanakanebi, and extension of the existing TV Tower Reservoir will be used at other Project sites or handed over to the appropriate authorities.

#### **Mitigation Measures**

155. The following practices will be adopted to minimize the risk of soil contamination and topsoil loss:

- The contractors will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination;
- Solid waste generated during construction and at campsites will be properly treated and safely disposed of only in demarcated waste disposal sites;
- Construction chemicals will be managed properly;
- Clearly labelling all dangerous products;
- Fuel tanks (diesel or oil) should be placed in a concrete pool which its perimeter walls

- will be at least 1.0 m high with the concrete or plastered masonry wall;
- A proper floor drain should be installed on the slab of the concrete pool for safely discharging the leakages.

## **Operation Phase**

156. During operation phase, the soil may be contaminated due to water leakage from the damage pipe. In case such damage is not detected in a due time, the area may be "bogged".

157. Soil contamination may also occur during performance of the planned or emergency repair works.

## **Mitigation Measures**

158. Water pressure in the pipelines shall be continuously monitored during entire operation phase. In addition, the relevant mitigation measures shall be implemented during maintenance works.

## **5. Biological Environment**

### **a. Impacts and Mitigation Measures during Construction**

159. The impacts on flora and fauna during implementation of contractor's yard will be minimised during site selection and installation.

160. In Kutaisi, the water supply pipes will be mainly laid into city streets. The impact on the biological environment will therefore only be minor. The required width for the construction and the deposition of excavated material is approximately 5 m.

161. Area of potential influence of construction site of New East Reservoir comprises a small Kokhetian forest with some old and rare trees that are endemic to the Caucasian region (*Zelkova caprinifolia*) and Elm tree. By preparing the design documents the old trees have already been taken into consideration and the reservoirs were shifted to the open space land, adjacent to the forest, as far as technically feasible.

162. In order to avoid any damage to the valuable old trees the following mitigation measures are to be implemented during construction stage:

- The old trees to be protected shall be marked.
- A vegetation protection fence will be installed during construction stage in order to protect the valuable trees and
- access road to construction site shall be shifted as far away from the old trees to be protected, as it is technically feasible

163. The following measures need to be implemented to avoid any impacts on flora and fauna:

- Avoid tree cutting
- In unavoidable cases, plant four trees of same species for each tree that is cut for construction
- The trench shall not be kept open in the night/after working hours. This will avoid any safety risk to people, domesticated, stray or wild animals.

164. Impact on Aquatic Ecosystems during construction of Rioni River Crossing by Aqueduct will be Medium size.

165. The designed bridge crossing consists of Accessible bunds and bridge itself. The designed bridge crossing consists of 11 spans, beam type, with scheme 11x33.0 m; In the plan view it is designed as the straight line, but in façade with zero inclination. The bridge overall dimension is 2,2 m, width is 2,4 m, total length is 371, 0 m. It has 2 pile type abutments and 10 piers. The roofing of the project bridge crossing spans is considered with Full-walled, beam type, steel construction, span structure which is calculated on permanent and operation loads.

166. The length of the steel span structure is 33.0 m. assumed span length is 32.4 m. the height is 1.4 m. The designed bridge abutment piers are made with in-situ reinforced concrete and the diameter is 1.5 m. The middle piers are of the same type. They are of in-situ reinforced concrete structure and consists of 1.5 m drilled piles strengthened by trapezoidal shape crossbar.

#### **a. Impacts during Construction**

167. The rehabilitation of the water network will be mainly conducted along existing roads in the town. Although work will not require land acquisition it could still have economic impacts, if the presence of trenches, excavated material and workers discourage customers from visiting shops and other businesses, which lose income as a result. These losses however will be short in duration. Implementation of the following best construction measures will reduce the inconvenience and disturbance:

- Informing all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary;
- Providing wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required
- Increasing workforce to complete the work in minimum time in these stretches
- Initial situation of private properties has to be re-established after construction

168. Another aspect of the work that has economic implications is the transportation of material to the site and surplus soil from the site to locations where it can be put to beneficial use as recommended. There will be truck movements carrying material. Although this is not significant, considering the narrow roads, it could disrupt traffic in the Town. Dust generated during the transport may also impede the commercial and trade activities, which are predominantly located along the main roads. The transportation of material/waste shall be implemented by the Civil Contractor in liaison with the town authorities, and the following additional precautions should be adopted to avoid effects on traffic:

- Plan transportation routes in consultation with Municipality and Police
- Schedule transportation activities by avoiding peak traffic periods.
- Use tarpaulins to cover loose material that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site

169. There is medium risk of temporary impacts to the aquatic ecology of the River Rioni during the construction of Aqueduct. To minimize an impact to fish and also to produce the least amount of noise for the local community bore piling method will be done by Contractor. Also number of piles have been reduced as much as possible to reduce the footprint in the Rioni River. Small coffer dams will be considered during the construction to reduce sediment flow of the river (Please see comment below).

170. The mitigation measure for the aqueduct's construction is that the aqueduct's pile construction process coincides with the period of the Rioni River's shallowness, minimum yield period (winter), when all the fish species found within the design section spend winter in deep sections of the river within the vicinity of the Vartsikhe HPS, which is located at the confluence points of the Kvirila River (fairly rarely) and the Khanistskali River (mostly).

171. During the winter, the small number of the fish at the Kvirila River is conditioned by the constantly high level of suspended solids concentration in the Kvirila River proper.

172. The following mitigation measures will be implemented to minimize the impact on aquatic ecosystems in the project area:

- Works should be carried out in low water period (in winter) when fish is not active;
- Prohibition of dumping any waste/material in the riverbed to avoid blockage of the stream after reinstatement of the flow;
- All works scheduled to be performed in or near watercourse will follow statement/ plan for the execution of particular works;
- Control of the status of technical maintenance of machinery/vehicles and prohibition of damaged/leaking machinery/vehicles on the site;
- Arranging material storage area away from the riverbed (not closer than 50m from the active riverbed);
- Prohibition of fuelling and/or maintenance of machinery near (in less than 50m) the river;
- Prohibition of untreated discharge of wastewater/ potentially contaminated run off into the riverbed;
- Regular clean up of the work area and timely removal of waste;
- Removal of surplus material, waste, temporary structures and machinery from the area after completion of works;

In case planned to have some amount of fuel on the site – adequate protection of environment from spreading of accidentally spilled liquid. (Precaution measures include – secondary containment capable to retain 110% of container volume, location of the stock at not less than 50 m distance from the riverbed. Provision of adsorbents and training/briefing the staff in good operation practice and environmental safety issues.)

#### **b. Impacts during Operation**

173. As the operation and maintenance activities would be conducted within the existing facilities no impact is envisaged on economic resources. Repairs and leaks of the water supply pipes will be minor and localized. In fact, the improvements to the water supply system will bring various benefits. Availability of good infrastructure facilities will add to the quality of life, and there will be more people interested to live and visit, which will bring new investments and boost economic development.

#### **Impact During operation**

174. Next to the piers accumulation of sediments may create additional habitat for invertebrates that may be considered as a positive impact on fish though improvement of the food base. Impact on fish and macroinvertebrates during maintenance works that may involve works in/close to water body.

Mitigation measures:

No mitigation is required. However monitoring of fish and macroinvertebrates is advisable to register any less likely, but adverse effect

- Mitigation measures set for construction period will apply.

## **6. Hazardous Construction Wastes**

175. Small quantities of hazardous wastes will be generated as a result of vehicle operations and the maintenance activities.

### **Mitigation Measures**

176. There are no specific hazardous waste treatment facilities in Georgia, so the common construction practice accepted by the authorities is to dispose of these types of wastes at the municipal landfills. However, prior to disposal appropriate consultation and agreement of MENRP is required, and controlling will be required to obtain the necessary approvals. To ensure good practice they will also be required to store, transport and deposit all hazardous materials in secure watertight containers.

#### **a. Other Wastes from Construction Activities**

### **Municipal Waste**

177. Municipal waste may be generated on the Storage area. Mainly this is rubbish, plastic or glass bottles, glasses, waste food, etc. and a stationary waste. Waste should be collected both by the specially assigned personnel and the workshop workers on the area. The waste is placed into 0.24m<sup>3</sup> plastic containers and further a local Sanitary Service takes it to landfills. The following should be taken into account:

- Generation of dust should be avoided;
- Plastic containers should be closed to prevent spread of the smell and also to avoid contact of rodents and insects with the waste.

178. The personnel involved in the handling of hazardous and non-hazardous waste will undergo specific training in:

- Waste handling
- Waste treatment; and
- Waste storage.

179. Burning of waste on any construction site is forbidden with the exception of stub and small branches from felled trees and bushes, which is better to be burned in order to avoid pest dissemination.

### **Medical waste**

180. Medical waste is generated in the Medical Care and Control Point and belongs to hazardous waste category. This waste is collected in special plastic boxes and is transferred to a contractor for farther incineration. It is recommended that the medical waste is directly transferred to a contractor from the place of its consolidation. While disposal of the medical waste the following requirements are to meet:

- Medical waste must be disposed in special plastic boxes, which can be hermetically closed.
- Medical waste for farther incineration should be transferred to a certified contractor (Batumi municipal waste operator).

### **Non hazardous construction waste**

181. Non hazardous construction waste may be generated on the Storage and construction area and will be collected by contractors workers. Waste disposed first on the sites

of origin, and then moved to construction waste temporary storage facility before transferred to a contractor.

182. While disposal construction wastes both on the sites and at the temporary storage facilities the following requirements are to meet:

- Place of disposal of the waste concerned must be enclosed.
- The waste must not have access to drainage water.
- Waste must be immediately removed from the working sites.
- Waste must be placed in secondary protective basins.
- This waste can be transferred only to a certified contractor.

#### **b. Impacts on Archaeological Sites**

183. Land clearance works, grading and excavations are associated with the risks of damaging underground archaeological remnants. However in the case of the proposed Project no archaeological monuments are expected to be touched during construction phase since pipes will run along and inside existing roads as far as technically feasible. There is a low probability for chance finds of archaeological objects. However, still there are several sites where such objects may be discovered during conduct of earthworks (for construction of the New East Reservoir, Partskanakanebi and Mukhrani collector reservoirs, and extension of TV Tower Reservoir). Therefore, special care should be taken not only at the new construction sites, but also at construction camps and storage areas.

#### **Mitigation Measures**

184. To avoid this risk, preliminary preventive studies and archaeological supervision during the earth-works is necessary. Supervisory procedures and all other necessary measures should be agreed with the Ministry of Culture when obtaining the construction permit, in accordance with the rules of the permit issuance. According to the article 14 of the Law on Cultural Heritage, Permit on conducting quarrying activities in Georgia, as well as construction of an object of a special importance as it may be defined under the legislation of Georgia, is issued by a competent authority based on the positive decision of the Ministry of Culture, Monument Protection of Georgia. The basis for the conclusion is the archaeological research of the proper territory to be carried out by the entity wishing to accomplish the ground works. The entity wishing to do the earth-works is obliged to submit the Ministry the documentation about the archaeological research of the territory in question. The preliminary research should include field-research and laboratory works.

185. Therefore steps should be taken minimize the risk. This should involve:

- Contractor should put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve:
- Having excavation observed by a person with archaeological field training. Supervisory procedures and any other necessary measures shall be agreed with the Ministry of Culture;
- Stopping work immediately to allow further investigation if any finds are suspected;
- Calling in the state archaeological authority if a find is suspected, and taking any action they require ensuring its removal or protection in situ.

186. At the construction stage archaeological monitoring should be ensured by the contractor under the supervision of the Ministry of Culture, Monument Protection of Georgia. The budget necessary for the archaeological supervision and other agreed works should be fixed under the construction works appraisal.

## 7. Socio-Cultural Resources

### a. Impacts during Construction

187. There are various social-cultural resources (such as schools, hospitals, churches, university) in the town. The construction impact will include noise and dust, and interrupted access due to movement of heavy vehicles transporting material and waste. Mitigation will therefore be needed to protect socio-cultural resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures recommended above (under the impacts on air quality), including:

- Limiting dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks
- Providing wooden walkways planks across trenches for pedestrians and metal sheets where vehicle access is required
- Increasing the workforce in to complete the work quickly

188. There is invariably of safety risks when substantial construction such as this is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to formulate and implement health and safety measures at construction sites, which should include such measures as:

- Following standard and safe procedures for all activities – such as provision of shoring in deeper trenches (> 2 m)
- Excluding public from the site – enclosing the construction area and provide warning and sign boards, and security personnel
- Providing adequate lighting to avoid accidents
- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc.)
- Maintaining accidents records and report regularly
- Traffic control. Irregular control of trucks by local police (radar control, safety control). Speed limits to be introduced within construction areas and on access roads.
- Yellow / orange warning tape to protect workers and pedestrians from falling into building pits, to prevent pedestrians from entering the construction site. Warning signs to prevent accidents within the construction site and on access roads.

189. *Economic Benefits.* There could be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to local people, the Contractor should be required to employ as much of his labour force as possible from the local communities in the vicinity of construction sites. Drawing of majority of workforce from local communities will avoid problems that can occur if workers are imported, including social conflicts and issues of health and sanitation due to labour camps. If temporary labour camps are to be provided, Contractor should ensure that they are maintained well with proper water supply and sanitation facilities. In unavoidable case of sourcing labour from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people. Following measures shall be followed:

- Establish temporary labour camps in consultation with the local authority
- Shall be located away from water bodies
- No clearance of trees vegetation shall be allowed for establishment of camp
- Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc.)
- Contractor shall provide fire wood and no worker shall be allowed to cut any tree
- Ensure regular and clean maintenance of the camp

## b. Impacts during Operation

190. As the operation and maintenance activities would be conducted within the facilities, no impacts on socio-cultural resources envisaged.

191. Regular water quality surveillance program shall be implemented to avoid any public health risk as detailed below:

- Conduct regular water quality monitoring at well fields; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future
- Develop & implement a water quality monitoring program for distribution system according to the Georgian Law<sup>2</sup>

192. The improved water supply system will bring numerous benefits when it is operated. The main beneficiaries will be the citizens of Kutaisi, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including urban poor. This will improve the quality of life of people as well as raise standards of both individual and public health. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase. Improvement in infrastructure will bring more economic opportunities.

193. The improved and expanded water supply system would require additional workforce – both skilled and unskilled, for operation and maintenance, and therefore creates new employment opportunities for local people.

## 8. Noise and Vibration

### a. Impacts during Construction

194. Construction activities are likely to generate noise and vibration from usage of equipment and haulage of construction materials/waste. This project however does not involve high noise/vibration generating activities like pile-driving or rock cutting. Appropriate personal protection equipment needs to be provided for workers at the site. Haulage of materials/waste, and operation of backhoe (if used for transmission main trench excavation in the town), will also generate noise, but will be limited in duration and require no special measures.

195. Table 12 presents Noise level guidelines, in accordance with the Georgian regulations - Decree No. 297/N “On Approval of Environmental Quality Norms” (August 16, 2001 of the Ministry of Labor, Health and Social Affairs) and World Health Organization (WHO) 1999. In the case of noise, WB/IFC Standards will apply and noise impacts should not exceed the WB/IFC Standards presented in Table 12, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

**Table 12:** Noise Level Guidelines

Noise	dB		dB	
	National Regulations		WHO	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00	Daytime 07:00- 22:00	Nighttime 22:00- 07:00
Residential; institutional; educational	55	45	55	45

Noise	dB		dB	
	National Regulations		WHO	
Industrial; commercial	70	70	70	70

196. Sensitivity to noise increases during the night hours in residential neighbourhoods. Following measures therefore shall be implemented:

- Provide prior information to the local people about the work
- No construction of activities shall be conducted in the night
- Provide personal protection equipment like ear plugs to the workers at the noisy working site
- Sound barriers should be erected at schools and hospitals if the distance to the construction site is 50 m or less than 50 m

197. Another important activity is haulage of construction material and waste to and from site. Roads in the town are narrow and not in good condition. Following measures shall be included to avoid nuisance due to haulage of material and waste.

- Schedule material and waste haulage activities in consultation with local authorities
- No night time haulage activity; limit to day time off peak hours
- Educate drivers: limit speed between 20-25 km/h and avoid use of horn in the town

<sup>2</sup> Schedule N7 of Technical Regulation on Drinking Water issued in 2007 by Ministry of Labor, Health and Social Welfare, Government of Georgia

- Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement

198. As for the construction vibration is considered, none of the activities in the subproject has potential to generate significant vibration, and there are no sensitive structures in the proximity of the site. Therefore there are no likely impacts.

#### **b. Impacts during Operation**

199. There are no sources of noise or vibration from the operation activity of the new water supply system.

### **9. Construction Camps**

200. The establishment of contractor's work camp may cause adverse impacts if various aspects such as liquid and solid waste management, equipment maintenance, materials' storage, and provision of safe drinking water are not addressed properly. The site for the work yard will be selected by the contractor in agreement with the Municipality, UWSCG and the supervisor.

201. To ensure that potentially resulting impacts are kept at a minimum the contractor will be required to prepare the following plans or method statements:

- Layout plan of the work camp including a description of all precautionary measures proposed to avoid potential adverse impacts on the receiving environment (surface and ground water, soils, ambient air, human settlement);
- Sewage management plan for provision of sanitary latrines and proper sewage collection and disposal system to prevent pollution of watercourses or groundwater;
- Waste management plan covering the provision of garbage bins, regular collection and disposal in a hygienic manner, as well as proposed disposal sites for various types of wastes (e.g., domestic waste, used tires, etc.) consistent with applicable national regulations; and
- Description and layout of equipment maintenance areas and lubricant and fuel storage facilities including distance from Rioni River. Storage facilities for fuels and chemicals will be located at a safe distance to the river. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination.
- These plans will be approved by the Engineer prior to beginning of construction activities.

202. Prior to establishment of the work camp(s) the contractor shall conduct consultations with local authorities to identify sources of potable water for the workforce that will not compete with the needs of the local population. Potable water for the workforce shall comply with the national quality standards. Construction water should be sourced from the local water supply.

### **10. Construction Related Impacts at the Quarrying Sites**

203. The quarries and borrow pits will be finally selected by the contractor. The exploration of the borrow pits should be conducted by the licensed companies or the Contractor has to obtain its own license. However, potential impact of the increased quarrying activities on river bed and floodplain landscape, ichthyofauna and groundwater should be considered.

## Mitigation Measures

204. The exploration of the borrow pits should be conducted by the licensed companies. In case if the constructing company intend to perform quarrying activities, the company has to obtain related license. Potential impact of the increased quarrying activities on ichthyofauna, groundwater and landscape should be considered anyway. Validity of licenses for the abovementioned companies is a main mechanism to guarantee that most of impacts related to quarrying will be mitigated. License is provided by the MENRP only on a basis of preliminary assessment (including limits and conditions for reinstatement). The Regional Services of the MENRP and Environmental Inspectorate are in charge to control compliance of the quarrying company's performance. The role of the UWSCG within this plan should be to ensure timely and permanent involvement of the MENRP in construction supervision.

205. The measures aimed on mitigation of the dust and emission impacts, as well as potential river contamination due to improper fuelling and vehicle operation should be the same as above described pollution prevention measures, but control on this sensitive site should be stricter. Contractor's environmental personnel shall pay attention to this site during monitoring.

## 11. Cumulative Impacts

206. Project is designed to improve environmental quality and living conditions in Kutaisi through the improvement of water supply system. The potential negative impacts identified on various environmental parameters, during both construction and operation, in the previous sections of this report, are localized and temporary.

207. By nature, impacts such as on air quality and on people (due to disturbance, nuisance and safety risk of construction activity) can have cumulative impacts, as all the construction activities are conducted simultaneously. These are common impacts associated with any construction activity, and as discussed in the earlier sections, there exists proven and easy-to-implement measures to mitigate these impacts.

208. No cumulative impacts envisaged during the operation stage.

## ANALYSIS OF ALTERNATIVES

209. The Kutaisi water supply subproject to be financed by tranche 3 loan will comprise a second phase of the rehabilitation of the water supply system. The subproject will (i) reduce nonrevenue water losses through the replacement of old pipelines; and (ii) improve the pressure in the supply area through the construction of additional reservoir capacity and the establishment of supply and pressure zones. The subproject comprises the laying of 158 km of distribution pipes, the rehabilitation of 2 pumping stations and the construction of 9,000 m<sup>3</sup> storage volume at two locations.

210. As the works mainly comprise rehabilitation and replacement works within the existing water supply system, no major alternatives are to be investigated. Pipeline routes and reservoir locations are not changed with the exception of one new reservoir in the East of Kutaisi. The location was chosen for its elevation and the location near the Eastern parts of Kutaisi. Alternatives were limited to three hills with similar elevation; the location with available land was chosen. There are no environmental advantages and disadvantages compared with the alternative locations. Other options were limited to existing locations and concern reservoir sizes, capacities of pumping stations and diameters of transmission and distribution lines that have no environmental impact.

211. The following alternatives have been discussed for the crossing the Rioni river which included:

212. Alternative #1 Horizontal Direction Drilling;

- This method consists of drilling under the riverbed with appropriate machinery, depending on the soil type, river flow, and pipe diameter. Installation of a pipeline by HDD is generally accomplished in three stages;
- The first stage consists of directionally drilling a small diameter pilot hole along a designed directional path;
- The second stage involves enlarging this pilot hole to a diameter suitable for installation of the pipeline;
- The third stage consists of pulling the pipeline back into the enlarged hole.

213. It is not considered by the UWSCG due to the possibility of damage in PE pipes during construction, the inability for maintenance after the construction, and the exposure of rocky material in recent geological surveys.

214. Alternative #2 Diversion of the river and construction of a culvert. This method mainly consists of;

- Diverting the river;
- Making trench excavation on the diverted part of the river;
- Construction of a reinforced concrete culvert, size depending on the pipe diameter, river flow, and excavation depth;
- Backfilling the trench

215. It is not considered because of the long period of river diversion. Construction or installation at a culvert site generally results in disturbance of the site soil, stream banks, or streambed, and can result in the occurrence of unwanted problems such as scour holes or slumping of banks adjacent to the culvert structure. The period of diversion will have negative effects on river flow during seasons with high discharge.”

#### Alternative #3: Crossing the river by Aqueduct

216. The designed bridge crossing consists of Accessible bunds and bridge itself. The designed bridge crossing consists of 11 spans, beam type, with scheme 11x33.0 m; In the plan view it is designed as the straight line, but in façade with zero inclination. The bridge overall dimension is 2,2 m, width is 2,4 m, total length is 371, 0 m. It has 2 pile type abutments and 10 piers. The roofing of the project bridge crossing spans is considered with Full-walled, beam type, steel construction, span structure which is calculated on permanent and operation loads.

217. The length of the steel span structure is 33.0 m. assumed span length is 32.4 m. the height is 1.4 m. The designed bridge abutment piers are made with in-situ reinforced concrete and the diameter is 1.5 m. The middle piers are of the same type. They are of in-situ reinforced concrete structure and consists of 1.5 m bore piles strengthened by trapezoidal shape crossbar.

218. The project envisages protection of access embankment. Right bank embankment protection is considered with concrete cleat and with a flexible pad compiled with reinforced concrete slabs, and the left bank embankment protection is considered with the help of Reno-mattress. The safety rules must be adequately protected and traffic control measures should be maintained.

#### Alternative #3 Justification

219. The river crossing with drilling method (please see para. 210) presented by

Contractor was unconvincing and he could not take responsibility that the installed network would not get damaged. Thus the proposed methodology was unpersuasive. In addition Geological surveys performed by the Contractor revealed that HDD had to be carried out in the VI-VII category soil (calcareous soil) which makes the drilling possibility doubtful (for the diameter envisaged by the project Ø500mm and distance – 400m).

220. Crossing the river by aqueduct will be advantageous for the United Water Supply Company of Georgia, LLC for further operation of water supply network. The cost of construction works for the proposed aqueduct is less than the cost for HDD envisaged by the project (approximately GEL 400 000). In case of crossing with aqueduct if the pipe gets damaged, its restoration works will be much easier in terms of technical issues and time than by drilling.

221. Based on above mentioned Aqueduct was considered as the best solution for crossing the Rioni River. It should also be mentioned that the UWSCG has considered all appropriate measures to minimize the number of pillars as far as possible and to reduce its footprint in the Rioni River. The piling method will be implemented by contractor in order to minimize impact on the water ecosystems of the Rioni River. Further reduction of number of piles would not be advisable since the parameter of span structure will increase (made of metal) leading to increasing of costs.

## **INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION**

222. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Stakeholders of this project include:

- People who live, and work near construction sites of facilities in Kutaisi
- UWSCG as implementing agency
- Other government regulatory institutions
- Municipality of Kutaisi
- NGOs and CBOs working in the affected communities;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in Kutaisi in general; and
- The ADB, as funding agency

181. Two forms of public consultation are used to discuss the project and involve the community in planning the mitigation measures and develop the Environmental Monitoring Plan. These are:

- Public meeting in Kutaisi Town to which stakeholders were invited.
- Ad hoc discussions were held on site with people and communities who could be affected by the subprojects, so that views could be expressed in a less formal setting. These were also considered in preparing the IEE.

182. Public Hearings were held in Kutaisi on 10th of May 2012 for Tranche 1 project and on 16<sup>th</sup> July 2013. The latter meeting exclusively informed about project measures to be implemented under Tranche 3. The appendix No1 contains a minutes of the meeting. Ten (10) local residents plus a representative of the local service centre attended the meeting. The project measures and their locations were explained. The time schedule of construction activities and construction supervision were explained. Environmental impacts were discussed. Benefits of the project for local people were presented. Opinions, ideas and suggestions of the local residents and related people were received during the meeting.

183. Consultation with affected population was undertaken
- to ensure their informed participation in the design, implementation and monitoring of the project measures and their impacts on the environment, as well as the efforts to minimize and the mitigate impact when avoidance is not possible;
  - to introduce the project benefits to the local population that accrue to them as a result of project implementation;
  - to incorporate all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

184. The following topics were discussed during the meeting:

- project context and rationale
- expected start and end of the project
- benefits of the project to local population and to the country as a whole
- the environmental issues and mitigated measures related to the project

185. The population recognizes the need to accept limited nuisances as a result from the construction works, and understands that the implementation would fail without a good cooperation between the local population, the contractor and UWSCG. They are aware of the deficiencies of the present water supply situation and realize that rehabilitation works need to be carried out in order to achieve a 24 h water supply. The time schedule for the start and end of works was of particular interest to the participants. UWSCG explained that an Environmental Management Plant has been prepared that will have to be implemented by the Contractor. This plan describes mitigation measures to minimize the impacts during construction works. Findings, list of participants, key concerns, and data are provided in Appendix 1 of this report.

186. This IEE Report in Georgian language will be distributed to the interested public. Report will be available for review in Tbilisi (at UWSCG Head Office), and Kutaisi (at UWSCG Service Centre and the Town Hall). It will also be disclosed to public by making it available on websites of UWSCG, MoRDI and ADB, together with the IEEs prepared for the other subprojects.



**Map 7: Kutaisi - office of the UWSCG in Gugunava Street 12**

187. Additional consultations were held with key stakeholders on the changes in the draft water supply project, in particular the construction of the Aqueduct along the Rioni River.

188. Consultations were held with representatives of WWF Caucasus in Tbilisi and MoENRP, namely with Ms. Mako Bitsadze, Coordinator of the Program for Protected Areas at WWF Caucasus and Ms. Tamar Nasuashvili, chief specialist of the Department of

Environmental Permits, the Department of Permits, MoENRP of Georgia, as well as Ms. Nona Khelaia, Acting Head of the Biodiversity Department of the MoENRP.

189. As explained by Ms. Mika Bitsadze, the WWF network in the South Caucasus, in close cooperation with Norway, WWF developed a Feasibility Study for Sturgeon Conservation in Georgia (financially supported by the Norwegian Ministry of Foreign Affairs). As part of this study, all sturgeon breeding areas were identified along the Rioni River.

190. With the support of WWF Caucasus, UWSCG prepared a map showing the location of the planned Aqueduct as well as all sensitive receptors, including the sturgeon breeding area and the planned protected area for sturgeon conservation along the River Rioni.

191. The map clearly shows that the projected aqueduct is far from all the sensitive receptors mentioned above (please see Appendix 3).

192. UWSCG consulted with MoENRP and its Department of Permits whether there are any commitments regarding the construction of the Aqueduct on the River Rioni introduced by the recently adopted Environmental Assessment Code, which will enter into force in January 2018, as the new code will replace law on Environmental Impact Permit and Ecological Expertise. As it was explained the EIA shall be subject to the activities envisaged by the Annex I of this Code and the activities envisaged by the Annex II of the same Code, which will be subject to EIA on the basis of screening procedure set out in Article 7 of this Code (Article 5 of Chapter 2). Construction of Aqueduct is not listed in the Annex 1, and only construction of Aqueduct with the length of more than 2km may be subject to screening. The length of Aqueduct within the proposed project is not more than 400m.

193. In addition Contractor - "SMK Ulusal Insaat ve Ticaret A.S", who is carrying out water supply system rehabilitation works in Kutaisi requested the MoENRP of Georgia to receive a written explanation if an additional agreement is required, depending on the specifics of the MoENRP, to the changes made in the project, in particular, to cross the specified section of the river from the above (aqueduct), please see Appendix 4. The contractor received a response from the MoENRP that an additional agreement is not required for the construction of the Aqueduct.

194. During the preparation of the Baseline Survey of the Rioni River site, additional consultations were held with Mr. Archil Guchmanidze, National Expert of Sturgeon, where he emphasized that, "since 1984, there was not found any individual juvenile or adult Sturgeon, in the project area, in particular, the upper part of the Vartsikhe HPP canal, neither by researchers/ichthyologists, nor by experienced elderly fishermen.

195. Reference should be made also on the extraction from the Article entitled: "Current and Historical Status of Sturgeon (Acipenseridae, Osteichthyes) in Georgia", prepared by Archil Guchmanidze and Published in 2009, in the Journal: Status and protection of Globally Threatened Species in the Caucasus:

196. "Today, the only spawning ground of Sturgeons is in the Rioni, starting near the Ochopa stream mouth, about 4 km above the Sajavakho-Samtredia railway bridge, and ending near the Vartsikhe HPP's diversion canal. Only 9 km (16%) of Rioni's 57 km spawning ground remain today. The 44-km section of the spawning ground from Kutaisi to the Vartsikhe HPP's diversion canal and the 4-km section from Sajavakho-Samtredia railway bridge to the Ochopa stream mouth were destroyed by floods caused by regulation. The area has shrunk from 200 (51) to 30 ha or 15%. The 35 km spawning ground in the Enguri and 32 km section in the Tskhenistskali have been destroyed as a result of water flow regulation.

**Table 13. Length of sturgeon spawning areas in 1922 and 2007**

Year	River		
	Rioni	Enguri	Ckhenistskali
1922	57	35	32
2007	9	0	0

197. The decline in sturgeon populations and shrinking of the range are due to habitat destruction, poaching and unsustainable fishing. Habitat destruction is mainly caused by construction of hydroelectric power plants, pollution of rivers and banks, operations of the Kulevi port. Other noteworthy causes are timber rafting and sand and gravel recovery in the spawning rivers.

198. Consultations were held with the local fishermen and other river users as well. 5 fishermen were interviewed within the framework of biological environment baseline study for the project section:

1. Abjandadze Badri;
2. Gvasalia Irakli;
3. Vekua Tamazi;
4. Kirkitadze Rezo;
5. Sul Khanishvili Jemali.

199. Results of interviews with local fishermen is provided below.

**Table 14. Results of interview with local population and fishermen**

N	Question	Answer
1	How old were you when you started fishing and where?	I have been fishing since my childhood; I mainly fish at Khanistskali and Rioni Rivers, but downstream of Vartsikhe reservoir.
2	Have you ever fished on Kvirila River? If yes, what fish have you caught?	Fishing on Kvirila River means bathing the earthworm pointlessly! In summer, during the fishing season, Khanistskali and Rioni river banks are full of fishers, but no one can be seen on Kvirila River.
3	Have you ever caught fish at the dam of irrigation system, near Poti street, in Kutaisi?	Fish jumps out of water at the waterfall, at the dam in summer, but the environmental inspection and the dam security guard prohibit us fishing. Small fish is observed there, but I can't name exactly the species.
4	Have you ever caught a fish at the islands in Rioni River, across Nikea Street in winter and if yes, what species?	In those areas fish can't be obtained at all. From the upper dam the water flow is sometimes increased and sometimes – decreased; it happens for several times in a day and fish doesn't stay there. They enter Vartsikhe reservoir or Khanistskali River. There are favorable conditions for the fish and food can be also easily obtained there.
5	When is the fish more active on this section? I mean the area from Vartsikhe HPPs dam to the dam at Poti Street.	After spring floods, when water is relatively fresh; from the middle of May, or beginning of June; it depends on weather conditions in mountains.
6	Does poaching occur there? Where and when?	Through the area, which you are interested in, no fish can be observed. As for poaching, considerable

N	Question	Answer
		penalties are set in this regard, but we have seen neither poachers, nor fishers on this section.

### GRIEVANCE REDRESS MECHANISM

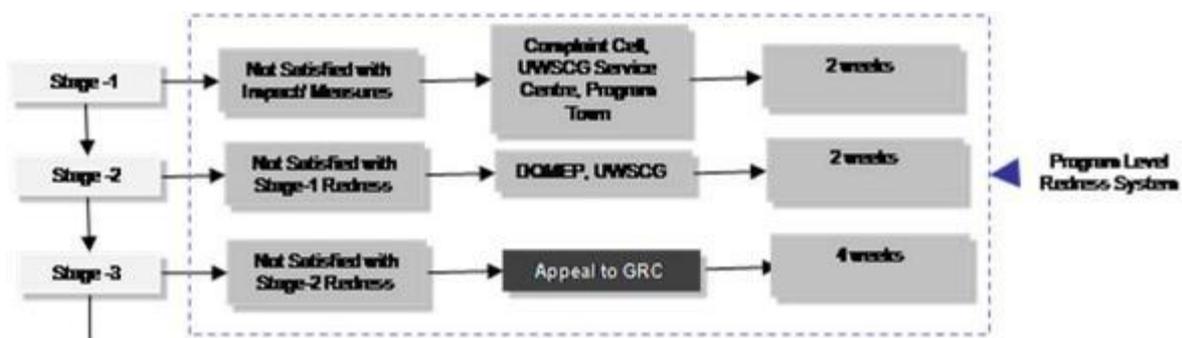
200. The contractor is obliged to implement the environmental management plan during the whole construction period and the supervising consultant will monitor these activities. The consultant will point out any deviations from the EMP and make sure that the contractor addresses all issues of the EMP in a timely and professional manner.

201. A grievance resolution mechanism will be set up to allow an AP appealing any disagreeable decision, practice or activity arising from project implementation. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during planning and implementation of the project. Care will always be taken to prevent grievances rather than going through a redress process. This is achieved by ensuring full AP participation and consultation, and by establishing extensive communication and coordination between AP, UWSCG, and the local government. The affected population and stakeholders may send their grievances, related to the project induced environmental impacts and nuisance to UWSCG or directly to the administrative bodies responsible for the environmental protection. The MoENRP and concerned municipalities are obliged to respond on the grievances, which have been received from population or other interested parties in accordance with the Administrative Code of Georgia.

202. UWSCG on its part, in order to provide a direct channel to the affected and concerned citizens for approaching project authorities and have their grievance recorded and redressed in an appropriate time frame, will establish a Grievance Redress Mechanism. A Complaint Cell and a Grievance Redress Committee will be established for each Investment Program town at the local UWSCG service centre, which will function throughout the construction period. The procedures adopted and the responsibilities of various project agencies in grievance redress are discussed in the following paragraph. During the public consultation process, UWSCG (the IA) will inform the stakeholders about the Grievance Redress Mechanism and provide contact details of persons responsible for grievance collection and response. These details will also be made available on UWSCG website. The DREP at the head office of UWSCG will be available for the local complaint cells for establishing direct links to relevant environmental authorities.

203. The Complaint Cell at the UWSCG Service Centre in the Investment Program town will accept complaints regarding the environment safeguard issues in implementation of subprojects under the respective town. A three stage grievance redress mechanism is indicated in Fig. 2 below. The grievances received and actions taken will be included into the environmental monitoring reports submitted to ADB

Fig. 2 Grievance Redress Mechanism



- (i) Complaints received (written or oral communication) by the Complaint Cell will be registered in database system, assigning complaint number with date of receipt; informs the complainant the time frame in which the corrective action will be undertaken.
- (ii) Complaint resolution will be attempted at Kutaisi level with the involvement of Community leaders and informal mediators.
- (iii) The Complaint Cell and the Investment Program Management Office (IPMO), which is the Project Management and International Relations Department at UWSCG, will investigate the complaint to determine its validity, and assess whether the source of the problem is indeed subproject activities; if invalid, the Complaint Cell intimates the complainant and may also provide advice on the appropriate agency to be approached.
- (iv) If the complaint is valid, the Complaint Cell will check the environmental management plan (EMP) of the subproject whether this issue was identified and mitigation was suggested; if yes, the Complaint Cell and UWSCG IPMO will direct the civil works Contractor to take immediate actions as per the EMP.
- (v) If this is an unanticipated issue, the UWSCG IPMO will to identify mitigation measures and advise the civil works Contractor accordingly and a corrective action should be taken and a Corrective Action Plan CAP prepared.
- (vi) The Complaint Cell will review the civil works Contractor's response on corrective action and update the complainant within two weeks.
- (vii) If the complainant is not satisfied with the action taken by the Contractor within two weeks from the start of corrective action as directed the Complain Cell, the grievance will be directed to the Division of Resettlement and Environmental Protection (DREP) of the UWSCG.
- (viii) The DREP will review the issue with the IPMO and relevant Service Centre and may ask for additional information or conduct site visit, and will advise the IPMO and relevant Service Centre on actions to resolve the issue.
- (ix) The Service Centre will submit the interim report in a week to DREP on the status of the complaint investigation and follow-up actions, and final action taken report within two weeks of completing the action. The DREP will intimate the complainant of the same.
- (x) If the complainant is still dissatisfied with the action taken or decision, he/she may approach the Grievance Redress Committee (GRC, see below) established in the town.

204. **Grievance Redress Committee (GRC).** A GRC will be established to resolve the unresolved issues at Stage 2 and this will function throughout the construction period, and will have hearings on need-basis. GRC will have following members:

- Chairman of the GRC – Head of Department of Social Issues at Kutaisi Municipality
- UWSCG Service Centre Head  
Mikheil Tataradze  
Adress: #12 Gugunava Street.  
E-mail: Mishataradze@yahoo.com  
Phone: + 995 597 000 700
- Designated informal leader of sub-project affected community
- Female AP
- Member of IPMO

- Local NGO representative

205. Considering the anticipated impacts, it is not expected that there is any likely issue which will remain unresolved in the Stage 3 of the process. In the unlikely event of dissatisfaction after Stage 3, the complainant can approach ADB with a complaint. ADB has in place a system under the ADB Accountability Mechanism, where people adversely affected by ADB-assisted projects can voice and find satisfactory solutions to their problems.

206. Complaints will also be accepted by any ADB office such as a resident mission, regional office or representative office, which will forward them unopened to the CRO.

## **ENVIRONMENTAL MANAGEMENT PLAN**

### **a. Institutional Arrangements**

207. Following agencies will be involved in implementing the Investment Program:

- (i) Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. MoRDI will have overall responsibility for compliance with loan covenants.
- (ii) United Water Supply Company of Georgia (UWSCG) is the project Implementing agency (IA), which will be responsible for administration, implementation (design, construction and operation) and all day-to-day activities under the loan. An Investment Program Management Office (IPMO) is established within the UWSCG for all Investment Program related functions. The IPMO, which is the Project Management and International Relations Department at UWSCG will coordinate implementation of subprojects across all towns, and ensure consistency of approach and performance.
- (iii) UWSCG as responsible IA for the project recruited a Supervision Consultant (SC). The national and international team of consultants will assist UWSCG as project supervision for the construction of Kutaisi WS project. The SC will also provide capacity building training to contractor staff for management and operation and maintenance for the Project. The SC will assist UWSCG in assuring that the project is implemented according to the specified standards. This SC assignment will include the supervising of the implementation of the environmental management plan.
- (iv) All mitigation measures during construction have to be implemented by the contractor that will be monitored by the supervision consultant (SC). Implementation of EMP of this project require an experienced Environmental Management Specialist (EMS), employed by the SC, to spend a total of around 9 months for project construction period, conducting routine observations and surveys, and preparing quarterly reports.

The Contractor has the following obligations.

- to employ Environmental consultant responsible for developing and implementing the construction phase EMP and for provision of corresponding information to UWSCG and SC;
  - to prepare SSEMP;
  - to develop, if required, a Spoil Disposal Plan and Construction Waste Disposal Plan agreed with the MENRP and Local government;
  - to prepare and update Construction Schedule;
  - The SSEMP implementation costs should be included into the construction budget.
- (v) ADB is the donor financing the Investment Program.

208. DC will be responsible for incorporation of mitigation measures in design and construction.

209. The environmental specialist (ES) assists and advises the Division of Resettlement and Environmental Protection (DREP) of the UWSCG in program implementation in compliance with the, ADB Safeguard Policy Statement, 2009 and National Legislation, and oversee the work of DCs and SCs in safeguard compliance. The ES will support UWSCG in preparing and submitting bi-annual reports to ADB for review.

210. Implementation of mitigation and monitoring measures during operation will be the responsibility of DREP. Government regulatory agencies such as MoENRP will also monitor the environmental performance. In addition the Contractor should employ an environmental specialist who will ensure that the site specific EMP (SSEMP) is prepared and implemented. SSEMP should be endorsed by SC and approved by UWSCG.

### c. Costs of Environmental Management Plan

211. The Costs for Environmental Management of the project shall mainly consist of the (i) monitoring of works by the EMS who will be employed by the SC; (ii) baseline and regular parametric measurements of noise, dust and emission (water quality testing may not be needed unless water supply sources will be affected by the construction works). All of the implementation of mitigation measures shall be part of the contractual works and obligation of the Contractor.

212. The cost for the environmental management for construction period is tentatively estimated.

Table 15: Environmental management cost table

Item	Quantity <sup>3</sup>	Unit Cost	Total Cost	Remarks
Baseline Parametric Measurements	6	200 USD	1,200	To be conducted by the Contractor for noise, air emissions, dust (and water, if necessary) measurements
Monthly Parametric Measurements (at least 6 sites)	216	200 USD	43,200	Tests to be conducted by the Contractor at 6 sites x 36 months monthly monitoring
Environmental Management Specialist (SC)	9 months	2,500 USD	22,500	The costs are included in the contract signed between UWSCG and SC and no additional costs will occur.
Miscellaneous Subtotal			6,690	10% for above Items
			73,590	Total for above
Contingency			8,831	12% of Subtotal
<b>GRAND TOTAL</b>			<b>82,421</b>	For the entire construction period of 36 Months

## 2. Performance Indicators

213. Based on the identified impacts of the project the performance indicators can be established. The objective of the EMP is to eliminate, avoid, minimize and if not possible, compensate the affected entities or individuals by the project. During the initial stage of the project, the Contractor, under the supervision of the CS Consultant, should establish the baseline parameters of the work sites and make appropriate parametric measurements which shall be the basis for comparison in the entire project. This shall include physical parameters on noise, dust, air emissions (water quality if necessary) and related local community

concerns. Mitigation measures shall be implemented or improved based on the level of non-conformance to the identified performance indicators. The environmental monitoring and management shall focus on the Contractor's conformance to these performance indicators throughout the en-tire duration of the project.

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<sup>3</sup>To be established by CS Consultant and international environmental specialist.

214. In establishing the performance indicators local as well as international standards and guidelines are used as reference. In addition, local social and community concerns should also be utilized as performance indicators of the project. These performance indicators are tabulated below:

Table 16: Environmental performance indicators

Environmental Aspect	Parameter	Performance Indicator	
Air Emission <sup>4</sup>	Nitrogen (IV) Dioxide	0.2 (mg/m <sup>3</sup> ) max	0.04 (mg/m <sup>3</sup> ) Daily Average
	Sulphur Dioxide	0.5 (mg/m <sup>3</sup> ) max	0.05 (mg/m <sup>3</sup> ) Daily Average
	Carbone Monoxide	5 (mg/m <sup>3</sup> ) max	3 (mg/m <sup>3</sup> ) Daily Average
	Soot (Carbone black)	0.15 (mg/m <sup>3</sup> ) max	0.05 (mg/m <sup>3</sup> ) Daily Average
Dust	PM10 (WHO Guidelines <sup>5</sup> )	20 µg/m <sup>3</sup> annual mean	50 µg/m <sup>3</sup> 24-hour mean
Noise <sup>6</sup>	Noise Levels for residential areas at 7am – 11 pm	55 Indicative Level L <sub>a</sub> dBA	70 Maximum Admissible Level L <sub>a</sub> max dBA
	Noise Levels for residential areas at 11pm – 7am	45 Indicative Level L <sub>a</sub> dBA	60 Maximum Admissible Level L <sub>a</sub> max dBA
Social and Community Concerns <sup>7</sup>	Traffic	Number or Complaints	
	Impairment of Access	Number or Complaints	
	Public Safety	Number or Complaints	
	Disruption to Utilities	Number or Complaints	
	Curtailment of Social and Business Activities	Number or Complaints	

<sup>4</sup> Environmental Quality Norms approved by the Order #297N (16.08.2001) of the Ministry of Labour, Health and Social Protection (as amended by the Order No 38/n of the same Ministry of 24.02.2003). The quality of atmospheric air (pollution with hazardous matter) is also defined by the order of the Minister of Environment Protection and Natural Resources (#89, 23 October 2001) on approval of the rule for calculation of index of pollution of atmospheric air with hazardous pollution

<sup>5</sup> <http://www.who.int/mediacentre/factsheets/fs313/en/>

<sup>6</sup> The Georgian standards for noise control as approved by the Decree of the Minister for Health, Labour and Social Affairs (297n of August 16, 2001) upon the 'Approval of Environmental Quality Standards', which specify the tolerable and maximum admissible levels of noise for different zones

<sup>7</sup> From the EMP Table

Table 17: Environmental Impacts and Mitigation Measures

Potential Negative Impacts	Mitigation measures	Responsibility	Location	Cost
<b>Pre-Construction</b>				
Possible removal of Terrestrial habitat. Loss of the top soil	Sites rehabilitated before contractor leaves site upon completion of construction activities. Planting and stabilization of site, including replacement of any native plant species	Construction Contractor	Construction and labor camps, storage area	Part of construction cost
Aquatic ecology survey of water bodies	Prior to start construction activities, contractor should carry out aquatic ecology survey of any water bodies likely to be directly or indirectly affected during the construction	Contractor	Project area	Included in Project price
<b>Construction</b>				
Ambient Air and Local Dust <sup>8</sup>	<ul style="list-style-type: none"> <li>• Cover or damp down by water spray on the excavated mounds of soil to control dust generation;</li> <li>• Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;</li> <li>• Bring the material (aggregate and sand) as and when required;</li> <li>• Ensure speedy completion of work and proper site clearance after completion;</li> <li>• Damp down unsatisfied /bad condition roads to avoid dust generation while using for transport of waste/material</li> <li>• Use tarpaulins to cover loose material that is transported to and from the site by truck</li> <li>• Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside barricaded area</li> <li>• Clean wheels and undercarriage of haul trucks prior to leaving construction site</li> <li>• Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing</li> </ul>	Construction Contractor	Trenching sites  Mukhrani pumping station	Part of construction cost
	<p>The Contractor shall coordinate with local Traffic Management Department to minimize construction traffic impact in the following topics:</p> <ul style="list-style-type: none"> <li>• Temporary parking restrictions,</li> </ul>	Construction Contractor	Along materials transportation routes	

<sup>8</sup> Environmental Quality Norms approved by the Order #297N (16.08.2001) of the Ministry of Labour, Health and Social Protection (as amended by the Order No 38/n of the same Ministry of 24.02.2003). The quality of atmospheric air (pollution with hazardous matter) is also defined by the order of the MoENRP, (#89, 23 October 2001) on approval of the rule for calculation of index of pollution of atmospheric air with hazardous pollution

Potential Negative Impacts	Mitigation measures	Responsibility	Location	Cost
	<ul style="list-style-type: none"> <li>• Pedestrian and cyclist diversion routes where construction prevents access,</li> <li>• Temporary traffic signals,</li> <li>• One way scheme,</li> <li>• Maintaining local residential access at all times,</li> <li>• General traffic diversion routes where roads are closed.</li> <li>• Sound barriers should be erected at schools and hospitals if the distance to the construction site is less than 50 m</li> </ul>			
Noise Pollution <sup>9</sup>	<ul style="list-style-type: none"> <li>• Maintain machinery and vehicle silencer units to minimize noise</li> <li>• Keeps noise generating activities associated with construction activities to a minimum and within working hours.</li> <li>• Notify the residents of Kutaisi town close to the Project area prior to commencement of the construction phase.</li> <li>• Vehicles and machinery that are used intermittently should not be left idling condition for long period of time.</li> <li>• Equipment used on site will be quietest reasonably available.</li> <li>• Haul routes for construction traffic entering and leaving the site will be selected to ensure noise levels at noise sensitive receptors are kept at a minimum.</li> </ul>	Construction Contractor	Trenching sites Mukhrani pumping station Along materials transportation routes	Part of construction cost
Impact on surface water bodies due to construction <sup>10</sup>	<ul style="list-style-type: none"> <li>• In case of heavy rain, protect open trenches from entry of rainwater by raising earthen bunds with excavated soil</li> <li>• Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site</li> <li>• Ensure that drains are not blocked with excavated soil</li> </ul>	Construction Contractor	Construction sites on slopes, New East Reservoir.	Part of construction cost
Soil Contamination	<ul style="list-style-type: none"> <li>• The contractors will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination.</li> <li>• Solid waste generated during construction and at campsites will be properly treated and safely disposed of only in demarcated waste</li> </ul>	Construction Contractor	Construction site Camp	Part of construction cost

<sup>9</sup> The Georgian standards for noise control as approved by the Decree of the Minister for Health, Labour and Social Affairs (297n of August 16, 2001) upon the 'Approval of Environmental Quality Standards', which specify the tolerable and maximum admissible levels of noise for different zones

<sup>10</sup> Rules of the Protection of the Surface Waters of Georgia from Pollution

Potential Negative Impacts	Mitigation measures	Responsibility	Location	Cost
	<p>disposal sites.</p> <ul style="list-style-type: none"> <li>• Construction chemicals will be managed properly</li> <li>• Clearly labelling all dangerous products,</li> <li>• Fuel tanks (diesel or oil) should be placed in a concrete pool which its perimeter walls will be at least 1.0 m high with the concrete or plastered masonry wall,</li> <li>• A proper floor drain should be installed on the slab of the concrete pool for safely discharging the leakages.</li> </ul>			
Impact on Flora and Fauna	<ul style="list-style-type: none"> <li>• Avoid tree cutting</li> <li>• In unavoidable cases, plant four trees of same species for each tree that is cut for construction</li> <li>• The trench shall not be kept open in the night/after working hours. This will avoid any safety risk to people, domesticated, stray or wild animals.</li> <li>• The Contractor shall ensure that the work site be kept clean, tidy and free of rubbish that would attract animals.</li> </ul>	Construction Contractor	Construction site Camp	Part of construction cost
Impact on Traffic	<ul style="list-style-type: none"> <li>• Informing all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary;</li> <li>• Providing wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required</li> <li>• Increasing workforce to complete the work in minimum time in these stretches</li> <li>• Initial situation of private properties has to be re-established after construction</li> </ul>	Construction Contractor	Construction site Access Road	Part of construction cost
Hazardous Materials	<ul style="list-style-type: none"> <li>• Comply with all national, regional and local legislation with regard to the storage, transport, use and disposal of petroleum, chemical, harmful and hazardous substances and materials.</li> <li>• Establish an emergency procedure for dealing with spills or releases of petroleum.</li> <li>• Storage of all hazardous material to be safe, tamper proof and under strict control.</li> <li>• Petroleum, chemical, harmful and hazardous waste throughout the</li> </ul>	Construction Contractor	Construction site Storage Area	Part of construction cost

Potential Negative Impacts	Mitigation measures	Responsibility	Location	Cost
	<p>site must be stored in appropriate, well maintained containers.</p> <ul style="list-style-type: none"> <li>Any accidental chemical / fuel spills to be corrected immediately.</li> </ul>			
Solid Waste	<ul style="list-style-type: none"> <li>Place of disposal of the waste concerned must be enclosed.</li> <li>The waste must not have access to drainage water.</li> <li>Waste must be immediately removed from the working sites.</li> <li>Waste must be placed in secondary protective basins.</li> <li>This waste can be transferred only to a certified contractor.</li> </ul> <p>The personnel involved in the handling of hazardous and non-hazardous waste will undergo specific training in:</p> <ul style="list-style-type: none"> <li>Waste handling</li> <li>Waste treatment; and</li> <li>Waste storage.</li> </ul>	Construction Contractor		Part of construction cost
Loss of top soil	<ul style="list-style-type: none"> <li>Top soil of about 1 ft depth (0.3 m) shall be removed and stored separately during excavation work, and after pipeline construction the same soil shall be replaced on the top.</li> </ul>	Construction Contractor	Pipeline work in pasture lands, agricultural land, Location of New East Reservoir	Part of construction cost
Erosion due to excavation/refilling	<ul style="list-style-type: none"> <li>Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer.</li> <li>In the steep slopes, local grass species shall be planted on the refilled trenches.</li> </ul>	Construction Contractor	All construction sites	Part of construction cost
Impact on air quality due to emissions from construction equipment/vehicles	<ul style="list-style-type: none"> <li>Ensure that all equipment &amp; vehicles used for construction activity are in good condition and are well maintained</li> <li>Ensure that all equipment &amp; vehicles confirms to emission and noise norms</li> </ul>	Construction Contractor	Kutaisi	Part of construction cost
Damaging of protected trees	<ul style="list-style-type: none"> <li>The old trees to be protected shall be marked.</li> <li>A vegetation protection fence will be installed during construction stage in order to protect the valuable trees and</li> <li>Access road to construction site shall be shifted as far away from the old trees to be protected, as it is technically feasible</li> </ul>	Construction Contractor	New East Reservoir	Part of Construction Cost

<p>Temporary flow diversion from construction site (“dewatering” of the construction site) – impact on fish migration</p>	<ul style="list-style-type: none"> <li>• Work implementation during low-water period (in winter), when fish is less active;</li> <li>• Prohibition of waste/material throwing into riverbed in order to avoid blockage after water stream restoration (release)</li> </ul>	<p>Contractor</p>	<p>Riverbed from the cut off area to the section of active flow downstream the crossing area.</p>	<p>Part of construction costs</p>
<p>During and after construction pollution of water/riverbed with waste and/or material (in case of improper management), fuel/oil; this can impact fish and macro-invertebrates after restoration of water stream within the project section.</p>	<ul style="list-style-type: none"> <li>• Works should be implemented in the riverbed or near it according to preliminary developed methods/plan;</li> <li>• Control over technical functionality of machinery/equipment; damaged machinery/equipment are not allowed to enter the site;</li> <li>• Material should be stored in not less than 50 m from active riverbed;</li> <li>• Prohibit fueling and/or maintenance in the distance not less than 50 m from active riverbed;</li> <li>• Prohibit discharge of processed wastewater/ potentially polluted surface runoff into the river;</li> <li>• Regular cleaning of the site and timely waste removal;</li> <li>• Removal of excess material, waste and temporary structures and equipment from the site after completion of works;</li> <li>• If there is fuel storage on the site – in case of accidental spillage avoid spreading in the environment (measures include – 110% of tank capacity) presence of spill trapping secondary storage device; Tank should be located in not less than 50 m from active riverbed. Provide absorbents; Train/inform personnel on best practice of work implementation and environmental issues.</li> </ul>	<p>Contractor</p>	<p>Work area</p>	<p>Part of construction costs</p>
<p>Impact on fish food base due to riverine vegetation cleanup.</p>	<ul style="list-style-type: none"> <li>• Maximum preservation of riverine vegetation cover;</li> <li>• Strict adherence to construction site borders in order to avoid impact on vegetation cover outside the borders of the work site;</li> <li>• Instruct personnel on the need of protection of riverine vegetation cover.</li> </ul>	<p>Contractor</p>	<p>Riverbanks in the project impact zone (work areas)</p>	<p>Part of construction costs</p>

Potential Negative Impacts	Mitigation measures	Responsibility	Location	Cost
Socio-economic benefits from employing local people in construction work	<ul style="list-style-type: none"> <li>To the extent possible labour force should be drawn from the local community</li> </ul>	Construction Contractor	All construction sites	Part of construction cost
Impacts due to import of labour and establishment of temporary labour camps	<ul style="list-style-type: none"> <li>In unavoidable case of sourcing labour from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people:</li> <li>Establish temporary labour camps in consultation with the local authority</li> <li>Shall be located away from water bodies</li> <li>No clearance of trees vegetation shall be allowed for establishment of camp</li> <li>Provide all basic amenities (water supply and sanitation, waste collection &amp; disposal, first aid facilities, etc.)</li> <li>Contractor shall provide fire wood and no worker shall be allowed to cut any tree</li> <li>Ensure regular and clean maintenance of the camp</li> </ul>	Construction Contractor	Temporary labour camps	Part of construction cost
Safety risk – public and worker	<ul style="list-style-type: none"> <li>Follow standard and safe procedures for all activities – such as provision of shoring in deep trenches (&gt;2 m)</li> <li>Exclude public from the site – enclose construction area, provide warning and sign boards, security personnel</li> <li>Provide adequate lighting to avoid accidents</li> <li>Ensure that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc.);</li> <li>Maintain accidents records and report regularly</li> <li>Trench construction shall be taken up in small segments, so that work (excavation, pipe laying and refilling) in each segment is completed in a day. No trenches shall be kept open in the night/after work hours.</li> </ul>	Construction Contractor	All construction sites	Part of construction cost
Historical, archaeological chance finds during excavation	<ul style="list-style-type: none"> <li>Contractor shall put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are</li> </ul>	Construction Contractor	All construction sites	Part of construction cost

	<p>protected and conserved. This should involve:</p> <ul style="list-style-type: none"> <li>• Having excavation observed by a person with archaeological field training; <ul style="list-style-type: none"> <li>• Stopping work immediately to allow further investigation if any finds are suspected;</li> <li>• Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.</li> </ul> </li> </ul>			
Cumulative impacts – re-peated disturbance to roads and people	<ul style="list-style-type: none"> <li>• Schedule the construction activities in harmony with the other on- going works</li> <li>• Schedule works before road work</li> </ul>	Construction Contractor, SC	Transmission line works, works on water supply network in the town	Part of construction costs
<b>Operation</b>				
Risk of delivery of unsafe water to consumers	<ul style="list-style-type: none"> <li>• Conduct regular water quality monitoring; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future</li> <li>• Develop &amp; implement water quality monitoring program for distribution system</li> <li>• Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel</li> </ul>	UWSCG	Water network	Part of operating costs
Disturbance/ nuisance/ noise due to operation activity	<ul style="list-style-type: none"> <li>• Plan transportation routes in consultation with Municipality and Police</li> <li>• Schedule transportation activities by avoiding peak traffic periods</li> <li>• Use tarpaulins to cover loose material that is transported to and from the site by truck</li> <li>• Educate drivers: limit speed between 20-25 KMPH and avoid use of horn in the town</li> <li>• Provide prior information to local people about work;</li> </ul>	UWSCG	Reservoirs, pumping stations, pipe alignments, transport routes	Part of operation costs

<p>Sediments accumulated near piers may create new, additional habitat for macro-invertebrates – This can be deemed as positive impact in terms of improvement of fish food base.</p>	<ul style="list-style-type: none"> <li>Implementation of mitigation measures is not required. However it is recommended to monitoring over fish and macro-invertebrates in order to identify any unfavorable impact (less expected)</li> </ul>	<p>UWSCG</p>	<p>Section upstream and downstream the new structure (50m each side of the new structure)</p>	<p>Part of operation costs</p>
<p>Impact on fish and macro-invertebrates during repair work implementation near the river or in the riverbed.</p>	<ul style="list-style-type: none"> <li>Carry out mitigation measures determined for the construction phase</li> </ul>	<p>UWSCG</p>	<p>Work area (50m each side of the new structure)</p>	

### **3. Monitoring**

215. Monitoring describes (a) monitoring measures with technical details, including parameters to be measured, methods to be used, sampling locations that will signal the need for corrective actions; and (b) monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures and document the progress and results of mitigation.

216. A program of monitoring will be required to ensure that all concerned agencies take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by Civil Contractors will be conducted by the SC, on behalf of Implementing Agency. Monitoring during operation stage will be conducted by the UWSCG.

217. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects. The regular control and inspection during general construction activities in Kutaisi is needed

Table 18: Environmental Monitoring Plan for general construction activities at Kutaisi

Item	Parameter	Frequency	Action Level	Response When Action Level Exceeded	Responsibility
<b>Pre construction</b>					
Tender documentation	Environmental Issues	Once before bid announcement	Environmental audit of bidding documents to ensure relevant sections of the EMP have been included	Integrate all environmental requirements into bidding documents	SC
Contract documentation with construction contractor	Environmental Issues	Once before contract signature	Environmental audit of contract documents to ensure relevant sections of the EMP have been included	Integrate all environmental requirements into bidding documents	SC
<b>Construction</b>					
Ambient Air	Dust	Continual	Visual assessment during the Works Impact Monitoring Compliance Monitoring	If dust levels are above acceptable visual levels, implement dust suppression techniques (wetting down area) and/or assess weather conditions and maybe temporarily cease works until conditions ease	Contractor, SC
Noise	(15 minute) Noise Levels	Only as required: Periodic attended Monitoring at hourly intervals at nearest potentially sensitive receivers.	+20 dBA for short term (< 4 weeks) +10 dBA for medium term (4 – 26 weeks) Impact Monitoring Compliance Monitoring	If noise action level is exceeded then review work practices and noise control procedures, including maintenance of equipment, installation of silencers, provision of noise barriers and modification of work hours.	Contractor, SC
Surface Water Quality	Quality/ Contaminant concentrates	Continue in rainy weather	guideline / licence requirements (whichever is Applicable) Impact Monitoring Compliance Monitoring	If contaminant concentrations/licence conditions are exceeded, review disposal options and decide on most applicable. Report any accidents of licence (of applicable) to issuing authority.	Contractor, SC

Item	Parameter	Frequency	Action Level	Response When Action Level Exceeded	Responsibility
Waste Management Implications	Segregation, Storage and transport of wastes	Monthly inspection	visual assessment during the Works; - Field inspection, - Report of waste volumes generated Report and record all leakages and spills Impact Monitoring Compliance Monitoring	Solid waste cycled as 0 % of movement of solids or liquid waste through the soil, rocks, water, atmosphere.	Contractor, SC
Ground	Soil Monitoring and Erosion Control	Continual	Assess adequacy of sedimentation/ environmental controls on-site Impact Monitoring	If controls have failed or are found inadequate, cease works immediately and repair to an acceptable standard	Contractor, SC
Ecological Resources	Fauna and Flora	Continual	Minimal ecological impacts Impact Monitoring	Required to ensure the recommended mitigation measures are properly implemented.	Contractor, SC
Landscape and Visual	Surface treatment of temporary structures	Once at the Completion of work	Minimum disturbance of the original landscape Impact Monitoring	Required to ensure the recommended mitigation measures are properly implemented	Contractor, SC
Aquatic Ecosystems	<b>Ichthiofauna</b>	Continual	Observation of riverbed-determination of potential blockage and removal (on a daily basis).  As it is not possible to drain the whole area, there can be holes with fish. It is necessary to observe the area in order to find fish, remained in the riverbed (note: it may be required to move fish to active flow)  Inspection/visual control	Required to ensure the recommended mitigation measures are properly implemented.	Contractor, SC

			(daily)		
<b>Operation</b>					
Drinkable water	Drinking water quality	According with GoG drinking water regulation	Full compliance to requirements of GoG drinking water regulation Impact Monitoring Compliance Monitoring	Close isolation valves to isolate sections where contamination is observed. Cease water supply until the water quality is reassured. Immediate remedial action	UWSCG
Aquatic ecosystems		Monitoring during the first year of operation - in June after high water; in early September and in December.	Monitoring –is analogous to that considered for the construction phase. Water quality control, if required (based on the decision of environmental officer of the operator company).	Required to ensure the recommended mitigation measures are properly implemented.	UWSCG
Infrastructure	Breaks / Deteriorations/ Leakage	Monthly inspection	Visual Assessment Public Complaints Compliance Monitoring	If breaks/ failures occur, close isolation valves (or plug man-holes) immediately and repair / replace to an acceptable standard.	UWSCG

## CONCLUSION AND RECOMMENDATION

### a. Recommendation

218. The environmental impacts of the infrastructure elements proposed in the water supply improvement subproject in Kutaisi were assessed and are described in the previous sections of this document. Potential negative impacts were identified in relation to design, location, construction and operation of the improved infrastructure. Mitigation measures were developed to reduce all negative impacts to acceptable levels.

219. Mitigation measures were discussed with engineering specialists, and some measures have already been included in the design. This means that the number of impacts and their significance has already been reduced by the design.

220. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. Appropriate avoidances/ mitigation/ enhancement measures are suggested for the likely impacts that are identified.

221. During the construction phase, impacts mainly arise from generation of dust from soil excavation and refilling; and from the disturbance to residents, traffic and important buildings by the construction work. These are common impacts associated with the construction processes, and there are well developed methods for their mitigation. Various measures are suggested, including:

- Utilizing surplus/waste soil for beneficial purposes
- Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc.)
- Providing prior public information and planning the work in consultation
- Avoiding night time construction activities

222. The environmental assessment process also identified opportunities for environmental enhancement. Certain measures suggested in this regard include:

- Employing the local people in construction work as much as possible to provide them with a short-term economic gain
- Employing local people in operation and maintenance of the new systems

223. Most facilities will operate with routine maintenance, which should not affect the environment. Measures have been suggested to provide adequate drinking water quality (water quality surveillance program).

224. The main beneficiaries of the improved water supply system will be the citizens of Kutaisi, who will be provided with a constant supply of good quality water, which serves a greater proportion of the population, including urban poor. This will improve the quality of life of people as well as raising standards of both individual and public health.. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

225. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged.

226. Performance indicators shall be utilized as reference for the level of performance of the project vis-à-vis the environmental and social concerns at the worksites.

227. Stakeholders were and will be involved through both face-to-face discussions on site and a public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project.

228. The recommendation of this IEE process is that all mitigation, enhancement and monitoring activities proposed here shall be implemented in full. This is essential to ensure that the environmental impacts are successfully mitigated; this is the responsibility of UWSCG.

229. KUT-01 project requires the crossing of Rioni River for the transmission line from Mukhiani pumping station to the New East Reservoir.

230. The draft design envisages the conveyance of the raw potable water from the right bank of the Rioni River, where Vartsikhe HPS dam is situated, upstream, about 6km, to the left bank territory of the Rioni River adjacent to the water pumping station, through a water supply pipe, which presumably will be conducted through the aqueduct, which is perpendicularly crossing the Rioni River course. It is envisaged that the several piles of the aqueduct will be constructed directly into the course of the Rioni River.

231. To determine the extent of the impact of the construction of the aqueduct's piles on the fish species found in this very section of the Rioni River, Gama-Consulting carried out ichthyologic survey of rioni River.

232. The mitigation measure for the aqueduct's construction is that the aqueduct's pile construction process coincides with the period of the Rioni River's shallowness, minimum yield period (winter), when all the fish species found within the design section spend winter in that deep places of the Vartsikhe HPS, which are located at the confluence points of the Kvirila River (fairly rarely) and the Khanistskali River (mostly).

233. During the winter, the small number of the fish at the Kvirila River is conditioned by the constantly high level of suspended solids concentration in the Kvirila River proper.

234. The optimal environmental conditions for the ichthyofaunal species dwelling in the design section are created in the confluence point of the Khanistskali River and Vartsikhe HPS water reservoirs. The water reservoir's mentioned territory is actually a delta, with relatively deep water, normal transparency, dense straws and reeds, which conditions the safe cohabitation of the different species of fish with different ages during the winter months.

## **2. Conclusion**

235. The environmental impacts of the proposed water supply subproject in Kutaisi were assessed by the Initial Environmental Examination reported in this document. The impacts are found to be limited to the construction phase.

236. An Environmental Management Plan (EMP) has been prepared and will be implemented during the project implementation. The EMP identifies the potential environmental impacts arising from the project along with a set of the mitigation measures to reduce the impacts to acceptable levels. It also includes the institutional arrangements for implementing the EMP to ensure its effectiveness.

237. The overall conclusion of the IEE is that provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

238. The citizens of Kutaisi will benefit from continuous supply of good quality water. The project will stimulate economic growth. Continuous water supply and drinking water of good quality is prerequisite for tourism development. The standard of individual and public health will improve as a result of the project. The project will generate new job opportunities.

239. Construction of the aqueduct over the Rioni River in winter period will have minor impact on the ichthyofauna found within the design section.

# Appendices

## Appendix 1

### Minutes of Meeting of Public Hearing on 16<sup>th</sup> of July 2013

#### LCC "United Water Supply Company of Georgia"

Public Hearing Meeting  
Improving the Water Supply System in Kutaisi

Initial Environmental Examination Report

Minutes  
11:00 am

Kutaisi

16.07.2013

The following persons attended the meeting:

1. Beso Nibladze - "United Water Supply Company of Georgia, LLC", Head of Environmental Protection and Resettlement Division;
2. Misha Tataradze - "United Water Supply Company of Georgia, LLC", Head of Kutaisi Service Centre;
3. Ketevan Chomakhodze - "United Water Supply Company of Georgia, LLC", Environment Specialist;

The following residents of Kutaisi attended:

1. Leo Nutsubidze - local resident
2. Zaur Shalamberidze - local resident
3. Pridon Shalamberidze - local resident
4. Irakli Dangadze - local resident
5. Badri Chiteishvili - local resident
6. Bejan Dangadze - local resident
7. Gioiri Gaganidze - local resident
8. Malkhaz Pruidze - local resident
9. Leri Shalamberidze - local resident
10. Lasha Sasageishvili - local resident

#### Public Consultation

The public consultation meeting was held on July 16, 2013 in Kutaisi, at the Service Centre of United Water Supply Company of Georgia, LLC. The consultative meeting was organized with representatives from the local population of Kutaisi.

By giving advertisements in advance, attendance of a wide range of related people to the meetings was encouraged. During the Public Consultation Meetings, citizens were informed about the activities to be carried out within the scope of the project, environmental effects of the project and measures to be taken against these effects. Opinions, ideas and suggestions of the local residents and related people were received during the meeting.

## Public Opinion

Consultation with affected population was undertaken

- to ensure their informed participation in the design, implementation and monitoring of the project measures and their impacts on the environment, as well as the efforts to minimize and the mitigate impact when avoidance is not possible;
- to introduce the project benefits to the local population that accrue to them as a result of project implementation;
- to incorporate all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

The following topics were discussed during the meeting:

- project context and rationale
- expected start and end of the project
- benefits of the project to local population and to the country as a whole
- the environmental issues and mitigated measures related to the project

The public consultation showed a support for the Kutaisi subproject by the local population. The population recognizes the need to accept limited nuisances as a result from the construction works, and understands that the implementation would fail without a good cooperation between the local population, the contractor and UWSCG. They were aware of the need to improve the water supply services. Residents also were of the view that the proposed project will improve the public health, the environment, and the socio-economic development of the City.

The Following questions have been asked from the local population:

#	Questions from local residents	Answers from the United Water Supply Company of Georgia
1	When will the project start?	The project will start in 2014, not before the 3rd Tranche is signed by the Government of Georgia and ADB and a Construction Company has been selected based on the 2 stage selection process.
2	Will the water provided to the local population for 24hours and will tap water quality improved?	Yes, water will be supplied for 24h to local residents and water quality will be greatly improved.
3	Name of the employer of a Kutaisi Water Supply System	United Water Supply Company of Georgia, LLC
4	What is the duration of the project?	36 months.
5	What type of impact on environment is associated with the project?	Environmental impacts that are associated with the project are only site specific. Impacts are mostly confined to the construction stage of the project and are therefore temporary. An Environmental Management Plan (EMP) has

#	Questions from local residents	Answers from the United Water Supply Company of Georgia
		<p>been prepared and will be implemented during the project implementation. The EMP identifies the potential environmental impacts arising from the project along with a set of the mitigation measures to reduce the impacts to acceptable levels</p> <p>Impacts mainly arise from generation of dust from soil excavation and refilling; and from the disturbance to residents, traffic and important buildings by the construction work. These are common impacts associated with the construction processes, and there are well developed methods for their mitigation.</p>
6	What will be benefit for local population from the rehabilitation of the water supply system in Kutaisi?	The Project will have overall beneficial impacts on quality of life for the citizens of Kutaisi. It will stimulate economic growth by constant supply and good quality of drinking water which is a prerequisite for tourism development.
7	Will local population employed by contractor?	Yes. Contractor will ensure involvement of local population in construction works.

There were no other comments or/and opinions from local population.

It should be mentioned also that public hearing meeting for the first tranche of Kutaisi project was held on May 10th, 2012, in Kutaisi at Kutaisi Opera House, where new east reservoir was also discussed as a planned one should be constructed in the next phase of the project.

Photos of the public consultation:





## Appendix 2

### Chance Finds Report Form

Please contact: \_\_\_\_\_  
To discuss find, on: \_\_\_\_\_

Date of Find: \_\_\_\_\_ Person who identified find: \_\_\_\_\_

#### Description of Initial Find:

Was work stopped in the immediate vicinity of the find?  Yes  No  
Was an archaeologist contacted?  Yes  No

#### Archaeological Detail:

Date of inspection: \_\_\_\_\_ Reporting Archaeologist: \_\_\_\_\_  
GPS coordinates: \_\_\_\_\_ Photo Record: \_\_\_\_\_  
Zone: \_\_\_\_\_ N: \_\_\_\_\_ E: \_\_\_\_\_  Yes  No  
Does Chance Find Correspond to a known PNG National Museum site?  Yes  No  
If Yes, which site code: \_\_\_\_\_  
If No, temporary site code is: \_\_\_\_\_  
If No, new Museum site code is: \_\_\_\_\_

#### Description of Find (fill in applicable information) (use additional pages if required):

Artefact type: \_\_\_\_\_  
Max artefact length (in mm): \_\_\_\_\_ Max artefact width (in mm): \_\_\_\_\_  
Max artefact thickness (in mm): \_\_\_\_\_ Max artefact platform width (in mm): \_\_\_\_\_

Approximate number of artefacts at site:  
 1  
 2 to 10  
 > 10  
 >50  
Other: \_\_\_\_\_  
Approximate size of site:  
Site area: \_\_\_\_\_ m<sup>2</sup>  
Site length: \_\_\_\_\_ m  
Site height (max) (for rockshelters/caves): \_\_\_\_\_ m  
Brief description of site and vegetation (e.g., surface sediment type, ground surface visibility, distance to nearest freshwater source, attach site sketch if necessary):

Brief description of find(s):

Statement of Significance (scientific, spiritual, historic, aesthetic and emotive and any evidence of stratification):

Level of Significance as per the PNG LNG Chance Finds Protocol Flowchart  
Low  Medium  High  Skeletal

**Impact Assessment**

Is site destroyed?  Yes  No  
Can further impacts to the chance find be avoided?  Yes  No  
Avoidance and mitigation measures discussed:

**Impact to Find**

Avoidance and mitigation outcome:

Date completed form lodged: \_\_\_\_\_ Person who lodged form: \_\_\_\_\_ Signature: \_\_\_\_\_

Appendix 3: Hydro Biological –Ichthyological Survey of Rioni River/Project Area

**Kutaisi Water Supply Project**  
**(20.10.2017 )**  
**(Hydro Biological –Ichthyological Survey)**



Tbilisi 2017

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## 1 General Overview

### a. Project Background Information

In the framework of “Urban Service Improvement Investment Program” (tranche 3) financed by the Asian Development Bank (ADB), a project on Kutaisi Water Supply System Improvement project is being carried out (Kut-01, phase 2).

The project considers delivery of drinking water from the riv. Rioni right bank adjacent territory, upstream Vartsikhe HPP dam, on the distance of about 6 km, to the water pump located on the left bank of the river. A pipe will be used for this purpose, which will most probably be located on the aqueduct perpendicular of the Rioni riverbed. Several piers of the aqueduct will be constructed within the Rioni riverbed.

It should be noted, that in the head race of the Vartsikhe HPP dam, riv. Rioni has two confluences: Kvirila River and Khanistskali River. Between head race of Vartsikhe HPP to the amelioration dam near the Poti street (Kutaisi), Rioni riverbed represents a half-closed reservation of Ichthyofauna, where fish species of the rivers Kvirila and Khanistskali dominate.

Ichthyological studies of this section have already been conducted, which includes filed surveys and analysis of literary sources by the Ichthyological team of “Gamma Consulting” Ltd.

To ensure implementation of the construction works for Kut-01 project, the ADB safety policy requires a field survey and update of the preliminary environmental study report based on this survey

The Ichthyological assessment must correspond the Safety Policy (2009) of the ADB and instructions of Good Practices (2012).

#### 1.1 Research Objectives

- Preparation of current condition of habitats within the project zone, including relevant maps and analysis;
- Conduction of theoretical study and review of literary materials to identify the types and status of Ichthyofauna;
- Definition of the mitigation, management, monitoring and, if necessary, conservation measures, in order to comply with the SPS requirements;
- Identification of the critical points (if any);
- Description of possible impacts from construction of the piers of the aqueduct;
- Implementation of mitigation measures with consideration of the impact factors.

#### Activity 1: Scoping and Literature Review

- Research of the existing environment, scientific literature or any other type of assessment of biodiversity within the project area;
- Existing conservation programs or initiatives in the zone and its adjacent territories (e.g. WWF sturgeon conservation plan);
- Determination of any invasive species using existing data on the project area.

#### Activity 2: Stakeholder Consultation

- Consultations with the local fishermen and other users of the river, in order to identify the main locations of the species.

#### Activity 3: Determination of the Critical Habitat

- A process carried out in a table format where every potential specie is listed and described in accordance with its characteristics (i.e. endemism, IUCN status, etc.). Evidence of such conclusion is also presented;
- Profile of each specie is presented, listing detailed information regarding ecology, life history, habitat preference, protection status, conservation actions and etc. of the species,

which is similar to the IUCN species profile. It was adapted to Georgia and the project zone.

#### **Activity 4: Recommended Mitigation and Management Plans**

- Recommendation of the mitigation and management actions using hierarchy of mitigation actions (avoidance, minimization, restoration and beginning). The actions must reflect the project related risks and impact on biodiversity that can be expected within the project zone. Mitigation and management measures are constituted in a compliance with the SPS;
- The recommendations also present information regarding implementation adequacy of the mitigation and management measures.

The report has been prepared basing on studies of the literary sources and results of field surveys, which have been carried out by the Ichthyological team of the “Gamma Consulting” Ltd. in 2017, October 20. Information provided by the local population and amateur fishermen has been used in the preparation of the report.

## **2. Study Methodology**

In the head race of the Vartsikhe HPP dam, the project river has two confluences: rivers Kvirila and Khanistskali. The Ichthyological studies of the rivers included desk researches, visual audit, field surveys, consultation with stakeholders (interviews with local population and amateur fishermen) and laboratory processing of the extracted material. Study methodology is in full compliance with the methods of international practice.

Conditions of fish volume within different water bodies are often discussed according to: general mass of the fish caught in recent years; quantitative ratio of age groups; first and massive maturity of the population; direct influence of fish growth rate and maturity; effectiveness of the fishing tools used and season of the fishing.

During field and laboratory researches Ichthyologists of the “Gamma Consulting” Ltd. used commonly accepted methods described in the following sources:

1. Правдин И.Ф. - Руководство по изучению рыб (преимущественно пресноводных). Издательство “Пищевая промышленность”, Москва 1966Г.
2. Константинов А.С. - Общая гидробиология. Издательство “Высшая школа”, Москва 1986Г.

### **2.1 Desk Research**

For the project section, which included rivers Kvirila and Khanistskali, following works have been conducted: field work plan was prepared, research route was defined, fishing and hydrochemical-hydrobiological sampling points have been determined. A questionnaire was prepared to interview the local population and amateur fishermen.

### **2.2 Visual Audit**

Visual audit considers identification of habitat for single fish species (general survey of the geomorphology of the riverbed, hydrological characteristics, habitat hypsometry, relief, benthic hypsometry, visual and landscape background), based on which, species inhabiting within the project rivers and their confluences (Rioni, Kvirila and Khanistskali) can be identified theoretically. This method of the preliminary assessment is intensively used in many countries.

### **2.3 Field Survey**

The field survey method involves the full biological analysis of obtained individuals (length, weight, sex, maturity stage, labeling and storage of scales for laboratory examination – to determine age,

growth and growth rate) on the particular location; to study their food base, hydro flora and hydro fauna; identification of macro invertebrates and insects suitable for feeding; to study the habitat-environment of fish and invertebrates; to determine suspended sediment concentration in water in mg/l; sampling in-situ, on a particular location and transportation to the laboratory for further examination. Determination of dissolved oxygen (O<sub>2</sub> mg/l) by using field Oximeter (Oxi 3300i/SET); Recording aquatic environment and air temperature; Water pH determination; Assessment of species composition and living biomass of the lowest plants - periphyton on rocks and boulders.

Field survey included control fishing conducted by cast net (weight 7,0 kg, hoop size 14 mm). Fishing activities were implemented on the control points, within 50 and 100 m sections. Only sport-amateur tools were used during fishing and accordingly, a special permit or license was not required. Survey parameters include studying all biotic and abiotic determining factors, related to fish ecological niche.

All fish individuals obtained by us using the small cast net are registered in a special field register, indicating the external parameters and internal physiological conditions. The scale samples, they are labeled and stored in a special polypropylene containers for further laboratory examinations.

#### **2.4 Stakeholder Consultations**

To fully illustrate the Ichthyofauna composition of the rivers Rioni, Kvirila and Khanistskali interviews with amateur fishermen and other users of the rivers was conducted. Amateur fishermen with fishing experience of 5-10 years have been selected for this purpose. The questionnaire was constituted so, to minimize possibility of falsification of the facts by the fishermen. Additionally, the information is found reliable if verified by three or more fishermen. In total, 5 fishermen participated in the interviews. Results of consultations are presented in the table 6.1.

#### **2.5 Laboratory Study**

The part of findings obtained during the control fishing is returned alive into the environment (Catch and Release Principle) and only the part is transported to the laboratory, where the material is processed; in particular, sex and maturity stage, age, nutrition ratio, meristic and plastic features, the digestive tract contents was also observed. Laboratory examination is conducted using recognized standard methods (see chapter 2 – Study Methodology).

### **3 Hydrological and Aquatic Biodiversity Background Conditions of the Project Territory**

#### **3.1 Visual Audit**

##### **Rioni River**

Within the project area riverbed of Rioni is covered with cobble stones, in some places gravel and rarely – silt. This results in creation of rapids, small waterfalls, pools, large and small islands. It should be noted that the project section represents a half-reservoir zone for the Ichthyofauna, namely on the section between irrigation system dam (Kutaisi, near Poti street) and Vartsikhe HPP cascade dam. The flow in the downstream of the irrigation system dam is rapid, one-channeled, after this section it branches and creates 40-60 m wide and 150-300 m long islands within the project section; islands are located along three-row flow.



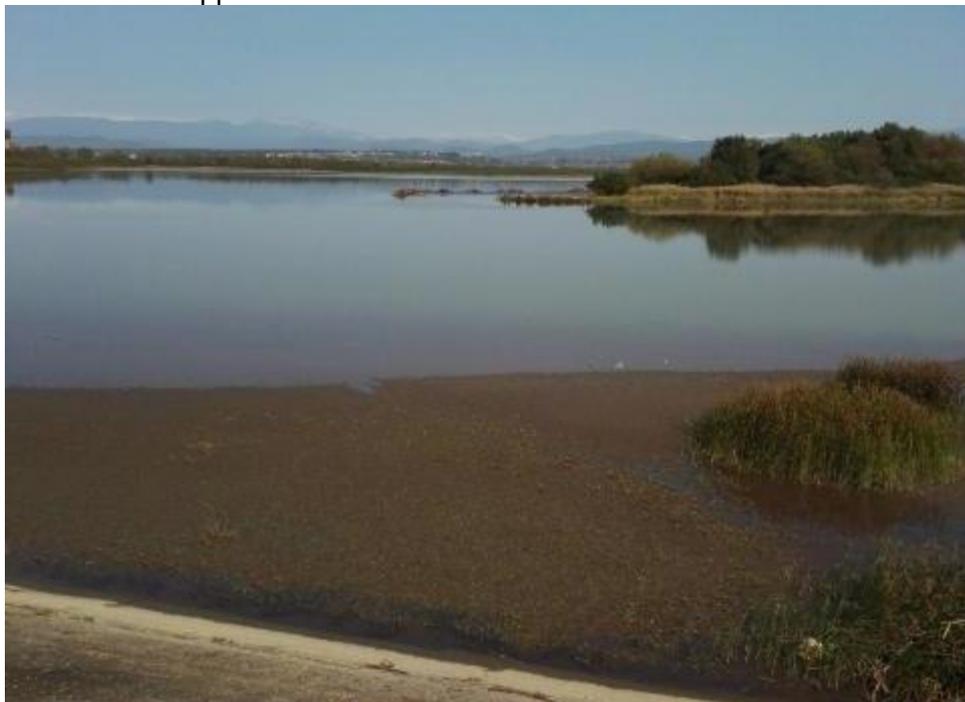
**Picture3.1.1.** A large island on the river Rioni

An insignificant inclination of the river banks was observed during the field works. The bottom is full of 0.2 m diameter stones. Reinforced concrete castings with diameter of 1,5X0.40 m is observed on the bottom of the Rioni River. Its objective is to protect the drinking water pipeline located under the riverbed from damage.

Flow depth within the project section varies between 0.4 to 0.8 m, and the velocity is 1.5-2.0 m/s.

Despite intensive changes in the river depth, fish food of average volumes can still be found on the bottom.

Two important confluences have been identified (rivers Kvirila and Khanistskali), that play a significant role in water supply of the reservoir.



**Picture 3.1.2.** Confluences of the rivers Kvirila and Khanistskali

Kvirila River is a tributary of the Rioni River. It is to be noted, that small numbers of fish within the mouth of the riv. Kvirila gathered for winter season is caused by high levels of suspended particles concentration within the riv. Kvirila itself (569.0 mg/l was observed within the samples abstracted during the expeditions).

The most optimal environment for wintering for the Ichthyofauna presented in the project section is created on the connection between the riv. Khanistskali and Vartsikhe HPP reservoir. This location is relatively deep, has normal transparency (34.2 mg/l was observed within the samples abstracted during the expeditions), it is densely covered with reed mace and bulrush vegetation, which contributes to the safe coexistence of fish of different age groups and species in the winter season.



**Picture 3.1.3.** Khanistskali delta at Vartsikhe HPP reservoir

**Table 3.1.1.** Title of the control point; geographical coordinates, morphometric characteristics of the riverbed and physical and chemical characteristics of the river

No	Benchmark Location	Aqueduct piers benchmark UTM coordinates	Morphology of the riverbed	River depth, m	Wet perimeter width of the river, m	Velocity of the river, m/s	Atmosphere temperature °C	River water temperature °C	Suspended particles, mg/l	pH	O <sub>2</sub> mg/l	Flow essence, rapids, waterfalls and etc.	Inclination of the banks in degrees	
1	Aqueduct piers will be arranged here	X=310139,065 Y=4677782,911	Within the project area riverbed of Rioni is covered with cobble stones, in some places gravel and rarely – silt. the project section represents a half-reservoir zone for the Ichthyofauna, between irrigation system dam (Kutaisi, near Poti street) and Vartsikhe HPP cascade dam	0,8-1,5	60-80	1,5-2,0	22	11,2	64,6	6,5	10,85		50-75-85;	
2		X=310171,383 Y= 4677788,055											The flow in the downstream of the irrigation system dam is rapid, one-channeled, after this section it braches and creates 40-60 m wide and 150-300 m long islands within the project section; islands are located along three-row flow. Aqueduct piers will be arranged on these islands.	
3		X= 310204,022 Y= 4677793,250												
4		X= 310236,661 Y= 4677798,446												
5		X= 310269,300 Y= 4677803,641												
6		X= 310301,939 Y= 4677808,836												
7		X= 310334,578 Y= 4677814,032												
8		X= 310367,218 Y= 4677819,227												
9		X= 310399,857 Y= 4677824,423												
10		X= 310432,496 Y=4677829,617												
11		X= 310465,135 Y=4677834,813												
12		X= 310497,453 Y= 4677839,958												

4. List of Fish Species within the River Rioni Basin (Head Race of Vartsikhe HPP Dam and Source)

**Table 4.1.**

Title	Latin title	Category evaluation	Presence within the project impact zone (+; -)
Crimean barbel	<i>Barbus tauricus rionica</i> Kamensky, 1899	Not evaluated	+
Gudgeon	<i>Gobio lepidolaemus caucasica</i> Kamensky, 1901	Not evaluated	-
Transcaucasian spirlin	<i>Alburnoides fasciatus</i> Nordmann, 1840	IUCN – not evaluated (NE).	+
Colchis nase	<i>Chondrostoma colchicum</i> Derjugin, 1899	IUCN – not evaluated (NE).	-
European chub	<i>Squalius cephalus</i> Linnaeus, 1758	IUCN – least concern (LC).	+
Stone loach	<i>Barbatula barbatula caucasicus</i> Berg, 1899	Not evaluated	+
Georgian bitterling	<i>Rhodeus colchicus</i> Bogutskaya & Komlev, 2001	IUCN – not assessed (NE).	-

**Diagram 4.1.** Spawning and feeding migration periods of species within the project area

Species	January	February	March	April	May	June	July	August	September	October	November	December
Crimean barbel Barbus tauricus rionica Kamensky, 1899				→	→	→	→	→	→			
Transcaucasian spirin Alburnoides bipunctatus fasciatus (Nordmann, 1840)				→	→	→	→	→	→			
Stone loach Barbatula barbatula caucasicus Berg, 1899						→	→	→	→	→		
European chub Squalius cephalus Linnaeus, 1758				→	→	→	→	→	→	→		

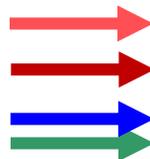
**Definition:**

Spawning period: →

Active spawning period: →

Upstream spawning migration: →

Feeding migration downstream: →



## 5 List of Fish Species Obtained in the Project Section

### 5.1 Crimean Barbel

**Species:** Crimean Barbel

**Latin name:** *Barbus tauricus rionica* Kamensky, 1899

**Type:** Freshwater fish

**Way of living:** Benthopelagic

**Diet:** Semi-predatory

**Habitat:** coastal rivers of Asia Minor, the Black sea. This species inhabit in the following Georgian rivers: Chorokhi, Choloki, Kintrishi, Sufsa, Rioni, Khobi, Enguri, Kododri, Bzifi, Psou and their tributaries. In Amtkeli lake, Tkibuli and Lajanuri reservoirs.

Length - 55 cm, weight - 1,5 kg, generally, smaller ones are found. It is benthopelagic freshwater fish. It lives in stony-sandy places.

**Habitat and behavior:** In rivers it visits high elevation together with Khramulia within the habitats of trout. This species prefers rivers with fast, fresh, sandy-stony bottoms. It migrates on small distances due to feeding and breeding, it overwinters in riverbank caves and holes of the bottom.

**Reproduction:** Fish reaches maturity from the age of 3-4 years. It spawns two times; breeding period is from May to August earlier in the lower reaches than in middle and upper reaches of the river; they spawn in shallow waters, sandy-stony areas, where the water temperature is 12-18°C. Fertility depends on the age and body weight. In rivers fertility of this fish is from 2000-15000 spawns, and in lakes – up to 30000. Young fries are hatched for a week.

**Feeding features:** this species eat benthos, mollusks, chironomids, Amphipoda, as well as animal or plant detritus, crayfish, sometimes small fish and their spawn. Due to the small number, fish does not have commercial significance.

### 5.2 European Chub

**Species:** European chub

**Latin name:** *Squalius cephaus* (Linnaeus, 1758) = *Leuciscus cephalus orientalis* Nordmann, 1840)

**Type:** Freshwater fish

**Way of living:** Benthopelagic

**Diet:** Semi-predatory

Its body is elongated, covered with thick scales; head is large, its length sometimes is longer than the maximum height of the body; in some specimens it is equal – and in some of them – smaller. Dorsal side is dark, lateral sides – dark grey, ventral side – whitish. There is usually dark spot behind the gill cover. Length - 50 cm, weight - 1,5 kg, generally, small ones are found.

**Habitat:** Rivers: Mtkvari, Khrami, Aragvi, Alazani, Iori, Chorokhi, Kintrishi, Supsa, Natanebi, Rioni, Khobi, Enguri, Kodori, Bzifi; Lakes: Jandari, Paravani, Saghamo, Bazaleti, Paliastomi, Bebesiri; Reservoirs: Khrami, Tbilisi, Sioni.

**Habitat and behavior:** Freshwater fish, inhabit in stony-sandy rivers.

**Diet:** It feeds animal and vegetable food

**Reproduction:** It reaches sexual maturity from the age of 2-3 years; reproduces from May to August, fertility reaches 15000-150000 spawns. It is freshwater fish, lives in stony and sandy areas.

It does not have commercial significance.

**IUCN - Least Concern (LC).**

### 5.3 Stone Loach

**Species:** Stone loach

**Latin name:** *Barbatula barbatula caucasicus* Berg, 1899

**Type:** Freshwater fish

**Way of living:** Benthophage

**Diet:** Pelagic

Length - 9 cm, weight - 5 g.

**Habitat:** It can be found in every reservoirs and rivers of Georgia.

**Habitat and behavior:** Freshwater fish. It inhabits in lakes and reservoirs, silt and stony-sandy areas.

**Diet:** It feeds on plankton, benthos and algae.

**Reproduction:** It reproduces from June to September; fertility - 2000- 3000 spawns. It is endemic species of Caucasus.

### 5.4 Transcaucasian Spirlin

**Species:** Transcaucasian Spirlin

**Latin name:** *Alburnoides bipunctatus fasciatus* (Nordmann, 1840)

**Type:** Freshwater fish

**Way of living:** Benthopelagic

**Diet:** Pelagic

Length - 13 cm, weight - 60 g, mainly inhabit in shallow, sluggish waters, in small branches, well adapted to the lake conditions.

Its body is high, flattened from the sides, covered with easily removable scale. There is the bare body part behind the caudal fin. Dorsal is dark greenish, sides are silver. Along the lateral line double line follows, it may be dark or light color. Dark spots are scattered on the sides, especially to the upper direction. Sometimes bottoms of pectoral, pelvic and anal fins are reddish.

**Habitat:** In Chorokhi River and in its tributaries (Tkhilnaristskali, Chanaristskali, Adjaristskali, Machakhela); Rivers: Chakvistskali, Kintrishi, Supsa, Rioni, (entire length), Churia, Tkori, Enguri, Tikori, Enguri, Ghalidzga, Timushi, Dghamishi, Mokvi, Okumi, Kodori (its tributaries), Gumista, Tetriskaro, Shavtskala, Bzifi, Psou; Lakes: Paliastomi, Nabada, Amtkeli, Tkibuli reservoir; Eastern Transcaucasia.

**Reproduction:** it reproduces from May to August, fertility - 2000-6000 spawns

**Diet:** it feeds on plankton, benthos and partly, algae.

It has no commercial meaning. It is the competitor in feeding the breeding areas.

## IUCN – Not Evaluated (NE).

### 6. Stakeholder Consultations - Results of interviews with local fishermen and other river users

5 fishermen were interviewed within the framework of biological environment baseline study for the project section:

6. Abjandadze Badri;
7. Gvasalia Irakli;
8. Vekua Tamazi;
9. Kirkitadze Rezo;
10. Sul Khanishvili Jemali.

**Table 6.1.** Results of interview with local population and amateur fishermen

N	Question	Answer
1	How old were you when you started fishing and where?	I have been fishing since my childhood; I mainly fish at Khanistskali and Rioni Rivers, but downstream of Vartsikhe reservoir.
2	Have you ever fished on Kvirila River? If yes, what fish have you caught?	Fishing on Kvirila River means bathing the earthworm pointlessly! In summer, during the fishing season, Khanistskali and Rioni river banks are full of fishers, but no one can be seen on Kvirila River.
3	Have you ever caught fish at the dam of irrigation system, near Poti street, in Kutaisi?	Fish jumps out of water at the waterfall, at the dam in summer, but the environmental inspection and the dam security guard prohibit us fishing. Small fish is observed there, but I can't name exactly the species.
4	Have you ever caught a fish at the islands in Rioni River, across Nikea Street in winter and if yes, what species?	In those areas fish can't be obtained at all. From the upper dam the water flow is sometimes increased and sometimes – decreased; it happens for several times in a day and fish doesn't stay there. They enter Vartsikhe reservoir or Khanistskali River. There are favorable conditions for the fish and food can be also easily obtained there.
5	When is the fish more active on this section? I mean the area from Vartsikhe HPPs dam to the dam at Poti Street.	After spring floods, when water is relatively fresh; from the middle of May, or beginning of June; it depends on weather conditions in mountains.
6	Does poaching occur there? Where and when?	Through the area, which you are interested in, no fish can be observed. As for poaching, considerable penalties are set in this regard, but we have seen neither poachers, nor fishers on this section.

7.Results of Field Research



**Figure 7.1.** Rioni River Section between the dams of Vartsikhe HPP and the irrigation system, with the confluences of Kvirila and Khanistskali Rivers



**Figure 7.2.** Exact location of the aqueduct construction on Rioni River for Kutaisi water supply project

### 7.1 Critical Points of the Project Section and Their Description

Critical points are those points, which are formed by boulders and woods accumulated during various natural disasters, they create additional barriers on spawning and feeding migration routes of fish species. Those points, which may be formed during the construction of the aqueduct piers, are also considered as critical points.

3 critical points were detected as a result of visual audit of the project area, which are given below (Table 7.1.1).

**Table 7.1.1** Layout of critical points on the project section

Point №1	X=310160.86; Y=4677806.46; H=118 m. a.s.l
<p>Variability of Rioni River water in the short period of time is shown on the given section. Variability of water level causes destruction of the benthic invertebrates that results in reduction of fish feeding base.</p>	

<b>Point №2</b>	<b>X=310482.71; Y=4680578.94; H=134 m a.s.l.</b>
<p>The headwork of the irrigation system is shown on the section, from where fish migrate downstream without any hindrance, while during migrating in the opposite direction, crossing the relatively high waterfall coming from the dam is insuperable obstacle for the small fishes.</p>	
<b>Point №3</b>	<b>X= 310933.44; Y= 4669299.05; H=85 m a.s.l.</b>
<p>In case of freshets and releasing of considerable debit of water, lots of fish can massively follow the water supplied to the HPPs Cascade from the upstream of Vartsikhe HPP dam.</p>	

## 7.2 Ichthyological Survey Results

Based on the interviews with locals and conducted test fishing, following species have been identified: European chub - *Squalius cephalus* (Linnaeus, 1758) = *Leuciscus cephalus orientalis* Nordmann, 1840), Colchis barbell - *Barbus tauricus rionica* Kamensky, 1899, Spirlin - *Alburnoides bipunctatus fasciatus* (Nordmann, 1840), Stone loach - *Barbatula babatula caucasicus* Berg, 1899.



**Picture 7.2.1.** European chub *Squalius cephalus* (Linnaeus, 1758) =*Leuciscus cephalus orientalis* Nordmann, 1840), Colchis barbel *Barbus tauricus rionica* Kamensky, 1899, Spirlin *Alburnoides bipunctatus fasciatus* (Nordmann, 1840), stone loach *Barbatula babatula caucasicus* Berg, 1899.



**Photo 7.2.2.** Fishing in the project section of Rioni River

**Table 7.2.1.** Detailed description of obtained specimen (age, length, weight, sex and maturity stage, fishing coordinates)

No of Fishing points	Date	Location coordinates and nearby territories	Species	Number	Length, cm	Weight, g	Sex and maturity stage	Age		
№1	20.10.2017	X= 310160.86; Y= 4677806.46; H=118m, a.s.l.	Caucasian chub <i>Squalius cephaus</i> (Linnaeus, 1758) = <i>Leuciscus cephalus orientalis</i> Nordmann, 1840)	5	17	49	♂ <sub>3</sub>	3 <sup>+</sup>		
					12	20	♂ <sub>3</sub>	3 <sup>+</sup>		
					11	14	♀ <sub>3</sub>	2 <sup>+</sup>		
					11	18	♂ <sub>3</sub>	2 <sup>+</sup>		
					11,5	15	♀ <sub>3</sub>	2 <sup>+</sup>		
					Colchis barbel <i>Barbus tauricus rionica</i> Kamensky, 1899	1	8,5	6	♀ <sub>2</sub>	2 <sup>+</sup>
					Spirlin					
					<i>Alburnoides bipunctatus fasciatus</i> (Nordmann, 1840)	1	11	12	♀ <sub>3</sub>	3 <sup>+</sup>
					Stone loach <i>Barbatula babatula caucasicus</i> Berg, 1899	2	10	10	♂ <sub>2</sub>	2 <sup>+</sup>
			10	12			♂ <sub>2</sub>	2 <sup>+</sup>		

### 7.3 Hydro Chemical and Hydro Biological Survey Results

**Table 7.3.1.** Water sampling results of Rioni River project section:

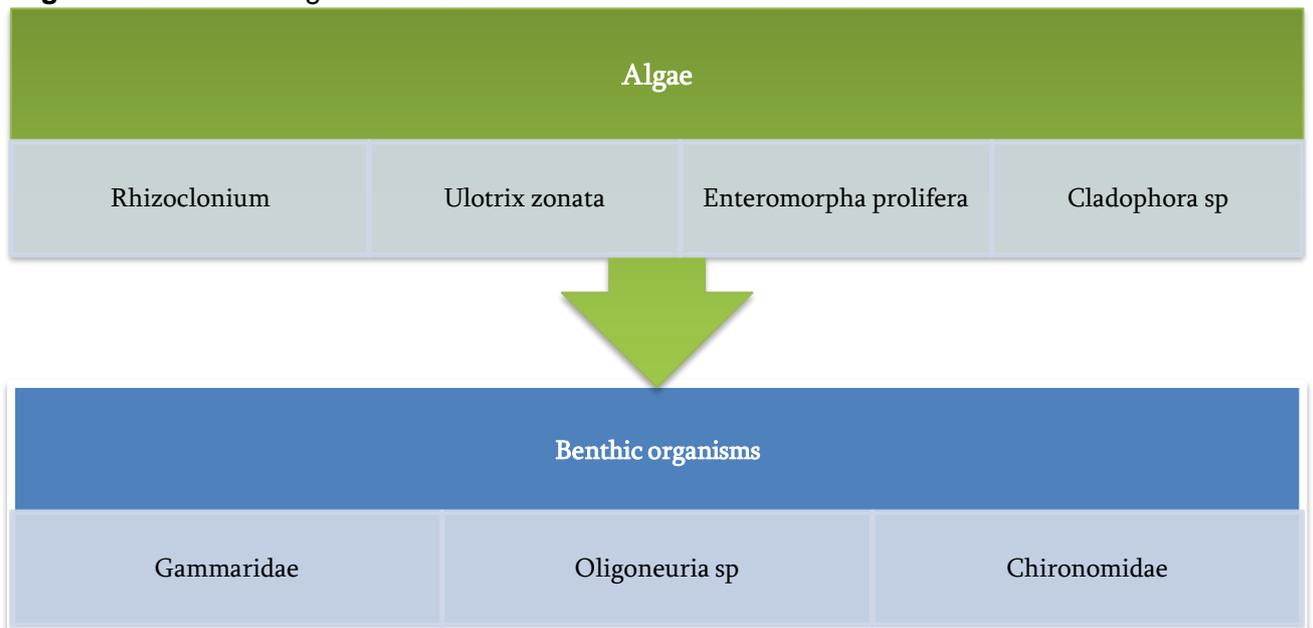
Suspended particles	64,6 mg/l
Dissolved oxygen (O <sub>2</sub> )	10,85 mg/l
Hydrogen ion concentration (pH)	6,5
Water temperature	+11,2 °C
Ambient air temperature	+22 °C

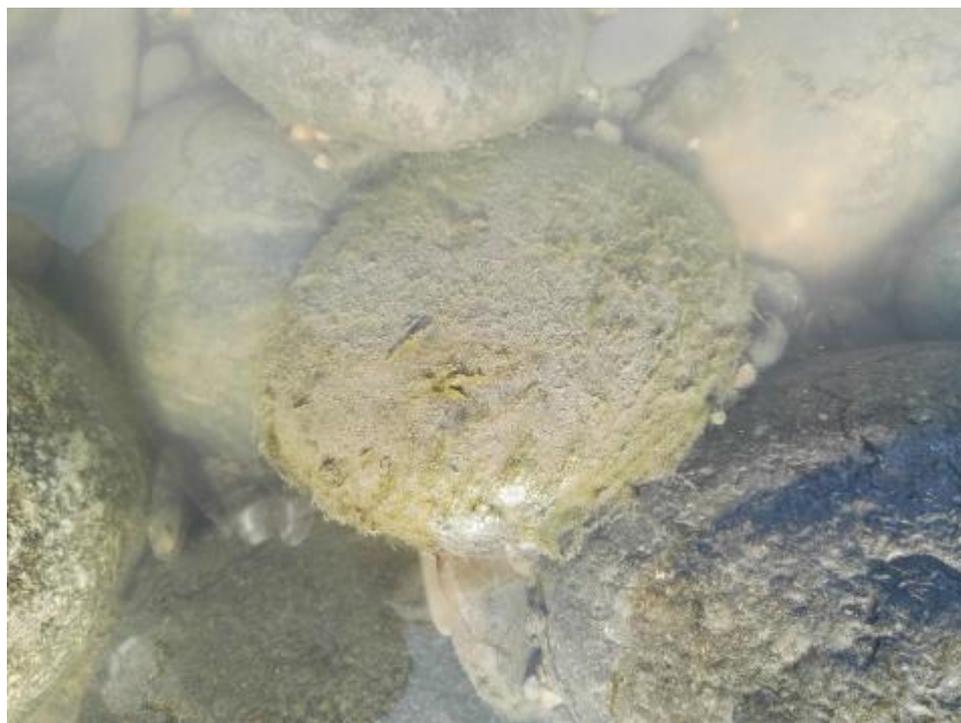
We obtained specimen of stoneflies on the bottom of Rioni River through the project area. In addition, colonies of invertebrates are also represented, which are optimal feeding base for fish; but diversity and abundance of invertebrates indicates the scarcity of fish species and their populations in this section.



**Picture 7.3.1.** Zoobenthos of Rioni River bed

**Diagram 7.3.1** List of algae and benthic invertebrates of Rioni River





**Picture 7.3.2.** Phytobenthos of Rioni River bottom

#### 8. Description and Assessment of Possible Impact on Fish Fauna in Rioni Riverbed during Construction of Aqueduct Piers

Construction process mainly cause negative impact on fish fauna. Following negative impacts, described in Table 8.1., may take place during construction of several piers of aqueduct, planned on Rioni River.

**Table 8.1.** Factors of Possible Impact during Construction of Aqueduct Piers

<b>During Construction of Aqueduct Piers</b>	
Drying out of the river	During construction of aqueduct piers, temporary drying out of the flow (temporary changing of flow) on the construction site 'dewatering' of the construction site) – impact on fish migration.
Water Turbulence	On construction phase during implementation of works loose soil may get into riverbed, causing siltation, which creates unfavorable conditions for fish fauna. Impact on fish food base due to riverine vegetation cleanup
Noise	Using heavy machinery (loaders, excavators) will cause significant noise, leading to negative impact on natural conditions of fish.
Chemical Pollution	During and after construction pollution of water/riverbed with waste and/or material (in case of improper management), fuel/oil; this can impact fish and macro-invertebrates after restoration of water stream within the project section.
	Sediments accumulated near piers may create new, additional habitat for macro-invertebrates – This can be deemed as positive impact in terms of improvement of fish food base.
	Impact on fish and macro-invertebrates during repair work implementation near the river or in the riverbed.

### 9. Mitigation Measures for Impact on Fish Fauna Expected during Construction and Operation of Aqueduct Piers

Mitigation strategy is based on safety principles and covers adaptive management practice. Mitigation and management measures, which is compliant with changes of circumstances and monitoring results during the project lifecycle, should be implemented in line with requirements of Asian Development Bank (ADB). This considers determination of mitigation, management, monitoring and where required conservation measures, in order to ensure compliance with SPS requirements. Need for each mitigation measure is determined for the period of construction and operation of aqueduct piers, providing description of negative impact.

**Table 9.1.** Mitigation measures for possible negative impact factors, expected on construction and operation phases of aqueduct piers

Possible Negative Impact	Mitigation Measure	Responsibility	Location	Monitoring
<b>Construction Phase</b>				
Temporary flow diversion from construction site (“dewatering” of the construction site) – impact on fish migration	<ul style="list-style-type: none"> <li>• Work implementation during low-water period (in winter), when fish is less active;</li> <li>• Prohibition of waste/material throwing into riverbed in order to avoid blockage after water stream restoration (release)</li> </ul>		Riverbed from closing section of the stream, downstream of the crossing stream, till active stream section.	<p>Observation of riverbed-determination of potential blockage and removal (on a daily basis).</p> <p>As it is not possible to drain the whole area, there can be holes with fish. It is necessary to observe the area in order to find fish, remained in the riverbed (note: it may be required to move fish to active flow)</p>
During and after construction pollution of water/riverbed with waste and/or material (in case of improper management), fuel/oil; this can impact fish and macro-invertebrates after restoration of water stream within the project section.	<ul style="list-style-type: none"> <li>• Works should be implemented in the riverbed or near it according to preliminary developed methods/plan;</li> <li>• Control over technical functionality of machinery/equipment; damaged machinery/equipment are not allowed to enter the site;</li> </ul>		Work site	Inspection/visual control (daily)

	<ul style="list-style-type: none"><li>• Material should be stored in not less than 50 m from active riverbed;</li><li>• Prohibit fueling and/or maintenance in the distance not less than 50 m from active riverbed;</li><li>• Prohibit discharge of processed wastewater/ potentially polluted surface runoff into the river;</li><li>• Regular cleaning of the site and timely waste removal;</li><li>• Removal of excess material, waste and temporary structures and equipment from the site after completion of works;</li><li>• If there is fuel storage on the site – in case of accidental spillage avoid spreading in the environment (measures include – 110% of tank capacity) presence of spill trapping secondary storage device; Tank should be located in not less than 50 m from active riverbed. Provide absorbents; Train/inform personnel on best practice of work implementation and environmental issues.</li></ul>			
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Impact on fish food base due to riverine vegetation cleanup.	<ul style="list-style-type: none"> <li>• Maximum preservation of riverine vegetation cover;</li> <li>• Strict adherence to construction site borders in order to avoid impact on vegetation cover outside the borders of the work site;</li> <li>• Instruct personnel on the need of protection of riverine vegetation cover.</li> </ul>		River banks within the project impact zone (work site).	Visual control (during vegetation cover removal).
<b>Operation Phase</b>				
Sediments accumulated near piers may create new, additional habitat for macro-invertebrates – This can be deemed as positive impact in terms of improvement of fish food base.	<ul style="list-style-type: none"> <li>• Implementation of mitigation measures is not required. However it is recommended to monitoring over fish and macro-invertebrates in order to identify any unfavorable impact (less expected)</li> </ul>		Upstream and downstream of structure (in 50 m on each sides of the structure).	Monitoring during the first year of operation – in June (after high-waters), at the beginning of September and in December.
Impact on fish and macro-invertebrates during repair work implementation near the river or in the riverbed.	<ul style="list-style-type: none"> <li>• Carry out mitigation measures determined for the construction phase</li> </ul>		Works site (in 50 m from the structure)	Monitoring –is analogous to that considered for the construction phase. Water quality control, if required (based on the decision of environmental officer of the operator company).

## 9.1. Invertebrates Protection Strategy

### 9.1.1. Impact on Invertebrates

Large amount of soil mass may get into the river during construction within the project impact area; it will result in siltation, accordingly, hydrobionts living on the bottom will not have conditions, necessary for their living. So it is essential to carry out each stage of the construction with maximum cautiousness.

**Table 9.1.1.1.** Impact Summary

Description of impact sources	Impacts on receptors	Impact characterization and assessment
<b>Construction phase</b>		
<p><b>Impact on fish fauna:</b></p> <ul style="list-style-type: none"> <li>➤ Direct impact sources:           <ul style="list-style-type: none"> <li>• River diversion for arrangement of the aqueduct piers;</li> </ul> </li> <li>➤ Indirect impact sources:           <ul style="list-style-type: none"> <li>• Water pollution;</li> <li>• Pollution of bottom sediments.</li> </ul> </li> </ul>	Biological environment of Rioni River	<p>Direct and indirect, negative, temporary impact; Mortality of single units of fish species is expected. Impact on habitat food base and temporary migration of fish. <b>Significance: Low</b>, considering mitigation measures <b>very low</b>.</p>

## 10. General Conclusions

According to draft project, it is considered to pump borehole water to the left bank of Rioni River on about 6 km upstream of Vartsikhe HPP dam, in the vicinity of Rioni right river bank. Pumping will be provided using pipes, which will supposedly be located on aqueduct, crossing the Rioni riverbed perpendicularly. It is planned to arrange several piers of aqueduct directly in the riverbed. The possible impact on certain fish species in the given section of Rioni River due to construction of aqueduct piers will be discussed based on available literary sources as well as information obtained from ichthyologic field surveys, conducted by our group.

Directly upstream of Vartsikhe HPP dam rivers: Kvirila and Khanistskali join Rioni river. Between upstream of Vartsikhe HPP dam and irrigation system headwork dam adjacent to Poti street in Kutaisi city, Rioni river is semi-closed reservation of fish fauna, where fish species, distributed in Kvirila and Khanistskali rivers mostly dominate. Based on literary sources and ichthyologic survey results, we can conclude that fish fauna of Rioni River is represented by following fish populations for autumn period:

### 9.1.1.2 List of Fish Species Obtained within the Project Section

Name	Latin Name	Assessment of Category	Fish Distribution within the Project Section of Aqueduct (+, -)
Transcaucasian Spirilin	Alburnoides bipunctatus fasciatus (Nordmann, 1840)	IUCN – Not Evaluated (NE).	+
Crimean Barbel	Barbus tauricus rionica Kamensky, 1899	Not Evaluated	+
European chub	Squalius cephaus (Linnaeus, 1758) =Leuciscus cephalus	IUCN – Least Concern (LC).	+

Stone loach	Barbatula barbatula caucasicus Berg, 1899	Not Evaluated	+
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Out of 41 fish species, distributed in Rioni River, above-mentioned species, listed in the table and verified can be found in autumn. As for fish representatives of sturgeon, distribution area of this species locates outside the project borders.

The upper point of distribution area of sturgeon fish species is downstream of Vartsikhe HPP dam, namely, from Rioni river confluence with the Black Sea till discharge location of Vartsikhe HPP Cascade used water into Rioni River. The only hindrance for spawning migration of sturgeons is the low environmental flow downstream of the dam. In order to exclude this factor, in 1983, under “Sakshavzghvatevzmsheni”, fish farm for artificial reproduction of sturgeon fish species was launched. This fish farm had to release grown fish fries of sturgeons (several billion units) upstream of Vartsikhe HPP dam annually.

Above-mentioned works were carried out till the end of 80s, and from 90s fish farm was destroyed and finally transferred to private ownership, with no obligation on provision of above-mentioned specific activities.

As construction of aqueduct piers coincides with the low-water period of Rioni River, period of minimum debit (winter), it can be deemed as mitigation measures for the impact. During this period all fish species within the project section migrate to deep areas of Vartsikhe HPP reservoir, which are located at the confluence of Kvirila (very rarely) and Khanistskali (mostly) with the reservoir, in order to spend winter there.

During fish wintering at Kvirila river confluence, the low number of fish is stipulated also by permanent high level of floated sediments in Kvirila River, as fish of all age and specie try to avoid it.

The most optimal conditions to spend winter for fish species distributed within the project section is Khanistskali-Vartsikhe HPP reservoir confluence area. This location of the reservoir is actually delta, relatively deep, with normal transparence, covered with dense reed mace and bulrush, which stipulates safe cohabitation of fish of various age and specie composition during winter months.

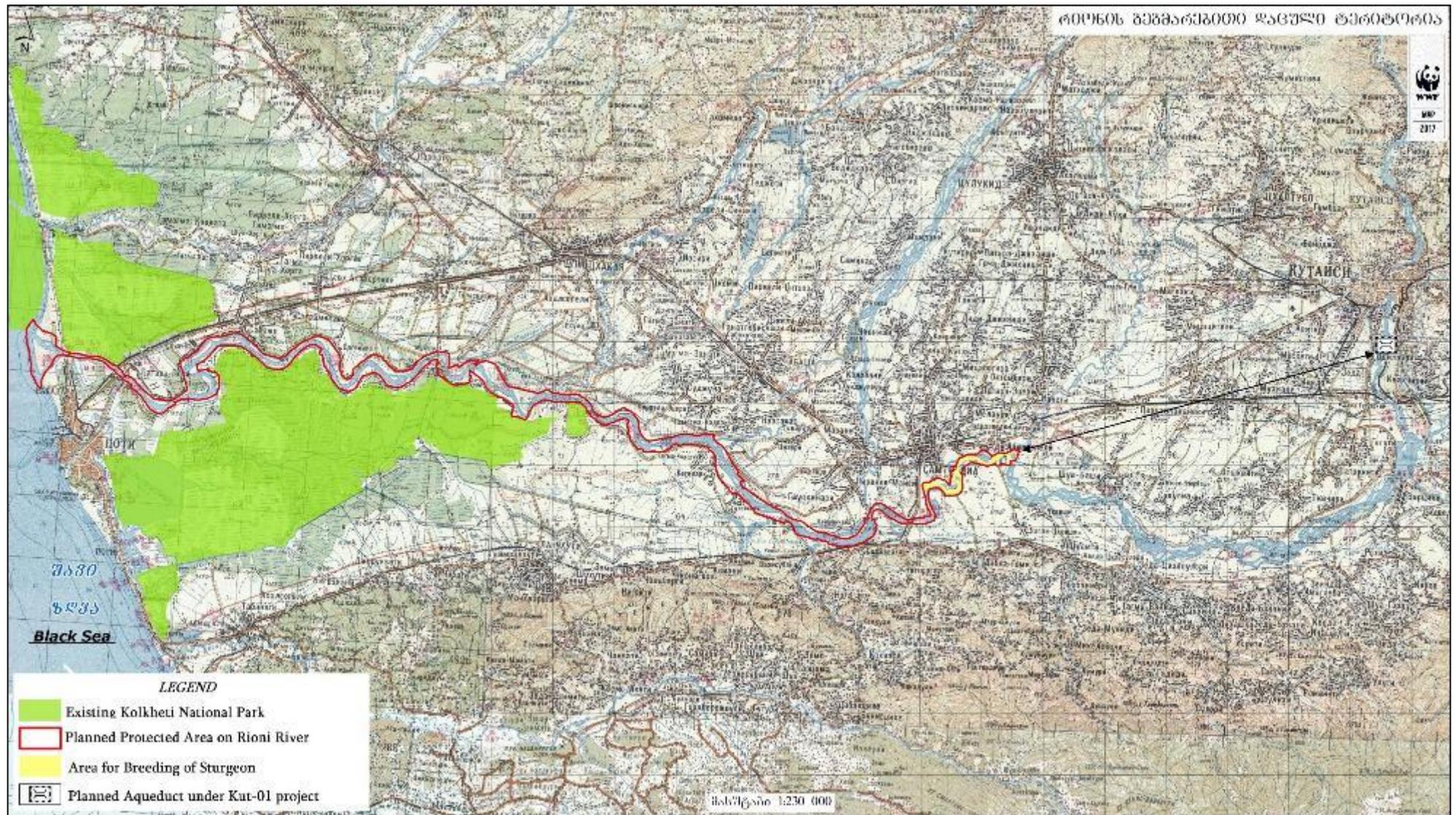
**Specific Conclusion:**

Implementation of aqueduct construction works on Rioni river **in winter**, will have insignificant impact on fish fauna, distributed within the project section

## References

1. ნარგიზ ნინუა, ბელა ჯაფომვილი, ვერა ბოჭორიშვილი, **საქართველოს თევზები**. გამომცემლობა „წიგნი ერი“, საქართველო, თბილისი, 2013.
2. **საქართველოს ცხოველთა სამყარო**, IV. გამომცემლობა „მეცნიერება“, თბილისი, 1973.
3. რ. ელანიძე, **საქართველოს შიდა წყალსატევების ჰიდრობიოლოგია და იქთიოლოგია, მდინარე ბზიფის იქთიოფაუნა**, ნაკვეთი II, რიწის ტბა, გამომცემლობა „მეცნიერება“, თბილისი, 1965.
4. საქართველოს პრეზიდენტის ბრძანებულება №303; 2006 წლის 2 მაისი; საქართველოს „წითელი წუსხის“ დამტკიცების შესახებ.
5. Павлов Д.С., Скоробогатов М.А. **Миграции рыб в зарегулированных реках**. — М.: Товарищество научных изданий КМК. 2014. 413 с.
6. Р. Ф. Эланидзе, **Ихтиофауна рек и озер Грузии**. Академия наук Грузинской ССР, «Мецნიერება», Тбилиси, 1983.
7. Поддубный А. Г., Малинин Л. К., Терещенко В. Г. **О точности оценки абсолютной численности рыб во внутренних водоемах**. Сб. « Оценка погрешностей методов гидробиологических и ихтиологических исследований»; тр. ин-та биологии внутренних вод. Рыбинск; АН СССР, 1982. Вып. 49(52). С. 83-102.
8. **Ресурсы поверхностных вод СССР, гидрографические описания рек, озер и водохранилищ. Том 9, Закавказье и Дагестан, выпуск I, западное Закавказье**. Гидрометеоиздат. Ленинград, 1974. Стр. 219-233.
9. Правдин И. Ф. **Руководство по изучению рыб** (преимущественно пресноводных) (4-е изд. ). М.: Пищевая промышленность , 1966 г.
10. Барач Г. П. **Рыбы пресных вод**. Акад. наук Груз. ССР. Зоол. Ин-т. Тбилиси : Изд-во Акад. наук Груз. ССР, 1941. - 287
11. Правдин И.Ф. - **Руководство по изучению рыб** (преимущественно пресноводных). Издательство “Пищевая промышленность”, Москва 1966Г.
12. Константинов А.С. - **Общая гидробиология**. Издательство “Высшая школа”, Москва 1986Г.

#### Appendix 4: Map of Planned Aqueduct and all Sensitive Receptors along the Rioni River



Appendix 5: Letter to the MoENRP of Georgia regarding Rioni River Crossing

