MDF
MUNICIPAL DEVELOPMENT
FUND OF GEORGIA

Environmental and Social Impact Assessment Report

for Construction of the Bridge on Khrami River in the vicinity of Pitareti Monastic Complex

February, 2017

Acronyms

EIA – Environmental Impact Assessment

EMP – Environmental Management Plan

ESIA – Environmental and Social Impact Assessment

ESMF - Environmental Assessment and Environmental and Social Management Framework

ESMP - Environmental and Social Management Plan

GoG – Government of Georgia

HSE – Health Safety Environment

KP – kilometers Benchmark

MCMP – Ministry of Culture and Monument Protection of Georgia

MDF - Municipal Development Fund of Georgia under the Ministry of Regional Development and Infrastructure of Georgia

MESD – Ministry of Economy and Sustainable Development of Georgia

MLHSA – Ministry of Labor, Health and Social Affairs of Georgia

MENRP - Ministry of Environment and Natural Resources Protection of Georgia

MRDI - Ministry of Regional Development and Infrastructure of Georgia

NGO – nongovernmental organization

OP / BP - Operational Policy / Bank Policy (of the World Bank)

RLG – Red List of Georgia

SRMIDP - Second Regional and Municipal Infrastructure Development Project

WB - World Bank

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EXECUTIVE SUMMARY

The Municipal Development Fund of Georgia (MDF) is implementing the World Bank-sponsored Second Regional and Municipal Infrastructure Development Project (RMIDP II). The main objective of the Project is to improve the capacity of local governments to carry out their primary function, related to rendering the proper services to the population and the accountability for implementation of the infrastructure investment through access to the effective funding sources to the local governments. Across the country, within the scopes of the RMIDP II, the municipal infrastructure rehabilitation / reconstruction is being carried out on the basis of funding the individual sub-projects.

Present sub-project envisages the construction of the bridge over Khrami River in Bolnisi municipality. It will connect Tandzia village in Bolnisi municipality, Kvemo Kartli the region and Pitareti Monastery located in Tetritskaro municipality. Also the project will allow the monks living in the monastery, as well as the parish and tourists to move smoothly and visit Pitareti Monastery.

According to the legislation of Georgia, the sub-project does not require an environmental impact assessment and environmental permitting. According to the World Bank OP/BP 4.01 Environmental Assessment and the Environmental and Social Management Framework (ESMF) developed for the RMIDP II, the sub-project is classified as high-risk B category that requires the Environmental and Social Impact Assessment (ESIA) as well as development of the Environmental and Social Management Plan (ESMP).

RMIDP II triggers World Bank OP/BP 4.01 Environmental Assessment and is classified as environmental Category B. The Project also triggers OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement, and OP/BP 7.50 Projects on International Waterways. OP 4.12 is not applicable to the subject sub-project.

The sub-project area includes the Khrami River (Ktsia) at Tandzia village (in ≈1.5 km distance) in Bolnisi municipality. The river has numerous small and medium-sized tributaries. In the sub-project area, the floodplain is spread out 250 meters wide and covered with vegetation. The depth of the river flow varies between 0.5÷0.7 meters while the banks are low – up to 1.0 meters.

Geologically the two banks of the river are not different from each other and are mainly represented with the Quaternary sedimentary rocks of a river origin – with up to 10% of sand filling large boulders and rocks. Sub-project will finance construction of the bridge as well as the roads to access the bridge from both sides.

The bridge will consist of three vertebras, under the scheme 3 * 22.0 m. The total length of the bridge will make 73.8 meters and the total width – 6.9 m. Some 67 m long access road will be constructed from the right side of the bridge and 131 m long - from the left.

<u>Sub-Project Alternatives</u>

After reviewing no-project alternative as well as a few options for the bridge location and design, it was concluded that construction of the bridge strongly prevails over the no-project scenario and there are no environmental and/or social showstoppers that would hinder construction. Furthermore, the best alternative is to construct bridge in 1.5 km North from Tandzia. This alternative has the following advantages: the bridge will connect (join) the existing road leading to the monastery on both sides of the river. In case of construction

of the bridge the situation gets better. Currently in this area the traffic intensity is not high. This traffic may slightly increase in its intensity after the subsequent construction of the bridge, which cannot increase the risk of environmental pollution because the vehicles will be able to move on the bridge without excessive power, and therefore without fuel, which was not possible when they crossed the river. Consequently there will be less air pollution. It should also be noted that the Church considers this sub-project as a positive development and supports its rapid implementation. In addition, the project will improve Pitareti Monastery connecting infrastructure (since it is the shortest way to connect with the Monastery), that will help to increase the flow of tourists and parish and improve socio-economic conditions in the area.

Sub-Project Area

The sub-project area is located in the municipality of Bolnisi, Kvemo Kartli region. Municipal area is 804.2 square kilometers. Majority of Bolnisi population are Azerbaijanis - 66%, 26.8% are Georgians and 5.9% - Armenians. Climatic conditions according to the closest weather station (Bolnisi) data are as follows: The average annual temperature is + 12.0^{0}C; the coldest month is January with the average monthly temperature + 0.3^{0}C, the hottest is July - + 23.6^{0}C; absolute minimum temperature is -24^{0}C, the absolute maximum is + 39^{0}C; the average annual rainfall is 572 mm. The number of days with snow cover is 22. Freezing depths for any soils is 0 cm.

Geological structure of the area, which includes the areas of deployment of construction sites, is participated by the formation of various ages, ranging from the Lower Paleozoic to the Quaternary. According to Georgia's geotectonic zoning, the area is included in the Artwin-Bolnisi clod, surrounding areas in the southern part of Bolnisi.

Due to small volume of traffic in the study area, the vehicle emissions are low. Pollution is rapidly dispersed through the wind. The source of air pollution is fuel combustion emissions. These include carbon monoxide (CO), nitrous oxides (NOx), volatile organic compounds (VOC), particulate dust (PM) and sulfur dioxide (SO_2). Because of the rural nature of the study area, there are no noteworthy sources of industrial pollution and noise.

The botanical study of the sub-project site showed no presence of plant species enlisted in the Red List of Georgia in the territory. The area does not represent an important habitat.

Walk-trough research of the sub-project area allowed to identify presence of vole burrows, rabbit toilet wastes; 3 species of Magpies were also recorded while they were flying among trees and bushes; also spades, kite – while flying. No reptiles have been identified. Among the amphibians, there was found pond frogs. The study paid particular attention to the determination of existence of otter tracks, since it is included in the "Red List" and according to the literature it is spread in the municipality. It was determined that the otter did not and does not live in the project area (the ground for this ascertaining is the fact that there was found an abandoned hole of an otter, or even ruined / destroyed traces of holes). This situation is probably caused in the territory by the impact on the area, especially the riverbed (movement of vehicle in water). It should be noted that there was organized controlled amateur fishing and sport fishing and no specie of trout was caught. In the project area there was not observed fish spawning areas, which is caused by traffic in the water.

Several remarkable monuments are located near the sub-project area: Pitareti monastery, dating back to 1213-1222 and formally listed as the cultural heritage of Georgia, is active and falls under subordination of Manglisi and Tsalka Eparchy. Tandzia village accommodates two churches and the ruins of a nobleman's palace. One church was built in 1670 by Papuna Orbeliani, the second – by Vakhtang Orbeliani the Mdivanbeg in 1683. Both churches are active.

Environmental Impacts and their Mitigation

The expected environmental and social impacts of the bridge construction and operation are small and may be easily mitigated.

Main impacts of the construction phase are expected from the works in the waterway which include temporary diversion of the water stream during placement of bridge supporting piles. River pollution and disturbance of the aquatic life may also be caused by borrowing construction materials from the watercourse and incidental or purposeful dumping of construction and household waste into the river bed. Finally, river may suffer from construction vehicles and machinery driving across it.

The main mitigation measures include minimizing the time of artificial diversion of the water flow by rapid conduct of pile installation works; well-organized waste management; and prohibition of material sourcing and vehicle entry in the waterway.

Stakeholder Consultation and Information Disclosure

Present draft ESIA report will be disclosed through the web page of MDF in Georgian and English languages and delivered to the local residents in Bolnisi municipality through the medium and in the format most suitable for their easy access.

Environmental and Social Management Plan

ESMP is developed based on the findings of the ESIA. It consists of a table with environmental and social mitigation measures to be applied during construction and operation phases, and an environmental and social monitoring plan table. These tables list out prescribed mitigation measures, indicators of their adequate application, monitoring methodology, and parties responsible for various aspects of environmental management at the construction and operation phases.

The ESMP will be included into the tender documents and later – be attached to the contract for the provision of civil works.

Institutional Framework for Environmental Management

The MDF is responsible for the control over the environmental compliance of works carried out under the sub-project. MDF's environmental specialists and/or external consultants will undertake monthly environmental monitoring of works and produce respective reports. In case of deviations from the ESMP requirements, MDF representatives will instruct works provider on the time-bound corrective actions and will follow up on their implementation. Monthly field environmental monitoring reports will be stored on file at the MDF office and be made available for the World Bank upon demand.

1. Introduction

The Municipal Development Fund of Georgia (MDF) is implementing the World Bank (WB)-financed Second Regional and Municipal Infrastructure Development Project (RMIDP II). The main objective of the Project is to improve the capacity of local governments to carry out their primary function, related to rendering the proper services to the population and the accountability for implementation of the infrastructure investment through access to the effective funding sources to the local governments. Across the country, within the scopes of the RMIDP II the municipal infrastructure rehabilitation / reconstruction is being carried out on the basis of funding the individual sub-projects. Sub-project selection is based on pre-defined criteria agreed with the WB and reflected in the legal agreements.

This sub-project envisages the construction of the bridge over Khrami River in Bolnisi municipality. It will connect Tandzia village in Bolnisi municipality, Kvemo Kartli the region and Pitareti Monastery located in Tetritskaro municipality. Construction of the bridge will improve connectivity of the monks living in the Pitareti monastery to the outer world, and improve access to the monastery for the local residents and tourists, which is welcome by the clergy.

According to the legislation of Georgia, the sub-project does not require an environmental impact assessment and environmental permitting. According to the World Bank OP / BP 4.01 Environmental Assessment and the Environmental and Social Management Framework (ESMF) developed for the RMIDP II, the sub-project is classified as high-risk B category that requires the Environmental and Social Impact Assessment (ESIA) as well as development of the Environmental and Social Management Plan (ESMP).

Map 1. Location and parameters of the bridge

2. Environmental Policy and Legal Framework

According to the Law of Georgia on the Ecological Examination (Article 1), ecological examination shall be a mandatory environmental measure implemented during decision-making process on issuing environmental impact or construction permits for activities - an essential environmental measure, objective of which is maintaining environmental balance in view of environmental requirements and principles of

rational nature management and sustainable development. A positive ecological examination report shall be a mandatory basis for issuing environmental impact or construction permits for activities subject to ecological examination.

The complete list of activities (i.e. the activities subjected to the ecological examination), which in the decision-making process of issuing the environmental impact or construction permit is subject to a mandatory ecological expertise is defined by the Law of Georgia on the "Environmental Impact Permit" (article 4, paragraph 1). The abovementioned list provides the following requirement regarding the construction of a bridge over a river: "Ecological examination is required for construction of international and intrastate highways and railways, and bridges and underway crossings over them, as well as structures for engineering protection of highways, railways and their territories". Since the sub-project activity (i.e. construction of the bridge on Khrami River) is planned on a local road, **it is not subject to ecological expertise and environmental permitting, and hence does not require conduct of the Environmental Impact Assessment** according to the national legislation. However, according to the Law of Georgia on the "Environmental Impact Permit" (article 5 paragraph 1), environmental standards currently in force apply to the respective types of activities even if they do not require ecological expertise (Article 4(1) of the above-mentioned Law).

Technical regulations establishing environmental standards applicable to the construction of the Bolnisi Bridge are as follows:

Technical Regulations of Georgia for Protection of Surface Water from Contamination (approved under the Resolution N425 of December 31, 2013 of the Government of Georgia) – the Regulations regulate the various types of business activities, which are likely to have adverse effects on surface water condition; contamination of surface water facilities from the point and diffuse sources. Essential requirements of the regulations are obligatory for all entrepreneurs, whose business activity influences the surface water conditions. Water user is required to design and implement the necessary water protection measures.

Technical Regulations of Water Protection Areas (approved under the Resolution N440 of December 31, 2013 of the Government of Georgia) - The Regulations determine the rules of establishment of sanitary zones around surface water for the protection of water from pollution, contamination, silting and depletion. These regulations are binding for the state authorities as well as for physical and legal entities. According to these Regulations, in the rivers, the length of which is more than 75 km, sanitary zone should be 50 meters wide (such as Khrami River). Construction; bottom deepening; explosive works; extraction of minerals, peat, waterborne timber and gravel; arrangement of pipeline and other communications lines; wood cutting (except for the sanitary cutting, which is covered by another regulation), drilling and other activities shall be carried out in accordance with the legislation of Georgia.

The hydraulic structures located in water facilities and water protection areas (such as bridges), as a rule, should be equipped with the appropriate technical means, in order to exclude completely the possibility of river pollution and littering. Therefore, during the implementation of this sub-project the requirements of the Regulations above shall be strictly observed.

Given that the implementation of the sub-project does not imply the existence of a stationary source of air pollution, the technical regulations regarding the air do not apply. The same is true for the regulations of

tree-cutting in the riparian forests – they do not apply because the sub-project implementation does not require clearing of forested areas.

RMIDP II triggers World Bank OP/BP 4.01 Environmental Assessment and is classified as environmental Category B. Although no environmental review of the sub-project design is needed based on the national legislation, because it will finance works to be undertaken in the waterway and in the immediate proximity to the historic monument, the ESIA was carried out for it based on the requirements of this policy. PMIDP II also triggers OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement, and OP/BP 7.50 Projects on International Waterways. According to OP/BP 4.11, sub-project will be implemented in the way avoiding any physical or aesthetical impacts on Pitareti Monastery buildings and disruption of the life routine of the monks. OP 4.12 is not applicable to the subject sub-project. Construction of the bridge over the Khrami River will not adversely change the quality or quantity of water flows to the other riparian country and will not be adversely affected by the other riparians' possible water use, and will therefore be compliant with the terms of exception from the requirement of communication to the riparians granted to RMIDP II.

3. Sub-Project Description

3.1 Site Location

The sub-project area mainly includes the Khrami River (Ktsia) at Tandzia village (≈1.5 km away) in Bolnisi municipality. The river originates from the southern slope of Trialeti mountain ridge at an elevation of 2850.0 meters from sea level, in the south-east direction it crosses the Javakheti and Tsalka plateaus, through narrow and deep canyon flows to Kvemo Kartli valley and from the right bank joins the Mtkvati (Kura) River near the Red Bridge. The length of the river is 201.0 km, the average inclination is 10.7 ‰, the catchment area amounts 8340.0 km2. The river is attached with many small and medium-sized tributaries.

Photo No1. Proposed location of the bridge

In the sub-project area, the river flows through a narrow and deep valley, part of which is represented in the rocky canyons of andesite and basalts. At this location, the river's flood plain width varies within the scopes of 60.0÷200.0 meters, while the river's – within the 25.0÷40.0 meter scopes. The flow depth ranges among 1.0÷1.8 meter. The average slope of the river is 18.4%.

In the bridge area, the floodplain is 250 meters wide and covered with vegetation. The river meanders in the floodplain flows in 25.0÷30.0 m wide bed. The depth of the river flow varies between 0.5÷0.7 meters while the banks are low – up to 1.0 meters. Geologically the two banks of the river are not different from each other and they are mainly represented with the Quaternary sedimentary rocks of a river origin – with up to 10% of sand filling large boulders and rocks.

Hydrological calculation showed that the water flow in the river with 1% assurance amounts to 300.0 m^3/s, the flow average speed is 2.4 m/s, while the reporting horizon is 101.64 m (in provisional indexes). Benthic common wash amounted to 1.0 m, and the size of the local wash-off volume near the bridge average pillars is 2.6 m. General washing of a river bottom amounts to 1.0 m, and the volume of a local wash-up to the designed middle supports of the bridge is 2.6 m.

3.2. Parameters of the Bridge and Access Roads

The sub-project will finance construction of the bridge as well as of the access roads to it.

The bridge will consist of three vertebras, under the scheme 3*22.0 m. the total length of the bridge is 73.8.4 meters and the total width – 6.9 m. In the plan the bridge is located on the straight slope while in the façade it is a zero slope. The bridge will cross the river aslant.

Due to poor accessibility of the bridge site, the construction is planned with steel and reinforced concrete pre-fabricated elements. The mentioned road is of soil and its main purpose is to connect the populated settlements (through Tandzia village) to Pitareti Monastery. Currently the municipality does not plan the road rehabilitation. Covering the 22.0 m long span is planned with the steel-reinforced concrete individual structure. It consists of the main load-bearing steel beams (2 pieces of the cross-section) and a reinforced concrete slab outriggers attached to it, on which in turn is designed the walking part with the appropriate structures.

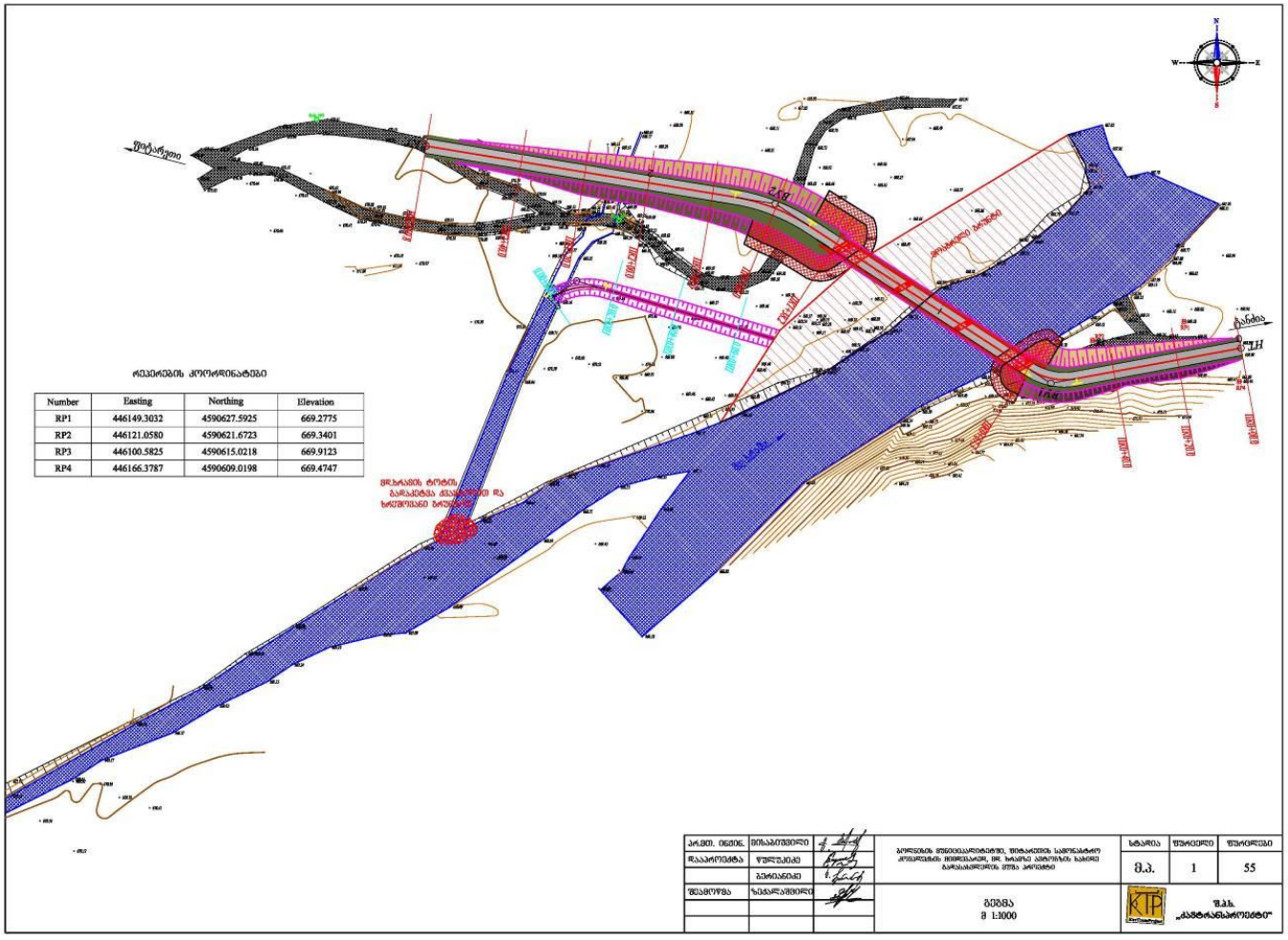
The welded steel main load-bearing beams are of welded asymmetrical outline with the height of 1.15 m, according to the steel reinforced concrete construction features and principles – the upper rack thickness is designated as 24 mm, and 36 mm – of the lower rack. The main beams will be of prefabricated construction and will be divided into two equal parts in a longitudinal manner in 10.5 m long blocks. Block will be connected by the steel welding. In the main beams span, the longitudinal connection will be provided by the longitudinal and lower transverse connections of the steel rolled construction. The steel frames supports will be of typical construction and attached to the ankle upper belt by welding symmetrically to the middle axis span. The support of the main load-bearing steel beams will be provided on the typical construction's similar steel tangential type parts. The slabs of reinforced concrete of the span carriageway will be of prefabricated construction. In the plan the slab sizes are 2.17 m in longitudinal manner to the bridge and 4.0 meters – in cross-section to the bridge. The reinforced concrete slab thickness will be 18.0 cm, its height in the support area near the steel main beams is increased by 26.0 cm.

The roadway structure monolithic slab construction is envisaged at a strength with B30 class concrete and for the reinforcement with the class A-III reinforcement of different diameter stems. The bridge railings will be the similar to the typical construction and their construction is envisaged with the profiled steel pipes. Railing elements can be connected to each other by means of welding. All steel elements of the construction will be painted. Steel railing in the roadway reinforced concrete slab should be fixed with the steel anchors. Closed deformation seam arrangement is considered for the bridge.

The interval and the coast piers piles drilling will be provided by the mean of УКС drilling device. Installation of the span component will be provided by the mean of auto cranes with 10 tons carrying capacity.

Small portion of the existing road accessing the bridge will be upgraded with gravel surface from both sides of the bridge: 67 m from the right side and 131 m - from the left.

Map 2. Parameters of the Bridge and Access Roads



4. ESIA Methodology

ESIA process consisted of six main components:

1. Collection of the information through desk and field works about baseline data of the presumably affected components of the environment (physical, biological, social) within the sub-project territory.
2. Impact identification, assessment of the significance and mitigation measures (according to the World Bank requirements and the MDF's policy the impact avoidance is preferred to the mitigation).
3. Options analysis in terms of the location, technology, design and operation of the bridge, including zero alternative.
4. Development of environmental and social mitigation measures and methodology for monitoring their application.
5. Preparation of the ESIA report.
6. Consultations with the other interested parties and the public disclosure of information (according to the legislation of Georgia and the World Bank policies).

Desk-top review of the available literature was performed to pool information on the biophysical characteristics of the study area.

Botanical and zoological surveys were undertaken during a walk-through of the sub-project area with the aim of verifying information obtained from the literary sources.

Visual observation of the site was carried out to identify any existing pollution hotspots.

Comparison of alternatives for the bridge location and design included assessment of environmental, social, and economic aspects. No-project scenario was also considered.

Mitigation measures were identified for the construction and operation phases; easily measurable indicators were selected for assessing quality of their application; and parties responsible for application of mitigation measure as well as for managing environmental performance of works providers were identified.

5. Analysis of Alternatives

Alternative 1: No project alternative

Now in the project area, there is only the old, damaged pedestrian bridge, so vehicles which are moving towards the monastery have to go through a river bed crossing the watercourse. Hence, the impact on biodiversity and the river water quality is significant. If the sub-project is not implemented, there will remain a risk of an injury of the people visiting the Monastery over the river as well as the risk of pollution of the river due to the vehicle which run through the river due to the absence of the bridge.

Alternative 2: bridge construction in 1.5 km North from Tandzia

The alternative 2 is the implementation of the proposed project. This alternative has the following advantages: the bridge will connect (join) the existing road leading to the monastery on both sides of the river. In case of construction of the bridge the situation gets better. Currently in this area the traffic intensity is not high. This traffic may slightly increase in its intensity after the subsequent construction of

the bridge, which cannot increase the risk of environmental pollution because the vehicles will be able to move on the bridge without excessive power, and therefore without fuel, which was not possible when they crossed the river. Consequently there will be less air pollution. It should also be noted that the church considers this project as a positive development and supports its rapid implementation. In addition, the project will improve Pitareti Monastery connecting infrastructure (since it is the shortest way to connect with the Monastery), that will help to increase the flow of tourists and parish and improve socio-economic conditions in the area.

Alternative 3: bridge construction in a different location

The option of selecting another location for the bridge construction was discussed. Alternative spaces in the vicinity of the bridge was inspected and visited. It should be noted that no distinguishing factor (efficient, less impact) is observed, for which the planning of construction of the bridge would be available in any other area. However, in this case it will be required not only the construction of the bridge, but the access road's sections as well, technical necessity of which does not exist. It increases the cost of the project and at the same time it will be an unnecessary load on the environment. Therefore, this alternative was ignored.

Conclusion

After reviewing the proposed alternatives, considering the environmental and social point of view, the alternative 2 is the best.

6. Social, Physical and Natural Environment

6.1 Social and Economic Conditions of the Region

The sub-project area is located in the municipality of Bolnisi, Kvemo Kartli region. Below are details about the municipality:

Bolnisi municipality is the administrative-territorial unit in eastern Georgia, in the central part of Kvemo Kartli region. Bolnisi municipality from the east is bordered with Marneuli municipality while from the west it is bordered with Dmanisi municipality; from the north it is bordered with Tetritskaro municipality while from the south – by the Republic of Armenia. Municipal area is 804.2 square kilometers.

The municipality has 49 settlements, including 1 city (Bolnisi), 2 towns and 46 villages. Large rivers of Bolnisi municipality are Khrami and Mashavera. Also there are some natural and artificial lakes in the administrative unit area.

According to the statistics in 2014, the population of Bolnisi municipality is 53 590 people. Density of the population is 98 inhabitants per square kilometer, which exceeds the country's average index (67 person / square kilometers). The demographic conditions of the region, in particular of Bolnisi is negatively impacted by internal and external migration. Migration processes are mainly due to difficult social conditions and employment small prospects. The population travel in search of work to the neighboring countries, (mainly to Russia and the ethnic minorities mostly to Azerbaijan and Armenia); among migrants men slightly outnumber women. Every second migrant financially helps his/her family.

Majority of Bolnisi population are ethnically Azerbaijanis - 66%, 26.8% are Georgians and 5.9% - Armenians. Number of population has a decreasing trend.

Table 2. Census Data

Census Year	Number of Population
1989	81,920
2002	74,243
2014	53,590

Municipality's basic income comes from agriculture, extractive industry, and small business in the service sector. Agriculture includes viticulture, horticulture, animal husbandry and bee keeping. The main mineral resources are barite, tuff and polymetallic ore deposit; also there are 2 licensed sand and gravel deposits. . Tbilisi-Yerevan highway passes through the municipality. The economic development plan priorities are: agriculture, agro processing, mining and stone-processing, and tourism.

There are 28 public schools in the region serving 65, 9 thousand students. Schools' infrastructure is mostly satisfactory. However, there are schools which are in need of rehabilitation. The students, who go to the schools far from their villages by more than 3 km have the availability to the municipal transport. There are 2 private higher education institutions in the region. In addition, there are 2 vocational training facilities in Rustavi, which provide with training in several professions. The material-technical base and resources of these institutions are limited. In general, there is a shortage of educational institutions in the region. Due to its proximity to the capital, Tbilisi, the Georgian youth prefer to receive higher education in Tbilisi. Ethnic non-Georgian young people often go to Baku and Yerevan for higher education (despite the fact that there is more expensive tuition fees there) and a very small part of them study in higher education institutions in Georgia. A large part of Non-Georgian population, due to the lack of knowledge of Georgian language, do show no sign of to continue their studies, often they decide to stop study in their tenth-eleventh classes at school. Among Azeri population it is highlighted the trend to marry final grade girls and usually they do not finish schools.

6.2. Cultural Heritage

Bolnisi municipality accommodates more than 120 historical architectural monuments, which once again shows how important place is Bolnisi. The local area accommodates the churches and castles of various centuries. Most important Bolnisi Sioni, a nave basilica type building in the village of Bolnisi. According to one of the inscriptions on the entrance was it was built in 478-493 years. Bolnisi Sioni inscriptions are the oldest examples of Georgian writing. The first relief sculptural expression in Georgian architecture can be found in Bolnisi Sioni is (bull's head, a variety of birds and animals).

Photo No2. Pitareti Monastery

Pitareti monastery, dating back to 1213-1222 under the rain of the King Lasha-Giorgi, was listed as the cultural heritage of Georgia in 2007. The Municipality is also famous for Tsugurasheni monastery, Vanati (V-VI c.) and Akvaneba (VI-VII c.) churches. Tandzia village, which is the immediate proximity to the sub-project site, houses two churches and ruins of a nobleman's palace. One church was built in 1670 by Papuna Orbeliani and the other – by the Mdivanbeg Vakhtang Orbeliani in 1683. Three fortresses in the area are Kveshi Castle, Qolagiri Castle and Berdiki Castle.

6.2 Biophysical Environment

The study area is located in the floodplain of Khrami River. There is an old, damaged hanging pedestrian bridge footings and metallic ropes stretched between them in this place.

Photo No3. Old, damaged hanging pedestrian bridge

Relief

In the north of Bolnisi municipality – in the middle among the rivers Mashavera and Khrami the Disveli plateau (dimensions 19X3 km) is located. It forms the part of the Kvemo Kartli plateau and is its southern part. Disveli plateau is sloped to east and north. East plateau's altitude is 500m and while in the west part

it is equal to 800-850 m. Disveli plateau south edge is surrounded by Shindlari array, it is steeply separated from the valley of Kvemo Kartli and Mashavera River gorge; it is characterized with a horizontal relief.

Geology

In the geotectonic point of view it is attributed to Artwin-Bolnisi - Bolnisi area Khrami sub zone. Within the survey area the Cretaceous age (K) breccia are constructed in a lithology manner and overlaid by alluvial, diluvia and alluvial sediments.

According to the normative document "Seismic Resistant Building" (pn01.01-09), the area belongs to 8-point earthquake zone.

According to the hydrogeological zoning the study area belongs to the Artwin-Bolnisi hydro-geological region – Javakheti ridge's east slope fissured groundwater hydrogeological region. Within the framework of the research district the ground water was fixed to the explored depths in all wells.
According to the engineering-geological zoning of Georgia the area belongs to Artwin-Bolnisi geotechnical engineering district Paleogene (P) and the Cretaceous (K) age rock semi-rock sediment engineering-geological region.

Climate

Climatic conditions according to the closest weather station (Bolnisi) data are as follows:
The average annual temperature is + 12.0^{0}C; the coldest month is January with the average monthly temperature + 0.3^{0}C, the hottest is July - + 23.6^{0}C; absolute minimum temperature is -24^{0}C, the absolute maximum is + 39^{0}C;

The average annual relative humidity is 67%; In January it is a 72% (average) and 56% - in July. The absolute minimum is 56% (July, August), and the absolute maximum is 77% (November). Average annual wind speed is 2.1 m/sec. Prevailing winds are: 24% from the East, 12% - from the South-East and 39% from the Western with the respective repeatability. Expected maximum speed: once a year - 19.0 m/s, once in 5 years - 23.0 m/s, once in 10 years - 25.0 m/s, 15, once a year - 27.0 m/sec and once in 20 years - 29.0 m/sec. Wind pressure once in every 5 years is 0.30 kPa, once in 15 years - 0.48 kPa. The number of calm days is 24%.

The average annual rainfall is 572 mm. Daily maximum rainfall is 132 mm.
The number of days with snow cover is 22. The day of emergence of the earliest snow is November 15, while the latest day of its disappearing is April 10. The minimum thickness of the snow cover is 0 cm, the maximum is 20.0 cm. Snow cover weight is 0.50 kPa. Freezing depths for any soils is 0 cm.

Geomorphology

The project bridge deployment area belongs to the municipality of Bolnisi, this area is characterized by relief's tectonic, volcanogenic and erosion forms alternation. Javakheti eastern slope of the pits is in the west part of the region. From the south of the region enters a Loki ridge North Slope with difficult geological structure, which as a result of intense erosion and denudation processes is heavily fragmented. The largest part of the region is occupied by the Kvemo Kartli plain, which is developed in intermountain tectonic depression. The plains of the river terraces are well expressed in the valley.

The researched sites are located along the floodplain of Khrami River. Its micro-relief is represented as follows: the slope base at the river bed is steep and inclined at about 30-40^0. The relative height of the steep bottom from the river bed to the Tsarba is up to 10-15 meters. After the mentioned Tsarba the slope inclination is sharply reduced and its average inclination to the ravine bed varies within 10-20^0 limits. The direct surface of the building site is undulating and smooth. Above the site the slope inclination gradually increases and after about 200-250 meters it is transformed into the slope from the steep.

Geological structure of the area, which includes the areas of deployment of construction sites, is participated by the formation of various ages, ranging from the Lower Paleozoic to the Quaternary. According to Georgia's geotectonic zoning, the area is included in the Artwin-Bolnisi clod, surrounding areas in the southern part of Bolnisi. Cracks, which reaches 10-15 cm in width, are filled with mud and focused in a different directions. Tuff-breccia occur in separate layers in the form of lenses with a thickness of 5-10 cm to 2.0 meters. In some places these layers to a total capacity amount 15-20 meters.

In addition to the above-described rocks, the territory covers other common varieties, such as modified tuff-genic rocks. In the areas of tectonic faults there are developed the rocks mechanical deformation products, tectonic breccia and clays. The sub-layer total power changes within 900 - 2000 m. Quaternary sediments are presented within the territory in alluvial, dealluvial, prolluvial genesis formations. Information about dire the project site and surrounding area's lithological structure is taken from a geological reports of the survey carried out in the Soviet period. According to the mentioned surveys, the construction site is built with the rocks of upper chalk sub-layer's lower part (K2 MS 1) so-called baked Tuff ignimbrite. Rock set in the area of the construction site from the top is covered by Quaternary alluvial and delluvial-prolluvial formations, clay and gravel and pebble angular variable thickness layers.

Hydrology

The bridge will be built on the river Khrami (Ktsia). The river is the right tributary of Mtkvari River. In the upper part it is called as Ktsia. Khrami originates from the slopes of the Trialeti Range, flows through a deep gorge. The river is 201 km long, the basin area - 8340 square kilometers, the average water consumption - 51 m^3/sec, the maximum - 448 m^3/sec. It is fed mainly by snow, does not freeze, in its lower part it is used for irrigation. Tsalka reservoir and 3 hydroelectric stations are built on the river Khrami; the tributaries of Khrami are: Debeda and Mashavera (right).

Due to the different types and relief crossed by the river its basin may be divided provisionally into three sections. The first section covers the territory from the origin to Tsalka settlement, the second section – from Tsalka settlement to Nakhiduri village and the third section – from Nakhiduri village to the territory in the affluent.

In the first section the river flows through the alpine zone wide plains to the south of Trialeti mountain range where the river width varies within 20.0÷30.0 meters, while the depth of the flow varies within 0.5÷1.5 meter. At this location the river average slope is 14.7%.

In the second section, the river flows through a narrow and deep valley, part of which is represented in the rocky canyons and basalts. At this location, the river's flood plain width varies within 60.0÷200.0 meters, while the one of the river - 25.0÷40.0 meter. Flow depth varies within 1.0÷1.8 meter; at this location, average river slope is 18.4%.

In the third section, Khrami River flows through Kvemo Kartli (Borchalo) wide plains, where it has a lot of the island and meander. At this location, the width of the river bed varies within 70÷100.0 meters while the flow depth reaches up to 2.0 meters.

The river is mainly fed by snow and rain waters. Ground waters have a slight influence on the river flow formation. River regime subjects to great influence from the torrential rains. Khrami River has a clear spring flood period. Flood on the river begins in late March-early April, lasts 2-2.5 months and ends in mid-July. The rest period is largely characterized by low water-resistant, which is rare, but can be broken by heavy rains caused by short-term (2-3 days) flood in August-November months. Khrami River water flow regulation is carried out by means of Tsalka reservoir and Khrami hydroelectric power station.

The bridge to be constructed will pass in the middle of the second district/section, in the vicinity of Tandzia village (≈1.5 km distance), Bolnisi municipality in the river's narrow and deep gorge. In the bridge area, the floodplain area is 250 meters wide and covered with vegetation. The river meanders and flows in the floodplain in the bed varying within 25.0÷30.0 m. The depth of the river flow is 0.5÷0.7 meters and the banks are low - 1.0 meters tall. The bridge height will make 3 meters from the maximum level of water surface.

Engineering-geological studies revealed that the both banks of the river are not different from each other and mainly they are represented with Quaternary sedimentary rocks of river origin – with up to 10% of sand and large boulders fillers.

Hydrological calculation showed that the water flow in the river with 1% assurance amounts to 300.0 m^3/s, the flow average speed is 2.4 m/s, while the reporting horizon is 101.64 m (in provisional indexes). Benthic common wash amounted to 1.0 m, and the size of the local wash-off volume near the bridge average pillars is 2.6 m.

Soils

In Bolnisi municipality in particular the foothill zone of the mountains there are developed brown forest soils, marl weathering and forest products. On the northern slopes of Loki it is found the Forest brown soils. The plain territory is characterized with brown dominated salty soils.

A large area is occupied also by dark brown calcareous soils. Along the river it is developed alluvial-calcareous soils.

Air Quality

The study area's air quality is generally satisfactory due to the agricultural production profile and the lack of pollution sources in the area. The vehicles used to move to the agricultural plots and pastures and the monastery is the only source of air pollution. The reason of pollution is the fuel combustion emissions. These include carbon monoxide (CO), nitrous oxides (NOx), volatile organic compounds (VOC), particulate dust (PM) and sulfur dioxide (SO_2). Taking into account a small volume of traffic, in the study area the emissions of vehicles is low. Pollution is rapidly dispersed through the wind.

Noise

In the study area, due to its rural nature, there is no significant source of the noise source, except the noise resulted in agricultural equipment working.

Flora

Flora of the study territory is represented with *Carpinus betulus, Carpinus orientalis*), Cornels (*Cornus mas*), Ordinary nut (*Corylus avellana*), Elderflower (Sambucus nigra), Hawthorn (*Crataegus sp.*), Pear (*Pyrus caucasica*), Plum (*Prunus divaricate*), Common elm (*Ulmus suberosa Moench*), Ash (*Fraxinus excelsior*), also Georgian oak (*Quercus iberica*), Field maple (*Acer campestre*).

Herbaceous cover is mainly made of *Dictamnus albus*, Nettle mother (*Lamium album*), *Urtica dioica, Plantago major*, and Fern of Etsera (*Pteridium tauricum*).

Along the river bank, there are weakly developed field plants: *Xanthium spinosum*, *Silybum marianum*, Alfalfa (*Medicago minima* and *Medicago orbicularis*), Clover (*Trifolium pretense*), *Lolium rigidum*, Oats (*Avena sativa*), and *Poa bulbosa var. vivipara*.

None of these species are entered to the Red List of Georgia.

Fauna

According to the literature data, within the municipality territory there are spread fields and forest animals. Following mammal species inhabit the plains: the hedgehog (*Erinaceus concolor Martin),* mole *(*Talpa caucasica *Satunin)*, rabbit *(Lepus europaeus Pallas)*, vole *(Apodemus agrarius Pallas)*; in the forest there are met wild boars *(Sus scrofa Linnaeus)*, wolves *(Canis lupus Linnaeus)*, jackals *(Canis aureus Linnaeus)*, martens *(Martes martes Linnaeus)*, foxes *(Vulpes vulpes Linnaeus)*, roe deer *(Capreolus capreolus Linnaeus*); in the river valleys otter (*Lutra lutra*) occurs. Avifauna is represented by Magpie (*Pica pica*), Stork *(Ciconia nigra)*, crow *(Corvus corone)*, starling *(Sturnus vulgaris)*, quail (*Coturnix coturnix)*, goldfinch *(Carduelis carduelis)*, partridge *(Alectoris graeca)*, woodcock *(Scolopax rusticola)* and others. Among registered reptiles are Colubridae *(Colubridae)*, Armenian lizard *(Darevskia armeniaca Mehely)*, turtles *(Maureyis caspica Gmelin)* and other. Amphibians are represented by Caucasian Toad *(Bufo bufo Linnaeus)* and others.

During the walk-through in the immediate area of the sub-project, vole burrows and rabbit droppings were discovered, and three species of magpies were seen flying among trees and bushes as well as spades and kites. No reptiles were in the vicinity. Amphibians observed were pond frogs. The study paid particular attention to the determination of existence of otter tracks, since this species is included in the Red List of Georgia and, according to the literature, it is spread in the municipality. River banks were examined carefully with the purpose of locating holes of otters, as well as the surrounding areas of the banks to find the tracks. Finally it was determined that otter does not inhabit the sub-project area (not even an abandoned or partially destroyed hole of an otter was present in the area). The reason is probably anthropogenic pressure on the study location that caused otters to abandon this habitat.

According to the literature, the following species of fish occur in Khrami river: Gobi (*Barbus mursa*), Trout (*Salmo fario*), Khramuli (*Capoeta capoeta*), Catfish (*Silurus glanis*), Carp (*Cyprinus carpio*) and Chanari Barbel (*Barbus capito*). Out of these species, only one of them is enlisted in the Red List of Georgia, which

is the river/lake trout (*Salmo fario*). However coltrol sample fishing, performed as part of the faunistic survey, did not confirm presence of trout in the subject section of the river. Literaty data may be outdated, as the river has been under significant anthropogenic impact for the recent decades.

Pollution Hotspots

An on-site assessment of the sub-project area was carried out to reveal pollution with household, inert or hazardous waste. No hotspots were discovered.

7. Expected Impacts and Mitigation Measures

7.1 Construction Phase

Site cleaning and earth works

Impact:

Construction works will commence with clearing of vegetation. This will imply removal of shrubs and grass. There is no need for tree-cutting. Top soil will be removed and stored for the reinstatement of the work site upon completion of works. Associated risks are unnecessary tree cutting by works contractor and mixing up the top soil with subsoil.

Mitigation:

Site preparation shall imply removal of the upper layer of soil and its storage in a designated location. Topsoil must be backfilled and spread out for creating enabling environment for natural regeneration of vegetative cover upon completion of earth works. Construction contractor shall be instructed to ban tree cutting and other unnecessary damage to vegetation by the personnel.

Works in the waterway

Impact:

Bridge construction will imply works near and within the Khrami River. Diversion of the water flow will be required while installing bridge supporting piles in the river bed. This will cause temporary increase of water turbidity and disturbance to the aquatic life.

River may be polluted with improperly stored construction material and waste; dumping of household waste, construction waste, and excess material into the river bed; leakage of fuel, oils and lubricants from the improperly parked/serviced machinery. Likelihood of construction vehicles and machinery moving in the river bed may not be excluded either.

Mitigation:

Diversion of the water flow should last the shortest period possible. Towards this end, installation of lines must be well prepared and undertaken quickly. Special attention will be paid to the preventive measures regarding the impact on aquatic biodiversity. Reversion should not block free movement of fish.

Specific locations in a decent distance from the river banks must be selected for temporary on-site storage of construction materials and waste. Arrangements shall be made for organized storage and removal of household waste. Its dropping into the river and open-air burning must be prohibited.

Construction vehicles and machinery shall be restricted from entering the water flow. Their washing and servicing, if conducted on-site, must be done in a specifically allocated location away from the river banks. Technical condition of vehicles and machinery shall be checked on daily basis to avoid operation spillage of fuel and lubricants.

Extraction of natural construction materials

Impact:
Bridge construction will require the use of natural construction materials, such as stone, gravel and sand. Borrowing of material may cause degradation of landscape, triggering of erosion, and worsening visual appearance of a natural landscape. Borrowing from the watercourse is not prohibited by the national legislation

Mitigation:
Opening of new quarries should be avoided to the extent possible. The nearest licensed sand and gravel quarry is located about 30 km from the sub-project site, near the village of Tamarisi. Contractor will be advised to purchase material from the existing licensed quarries. In case contractor wishes to open an own quarry, MDF must ensure that contractor obtains license according to the national legislation and applies good environmental practice in quarry operation. This will include terracing and compacting of quarry slopes, backfilling excess material, providing adequate drainage as required, facilitating natural regeneration of vegetation on the reinstated areas, etc. Material extraction from the watercourse shall be prohibited.

General construction works

Impact:
Common types of impacts from the medium-sized general construction works include generation of dust and noise from the operation of machinery, processing of natural construction materials (stone crashing) and earth works. Because construction of the bridge will take place in a rural setting, generated noise may cause disturbance of fauna.

Improper behavior of construction workers may cause unnecessary damage to the natural environment through unauthorized hunting, fishing, making fire, dumping waste, driving outside access roads, etc.

Mitigation:
Noise impacts will be modest and could be mitigated by keeping vehicles and machinery in good technical condition. The same measure will allow to minimize vehicle emissions. In exceptionally dry conditions, work site shall be sprinkled to reduce dust. Transportation of construction materials and waste should be undertaken under covered hoods of vehicles. Vehicle speed must be limited.

Construction contractor shall be instructed to prohibit its personnel from hunting, fishing, entering the natural area around the work site without need, and from driving outside the access roads.

Works near cultural heritage site

Impact:
Bridge construction will be undertaken in the vicinity of Pitareti monastery, which is the monument of Georgia's cultural heritage. It is also an active monastery. Construction works may cause deterioration of the aesthetic appearance of the area around the monastery and cause nuisance to the monastery life.

Due to high density of historic monuments in the greater area around the sub-project site, likelihood of chance finds during excavation works may be considered higher than average.

Mitigation:
Adherence to the general good construction practice and mitigation measures formulated above will allow to keep sub-project impacts on the natural landscape to the minimum and to avoid nuisance to the monks residing in the monastery.

Construction contractor must take all physical activity on hold immediately in case of a chance find and inform MDF. MDF will contact Ministry of Culture and Preservation of Monuments and seek guidance on the further course of action. Works may resume only upon written communication from the Ministry of Culture to MDF and subsequent notice from MDF to the Construction contractor.

Work site management

Impact:

Based on the scope and nature of works, no influx of workers to the sub-project site is expected from abroad or from the distant regions of Georgia. Most likely the work camp will not be used as a residence for workers, as they are expected to come to work from their permanent residences or from rented lodging in the vicinity of the works site. Nonetheless, poor sanitation at the work camp may negatively affect health of workers.

Poor organization of the works camp, including unregulated parking of machinery and storage of construction materials/waste may cause work-site accidents. The same may result from the lack of personal protection gear or failure of workers to use it.

Mitigation:

Construction contractor will be obligated to provide safe drinking water and adequate sanitation facilities at the work camp.

Workers using various construction technologies shall be adequately trained and licensed if required. Health and life insurance of workers is mandatory.

All personnel of works contractor must possess uniforms and adequate personal protection gear. Use of personal protection means must be enforced by the management of construction contractor.

Storage of construction materials and waste, and parking lots for machinery must be specifically allocated and signed.

Work site and work base shall be demarcated and fence as necessary. Contact information of works contractor and MDF shall be placed on the information boards as a mandatory element of grievance redress mechanism.

Contact information for emergency response service and the first medical aid must be posted at the work camp.

7.2 Operation Phase

Bridge operation

Impact:

Solid waste will be generated during operation of the bridge from regular road maintenance works and from littering by bridge users.

Impact of air pollution due to increase vehicle movement across the bridge will be minimal.

Improved connectivity will have positive social impacts on the local population, the monks, and visitors of Pitareti monastery, however increased occurrence of vandalism is also possible as common in case of increased tourist visitation.

Mitigation Measures:

Bolnisi municipality will be responsible for road maintenance and shall not dump or leave unattended at the roadside small amounts of waste that may remain from pothole patching, cleaning of drainage systems, trimming of vegetation or any other type of activity along the road. Waste must be disposed to a formal landfill in agreement with the Solid Waste Management Company. Periodic collection of roadside trash should be part of routine road maintenance service.

Adequate signage of the bridge access roads will be instrumental in preventing accidents and damaging the bridge from driving of large vehicles exceeding allowed weight and parameters.

8. Stakeholder Consultation and Information Publicity

Present draft ESIA report will be disclosed through the web page of MDF in Georgian and English languages and delivered to the local residents in Bolnisi municipality through the medium and in the format most suitable for their easy access. Feedback on the draft ESIA report will be sought from the sub-project-affected communities and clergy of Pitareti Monastery. Upon incorporation of the public feedback, ESIA report will be finalized and minutes of public consultation process will be attached. The final ESIA report will be re-disclosed through the MDF's web page and posted in the World Bank's electronic database.

9 Environmental Management Plan

9.1. Environmental management framework

ESMP is developed based on the findings of the ESIA. It consists of a table with environmental and social mitigation measures to be applied during construction and operation phases, and an environmental and social monitoring plan table. These tables list out prescribed mitigation measures, indicators of their adequate application, monitoring methodology, and parties responsible for various aspects of environmental management at the construction and operation phases.

The ESMP will be included into the tender documents and later – be attached to the contract for the provision of civil works.

9.2 Institutional arrangements of EMP implementation

The MDF is responsible for the control over the environmental compliance of works carried out under the sub-project. MDF's environmental specialists and/or external consultants will undertake monthly environmental monitoring of work and produce respective reports. In case of deviations from the EMP requirements, MDF representatives will provide instruction for the corrective actions and will follow up on their implementation. Monthly field environmental monitoring reports (prepared using the template attached to the Environmental and Social Management Framework for RMIDP II) will be stored on file at the MDF office and be made available for the World Bank upon demand.

CONSTRUCTION PHASE				
Type of operation	**Expected Impact**	**Mitigation Measures**	**Responsible Party**	**Supervising Party**
Site cleaning and earth work	Excessive damage to vegetation Loss of topsoil	Prohibit tree cutting Prohibit movement of vehicles and machinery outside the access roads Strip topsoil and stockpile it separately Backfill topsoil and spread it for site reinstatement upon completion of earth works	Contractor	Municipal Development Fund
Works in the waterway	Pollution of water and river bed Disturbance of aquatic life	Allocate construction materials and waste storage sites away from the river banks Prohibit dumping of construction and household waste into the river Prohibit extraction of sand and gravel from the watercourse Prohibit entry of waterway by construction vehicles and machinery Prohibit washing of vehicles in the river Revert water stream in the river bed without blocking passage for fish Complete works in the waterway in the minimal time technologically possible	Contractor	Municipal Development Fund
Extraction of natural construction materials	Landscape degradation Soil erosion	Purchase of natural construction materials from existing quarries whenever feasible Obtaining formal license for quarrying if performed by contractor Reinstatement of used-up sections of quarries through terracing, backfilling, compacting, arrangement of drainage and providing enabling environment for natural regeneration of vegetation Prohibition of material extraction from watercourse	Contractor	Municipal Development Fund National Environment Agency Department of Environmental Supervision, Ministry of Environment and Natural Resources Protection

General construction works	Nuisance to people and disturbance of wildlife with generated dust and noise Disturbance of wildlife by improper behavior of workers Pollution with construction and household waste	Keep vehicles and machinery in adequate technical condition; avoid engine idling Limit vehicles speed; allow driving only along the designated access roads; transport construction materials and waste under covered hood Sprinkle work site in excessively dry conditions and during works generating much dust Prohibit entry of natural area around the work site by workers without need; ban hunting and fishing Dispose construction waste in the locations designated by Bolnisi municipality in written Make advance arrangements for household waste disposal from the construction camp and adhere to these arrangements; prohibit dumping and burning of any type of waste	Contractor	Municipal Development Fund
Works near cultural heritage site	Deterioration of the aesthetic appearance of the area around Pitareti monastery Chance finds	Adhere to good construction practice in waste management, driving, etc. Take on hold all physical activity at the work site in case of change finds and inform MDF Resume works after occurrence of change finds only upon receipt of formal instructions from MDF	Contractor	Municipal Development Fund
Work site management	Damage to workers' health due to poor sanitation Trauma and fatality due to work site accidents	Ensure possession and use of uniforms and personal protection gear by personnel Train workers in the use of technologies and make sure they hold appropriate licenses for technology use as necessary Provide health and life insurance for the workforce Provide safe drinking water and proper sanitation at the work camp	Contractor	Municipal Development Fund

		Demarcate and fence work site and work camp as relevant; allocate special points for temporary storage of construction waste and materials and for parking of construction machinery and vehicles Post contact information for the contractor, emergency service and first medical aid at the work site		
OPERATION PHASE				
	River pollution	Organize collection and disposal of waste from the maintenance works on the bridge and access roads Provide for regular collection of trash from the surface of the bridge	Bolnisi municipality	
	Traffic accidents	Provide and maintain adequate signage on the access roads to regulate vehicle speed and give relevant warning signals	Traffic Police	
	Compromised integrity of the bridge	Limit weight and other parameters of vehicles entering the bridge established in the design	Traffic Police	

Negative Impact	Monitoring Indicator	Monitoring Place	Monitoring Method	Monitoring Time / Frequency	Institutional Responsibility
Damage to vegetation and disturbance of wildlife	No tree-cutting occurs in and around work site Vehicles and machinery drive exclusively along the designated access roads Contractor's personnel is not entering natural area outside work site; does not fish, hunt, make fire, etc.	Work site and its surroundings	Visual inspection	Monthly Unannounced irregular visits	Municipal Development Fund
Loss of topsoil	Topsoil is stripped and stored separately Topsoil is backfilled and spread out	Work site	Visual inspection	Monthly during earth works Towards completion of works	Municipal Development Fund
Generation of dust and noise	Vehicles and machinery are kept in adequate technical condition Engines are not idling Site is sprinkled in excessively dry weather of during conduct of works that generate particularly much dust	Work site Area of natural construction material processing	Visual inspection	Monthly throughout construction works	Municipal Development Fund
River pollution and damage to aquatic life	River flow diversion does not prevent fish passage Works requiring diversion of water flow are conducted at high speed Vehicles and machinery are not washed in the river and	River area in and around the works site	Visual inspection	Monthly during works in the waterway	Municipal Development Fund

	do not enter watercourse Sand and gravel are not extracted from the watercourse Site allocated for temporary storage of construction materials and waste are in decent distance from the river banks No construction or household waste is dumped into the river bed				
Deterioration of landscape	Natural construction materials are purchased from supplier or – if extracted by contractor – their extraction is formally licensed Exhausted sections of quarries are reinstated through terracing, backfilling, compacting and provision of drainage		Visual inspection	Monthly during operation of quarries	Municipal Development Fund
Mis-management of waste	Sites for temporary storage of waste are designated No excessive amounts of waste are present at the work site and work camp Written authorization for waste disposal is obtained and adhered to Waste is not dumped into the river bed and is not burned		Visual inspection Checking of documents on file	Monthly throughout construction works	Municipal Development Fund

Damage to cultural heritage	Works are taken on hold immediately upon encounter of change find MDF is promptly notified by contractor on the change find Works resume upon written communication of the Ministry of Culture to MDF and consequent notice of MDF to contractor	Work site	Visual inspection Checking of documents on file	In case of chance finds	Municipal Development Fund Ministry of Culture and Preservation of Monuments
Health damage to workers	Safe drinking water is available Proper sanitation is provided	Work camp	Visual inspection	Monthly throughout construction works	Municipal Development Fund
Work-site trauma and fatality	Workers possess and use uniforms and personal protection gear Workers are trained and licensed as required Workers are covered with health and live insurance Contact information of emergency service and first medical aid is posted at the work camp	Work site and work camp	Visual inspection Checking of documents on file	Monthly throughout construction works	Municipal Development Fund
Nuisance to local communities and monks	Contact information of the contractor and MDF is posted at the work site for grievance by affected people Grievances are recorded and reacted to according to the Grievance Redress Mechanism established in MDF	Work site	Visual inspection	Monthly throughout construction works	Municipal Development Fund Ministry of Regional Development and Infrastructure

OPERATION PHASE					
Water pollution in the bridge area	Waste generated from the maintenance of the bridge and access roads is collected and disposed in a designated landfill Trash is regularly collected in the bridge area and disposed through municipal service	Bridge area	Visual inspection	Recurrent	Bolnisi municipality
Traffic accidents	Traffic regulation signs and installed and regulations are enforced				Traffic Police
Deterioration of bridge integrity	Relevant limitation parameters of vehicles entering the bridge are established and enforced				Traffic Police