Environmental Assessment Report

Initial Environmental Examination
Rehabilitation and Reconstruction of Secondary Road Zugdidi-Jvari-Mestia-Lasdili
KM.74– KM.80, KM.89, KM.91 - 103 and KM.21-KM.125
Project Number: 42414
September 2010

Proposed Multitranche Financing Facility
Georgia: Sustainable Urban Transport Investment Program

CURRENCY EQUIVALENTS

(as of 10 May 2010)
Currency Unit – lari (GEL)
GEL1.00 = $0.57
$1.00 = GEL1.75

Abbreviations

ADB	- Asian Development Bank
CAS	- Center of Archaeological Search of the Ministry of Culture and Sports
MoE	- Ministry of Environmental Protection and Natural Resources
IEE	- Initial Environmental Examination
GIS	- Geographical Information Systems
EMP	- Environmental Management Plan
MAC	- Maximum Admissible Concentrations
RAP	- Resettlement Action Plan
MoA	- Ministry of Agriculture
MLHSP	- Ministry of Labor, Health and Social Protection
GOG	- Government of Georgia
NGO	- nongovernment organization
MUFSRA	- Management Unit for Food Safety and Risk Analyze of the Ministry of the Agriculture
FS	-Feasibility Study
MDF	-Municipal Development Fund
EIP	-Environmental Impact Permit
MoED	-Ministry of Economic Development
SPS	-Safeguard Policy Statement

CONTENTS

I. EXECUTIVE SUMMARY

A. Introduction

1. Upgrading and improvement of local transport and transport-related infrastructure plays a significant role in the development of Georgia infrastructure. To this effect a number of important activities have been implemented and financed from the budget of Georgia and from other sources. Improvement of transport and related infrastructure plays an important role in improvement of Georgia's urban infrastructure. Recently several significant programs, financed through state budget, loans and grants, have been implemented with this regard. Notwithstanding the efforts undertaken so far several problems need to be solved regarding development of transport infrastructure.

2. Rehabilitation of Zugdidi-Jvari-Mestia-Lasdili motor road was initiated by the Department of Motor Roads of Georgia. The road is of national significance and connects upper Svaneti region with Tbilisi-Senaki-Leselidze main motor road. Currently the road needs significant rehabilitation in order to restore its operational capacity and ensure traffic safety. Certain sections and infrastructure facilities of the road need significant reconstruction.
The secondary road Zugdidi-Jvari-Mestia-Lasdili links the villages located in Zeda Svaneti region, Daba Mestia and Mestia with the region Zugdidi as well as with the trunk road Tbilisi-Senaki-Leselidze, which is the main road in the region. It should be noted that the present project will significantly contribute to the socio-economic development of Zeda Svaneti region and facilitate development of tourism infrastructure.

3. Presented project is one of various projects backed by international donor organizations to be implemented by the Municipal Development fund (MDF).

4. MDF aims at strengthening institutional and financial capacity of municipalities through investing financial resources in local infrastructure and services, and on improving on sustainable basis the primary economic and social services,

5. The Municipal Development Fund of Georgia (MDF) is a legal entity under Public Law. Its objectives are to facilitate institutional and financial capacity building of the local municipalities, invest in the development of local infrastructure and services and improve economic and social services to the local communities

B. Legal and Administrative System

1. Legal System in Georgia and ADB Regulations

6. The basic legal document in the country is "The Constitution of Georgia", which was adopted in 1995. While the Constitution 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.

7. Legislative execution of constitutional requirements in the sphere of environmental protection is implemented through the framework "Law on Environmental Protection" (1996, as amended) and the set of specific laws developed on its basis. In particular, the law addresses a broad spectrum of issues, like environmental management, environmental education and awareness building, licenses and permits, fines and enforcement, environmental impact assessment, which should be further regulated by specific laws.

8. At present, the environmental permitting procedure in Georgia is set out in three laws: (i) The Law on Licenses and Permits (2005); (ii) The Law on Environmental Impact Permits (EIP), and (iii) The Law on Ecological Examination (EE) 2008. Details the EIA process and required content of the EIA document is described in the Regulation on EIA issued by the MOEPNR (16.03.2009).

9. The Law of Georgia on Environmental Impact Permits determines the complete list of activities and projects subject to ecological examination (clause 4 p.1) and the legal basis for public participation in the process of environmental assessment, ecological examination and decision making on issuance of an environmental impact permit.

10. According to Georgian Regulations, the project of reconstruction of the Zugdidi-Jvari-Mestia-Lasdili requires preparation of the EIA and obtaining of Environmental Impact Permit. The EIA has been developed, public consultations conducted and Environmental Impact Permit has been issued by MoEPNR in 2010, based on conclusion of the Ecological Expertise.

a. Other Environmental Laws pertinent to the project:

(i) The Law on the Environmental Protection Service (Agency), 2008;
(ii) The Law of Georgia "on Ambient Air Protection", 2000
(iii) Forestry Code of Georgia (1999,
(iv) Law of Georgia 'On the system of the protected areas' (1996)
(v) Law of Georgia 'On the Red List and Red Book' (2003)
(vi) The 'Law of Georgia on Cultural Heritage' was approved in May of 2007
(vii) Georgian Law on Regulation and Engineering Protection of Coasts of Sea, Water Reservoirs and Rivers of Georgia (27.12.2006, No. 4131)
(viii) The Law of Georgia on Construction Permit 25.06.2004
(ix) Decree No 140 of the Government of Georgia on the Rules and Conditions for Issuing Construction Permit (11.08.2005)

b. ADB Environmental Guidelines

11. All projects funded by ADB must comply with ADB Safeguard Policy Statement (2009). The purpose of the Policy is to ensure that the projects undertaken as part of programs funded under ADB loans are environmentally sound, are designed to operate in compliance with applicable regulatory requirements, and are not likely to cause significant environmental, health, or safety hazards.

12. Safeguard policies are generally understood to be operational policies that seek to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process.
ADB's safeguard policy statement (SPS) sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

(i) The Involuntary Resettlement Policy (1995);
(ii) The Policy on Indigenous Peoples (1998), and
(iii) The Environment Policy (2002).
(iv) EIA and Environmental Screening under ADB Guidelines
(v) ADB carries out project screening and categorization at the earliest stage of project preparation when sufficient information is available for this purpose. Screening and categorization is undertaken to (i) reflect the significance of

potential resources required for the safeguard measures; and (iii) determine disclosure requirements.

(vi) ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

- **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.

- **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.

- **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

13. The proposed investment project is classified as B category project under ADB SPS and accordingly, it is required to develop Initial Environmental Examination document (IEE) in compliance with the ADB SPS (2009) requirements.

2. Administrative System

14. **Ministry of Environment Protection and Natural Resources (MoE).** MoE has the overall responsibility for protection of environment in Georgia. The Service of Licenses and Permits of MoE is responsible for reviewing EIAs and for issuance of the Environmental Permits. The MoE Inspectorate is responsible for compliance monitoring, including monitoring of construction activities and auditing of all kind of entities. Regional services of MoE are involved during agreement on Terms of Reference on architectural design of a project and in commissioning of completed facilities. The Ministry of Environmental Protection and Natural Resources of Georgia (MoE) 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:

(i) Issuing permits for project development (Environmental Impact Permit);
(ii) Setting emission limits and issuing surface water intake and discharge consents;
(iii) Inspection of operating plants;
(iv) Responding to incidents and complaints;
(v) monitoring air pollution and noise levels (especially near residential areas);
(vi) Regional services of MoE will agree upon sites for disposal of spoil and construction wastes.

15. The Ministry defines and evaluates real and possible risks of impact on the natural environment during implementation of different types of activities. Accordingly the Ministry has been assigned as the responsible body for making decision on granting permission to the proponent on implementation of projects that require on Environmental Impact Assessment (EIA). Granting procedures differ slightly for different types of projects.

16. For projects, that do not require a Construction Permit, the Environmental permit is issued by the MoE on the ground of State Ecological Expertise. State Ecological Expertise is carried out by MoE upon official submission of Environmental Impact Assessment (EIA) prepared by project developers.

17. For projects requiring a Construction Permit, no special permit is issued by MoE (according to "One window principle", only one permit shall be issued for each activity). The Construction Permit is issued by the Ministry of Economic Development of Georgia, but is subject to the consent of the MoE in the form of Conclusion of Ecological Expertise, as well as the Ministry of Culture (Center of Archaeological Studies, Department of Monuments protection). Consent of the MoE in such cases should be issued according to the same procedures (EIA, public consultations; SEE etc.) as for issuing an Environmental Permit. The Ministry of Economic Development as an administrative body issuing a permit ensures the involvement of the MoE as a different administrative body in the proceedings initiated for the purpose of permit issuance, in accordance with Georgia's Law on Licenses and Permits (2008).

18. Project screening (definition of the project category and necessity for preparation of EIA) and scoping (definition of set of environmental issues and Terms of Reference for the EIA study) is carried out by the project implementing agency and its consultants (in this case Municipal Development Fund (MDF) and its consultants). Scoping and screening do not represent mandatory procedures according to Georgian legislature although review of scoping/screening outcomes and agreement is considered a desired practice

19. As a rule, EIA permitting conditions contain requirement for informing MEPNR regarding fulfillment of the EIA permit conditions. This basically means giving information regarding implementation of Environmental Management and Monitoring Plans

20. **The Ministry of Economic Development (MoED).** MoED is responsible for carrying out the review of technical documentation (including conclusion of state independent experts) and issuing Permits on Construction for projects classified as the projects of State Importance, as well as for supervision over constructing activities. State supervision of construction and compliance monitoring is provided by the Main Architecture and Construction Inspection (MACI), which is operating under the Ministry of Economic Development of Georgia.

21. **The Municipal Development Fund of Georgia (MDF).** MDFis a Legal entity under public law with the aim to promote the institutional and financial strengthening of the local self-governing bodies, investments in local infrastructure and services and sustainable progress of the principal economic and social services for the local population (communities).
The Fund is responsible for managing the finances received from central and local budgets, international financial institutions and other donors, and proceeds gained through the Fund loans as principal and interest amounts used to finance local and regional infrastructure and investment projects and appropriate technical assistance in the field of service.

22. MDF, within the limits of the programs accomplished by it, is responsible for purchasing the projects/plans and EIA research, as well as building and rehabilitation works of the

municipal infrastructure. During the deals of purchase, the Fund is obliged to follow the legislation of Georgia under the established rule and by observing the environmental and social requirements of donor organizations. MDF is responsible for proper consideration of the environmental problems within the limits of the accomplished projects.

23. In particular, the functions of MDF include considering the EIA and environmental management plans of the accomplished projects. In addition, the Fund evaluates the degree of consistency of the contractor's activity with the environmental management plans, EIAs, environmental standards and other obligations.

24. The domestic resources of MDF are sufficient for the administration and general environmental control of projects. In case of necessity, aiming at performing the environmental monitoring of specific projects, MDF will purchase proper services within the limits of a single project for technical-economic and environmental supervision.

a. Other Responsible Governmental Institutions:

25. The Ministry of Culture and Sports. The ministry is responsible for supervision of the construction activities in order to protect archaeological heritage. If construction is to be carried out in a historic site or zones of cultural heritage, consent of the Ministry of Culture, Monument Protection and Sport is also required for issuing a construction permit.

26. Management Unit for Food Safety and Risk Analysis of the Ministry of the Agriculture (MUFSRA). MUFSRA is responsible for implementation of complex sanitary protection measures in the case of identification of burial sites during earthworks. Information about suspicious burial sites should be delivered to the "MUFSRA" by the Constructing Contactor (field environmental officer).

C. Project Description

27. The investment project envisages reconstruction/rehabilitation of the following four sections of Zugdidi-Jvari-Mestia-Lasdili motorway (Picture 1):

(i) Section 1 – motorway section from km 74 to 80;
(ii) Section 2 – demolition of the existing balcony (260 m long) at km 89 and construction of a new tunnel instead;
(iii) Section 3 - from km 91 to 203 of the motorway;
(iv) Section 4 – from km 121 to km 125 of the motorway.

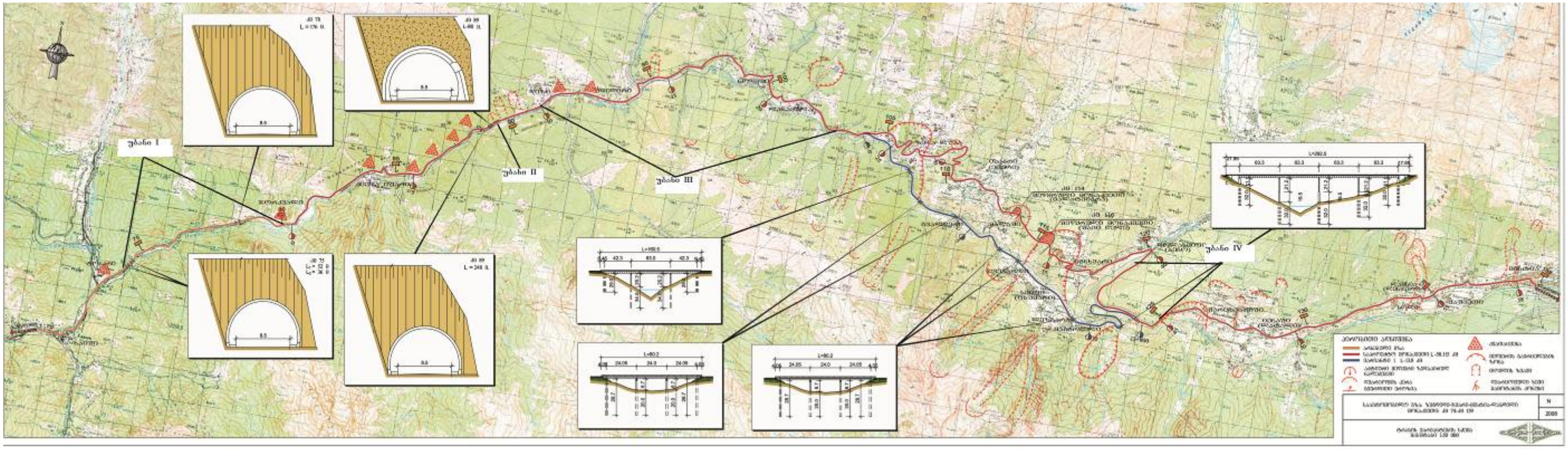

Fig 1. Zugdidi-Djvari-Mestia-Lasdilis Motor Road Map

1. Subproject 1: Rehabilitation of section km 74 – km 80 of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili

28. The project section is located in Mestia, mainly on uninhabited area. The project section starts at PK 73+200 of Zugdidi-Jvari-Mestia- Lasdili road corresponding the PK 0+00. The end section is PK 80+200 corresponding with project PK 70+00. Design does not consider the tunnel and gallery reconstruction works and under construction bridge section.

29. The separate sections of the roadway are damaged and ruptured requiring rehabilitation. Mainly the pavement is of gravel, on some sections there are remains of asphalt concrete pavements characterised with frequent mesh cracks and heavily damaged.

30. Structures require repair and cleaning. Construction of new structures is required as well. Considering the general technical state of the project section performance of rehabilitation works is necessary.

31. Water removal is considered by the design with construction and clearing of ditches. From PK 0+00 to PK 5+35 to restore the damaged places of the roadbed design considers construction and repair of retaining walls. Design considers as well repair of the existing reinforced concrete and steel pipes and reinforced concrete bridge. The new reinforced concrete culverts are stipulated as well.

32. The following works shall be performed upon the completion of preparatory works: repair and cleaning of culverts, construction of new culverts, repair of bridge PK 68+00 repair and construction of retaining walls.

33. Whilst construction of retaining walls the pit shall be removed in rock massive from the technological platforms by suspended buscket of the 10 t crane with jack hammers. Following the construction of the retaining wall the waterproofing at the contact areas with soil and drainage shall be constructed. The wall backfilling shall be done manually

2. Subproject 2: Reconstruction of section km 89 (Tunnel and Gallary) of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili

34. This section of a road is characterized with intensive rock falls (on the total length of balcony) and snow avalanches (From the end of balcony to Mestia direction, within the vicinity of small waterfall, see the photo).

35. Reconstruction of this section includes the construction of tunnel and gallery against snow slide with length 84 m.

36. In order to tie to the previously executed project for rehabilitation of the existing road the KP 77+68 is accepted as a start point for the reconstruction section and KP 82+65 is accepted as an end point.

37. On 89 km of the existing road the 260 m long balcony is located, structure of which is mainly represented by wide flange beam steel #40 span structure, where the precast reinforced concrete slabs are fixed on. Girders are rested on the massive concrete piers, height of which alter from 7-to 18m. Along the total length of the balcony the concrete wall is constructed to conjugate the superstructure and the roadway. Due to the narrowness of the study balcony

traffic is frequently interrupted, should be mention as well the fact that the balcony in profile sharply changes the slopes.

38. Elements and details of the existing balcony are significantly damaged and can not be rehabilitated. As it obvious from the photo the highest pier of the balcony and the wall conjugating the part of the balcony and roadway is in unsafe condition to carry the modern loads.

39. Actually, for reconstruction of the balcony is only possible if remove completely the existing balcony and construct the new one, in addition it should be covered in order to protect it from falling of rocks and snow avalanches, so it means the gallery shall be constrcuted.

40. In addition, for total reconstruction of balcony (removal of old and construction of new one) temporary bypass road will be required because of small width of roadway (changes from 4-6m), which, within the given topograhic conditions can be constructed only by boring of small size opening tunnel, considerably increasing the cost of reconstruction of balcony.

41. Due to mention above, the question arises to construct a tunnel on this section of the road and what can be considered as question having no alternative for the given case. The length of the project tunnel is 260 m.

42. Pre-loosening by blasting is required on the road Zugdidi-Jvari-Mestia-Lasdili km 89. Blasting works generally shall be done by specialized authorities and team and only when the corresponding Works Productions Plan is available, in accordance with the Project of Production and Organization of Blasting works.

Fig.2 Existing Balcony on KM 89

3. Subproject 3: Reconstruction of section km 91- km 103 of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili

43. There is no asphalt pavement on the road, only some remains are noted. Carriageway is covered with gravel and crushed aggregates with 30-35 cm thickness.

44. It is required to repair 16 culverts and 2 bridges from the listed above structures; Design considers construction of 30 culverts of various opening. 3 existing culverts are canceled.

45. Design considers restoration of the road bed on separate sections of the rehabilitated road with construction of retaining walls by gabion boxes. Repair of the existing retaining walls shall be done as well. Walls repair include rising in height, filling with stones and construction of reinforced concrete casing.
In total design considers:

(i) Gabion lower retaining walls –589/2738 linear m/m^3;
(ii) Gabion upper retaining walls–62/275 linear m/m^3;
(iii) Gravity gabion walls – 101/1702.5 linear m/m^3;
(iv) Repair of the existing concrete retaining walls– 32/1005 u/linear m;

46. The following works shall be performed immediately upon the completion of preparatory works: repair and cleaning of culverts, construction of new culverts, repair of bridges, repair and construction of gabion retaining walls.
Blasting of 63905 m^3 rocky soil (31^a, 31^g , 28^b) is required on the road Zugdidi-Jvari-Mestia-Lasdili km 91-km 103.

4. Subproject 4: Reconstruction of section km 121-km 125 of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili

47. The present Project contains design and bidding documents for the rehabilitation of the road section km 121-km 125 (section I). The length of the project section is 5.14 km.

48. The project section is located in Mestia, mainly on uninhabited area. The region is characterized as highland. Along the project section the village Becho is located, at 23 km the road junction is located directing the way to the villages Magarduli, Lezgara, Tskhumari and etc.

49. The roadbed shall be restored under the project to meet the technical requirements. The existing engineering structures repaired and restored, new engineering structures constructed if necessary. Construction of new road pavement instead of heavily damaged asphalt-concrete pavement is stipulated under the present project

50. 9 reinforced concrete pipe culvert and one box-culver 1.0x1.0 s from 16 require repair. Remained 6 structure require removal and construction of new box culverts of different dimensions. Culverts shall be cleaned, the damaged body and heads shall be removed and replaced with the new ones. Dismantling and installation of deformed sections of the culverts are foreseen by the project. Water intake concrete wells and wingwalls shall be constructed as well.

II. POLICY, LEGAL AND ADMINISTRATIVE SYSTEMS

A. Georgian Legislation

1. Administrative Structure in Georgia

51. **Ministry of Environment Protection and Natural Resources (MoE).** MoE has the overall responsibility for protection of environment in Georgia. The Service of Licenses and Permits of MoE is responsible for reviewing EIAs and for issuance of the Environmental Permits. The MoE Inspectorate is responsible for compliance monitoring, including monitoring of construction activities and auditing of all kind of entities. Regional services of MoE are involved during agreement on Terms of Reference on architectural design of a project and in commissioning of completed facilities. The Ministry of Environmental Protection and Natural Resources of Georgia (MoE) 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:

(i) Issuing permits for project development (Environmental Impact Permit);
(ii) Setting emission limits and issuing surface water intake and discharge consents;
(iii) Inspection of operating plants;
(iv) Responding to incidents and complaints;
(v) monitoring air pollution and noise levels (especially near residential areas);
(vi) Regional services of MoE will agree upon sites for disposal of spoil and construction wastes.

52. The Ministry defines and evaluates real and possible risks of impact on the natural environment during implementation of different types of activities. Accordingly the Ministry has been assigned as the responsible body for making decision on granting permission to the proponent on implementation of projects that require on Environmental Impact Assessment (EIA). Granting procedures differ slightly for different types of projects.

53. For projects, that do not require a Construction Permit, the Environmental permit is issued by the MoE on the ground of State Ecological Expertise. State Ecological Expertise is carried out by MoE upon official submission of Environmental Impact Assessment (EIA) prepared by project developers.

54. For projects requiring a Construction Permit, no special permit is issued by MoE (according to “One window principle”, only one permit shall be issued for each activity). The Construction Permit is issued by the Ministry of Economic Development of Georgia, but is subject to the consent of the MoE in the form of Conclusion of Ecological Expertise, as well as the Ministry of Culture (Center of Archaeological Studies, Department of Monuments protection). Consent of the MoE in such cases should be issued according to the same procedures (EIA, public consultations; SEE etc.) as for issuing an Environmental Permit. The Ministry of Economic Development as an administrative body issuing a permit ensures the involvement of the MoE as a different administrative body in the proceedings initiated for the purpose of permit issuance, in accordance with Georgia’s Law on Licenses and Permits (2008).

55. Project screening (definition of the project category and necessity for preparation of EIA) and scoping (definition of set of environmental issues and Terms of Reference for the EIA study) is carried out by the project implementing agency and its consultants (in this case Municipal Development Fund (MDF) and its consultants). Scoping and screening do not

represent mandatory procedures according to Georgian legislature although review of scoping/screening outcomes and agreement is considered a desired practice

56. As a rule, EIA permitting conditions contain requirement for informing MEPNR regarding fulfillment of the EIA permit conditions. This basically means giving information regarding implementation of Environmental Management and Monitoring Plans

57. **The Ministry of Economic Development (MoED).** MoED is responsible for carrying out the review of technical documentation (including conclusion of state independent experts) and issuing Permits on Construction for projects classified as the projects of State Importance, as well as for supervision over constructing activities. State supervision of construction and compliance monitoring is provided by the Main Architecture and Construction Inspection (MACI), which is operating under the Ministry of Economic Development of Georgia.

58. **The Municipal Development Fund of Georgia (MDF).** MDFis a Legal entity under public law with the aim to promote the institutional and financial strengthening of the local self-governing bodies, investments in local infrastructure and services and sustainable progress of the principal economic and social services for the local population (communities).
The Fund is responsible for managing the finances received from central and local budgets, international financial institutions and other donors, and proceeds gained through the Fund loans as principal and interest amounts used to finance local and regional infrastructure and investment projects and appropriate technical assistance in the field of service.
MDF, within the limits of the programs accomplished by it, is responsible for purchasing the projects/plans and EIA research, as well as building and rehabilitation works of the municipal infrastructure. During the deals of purchase, the Fund is obliged to follow the legislation of Georgia under the established rule and by observing the environmental and social requirements of donor organizations. MDF is responsible for proper consideration of the environmental problems within the limits of the accomplished projects.

59. In particular, the functions of MDF include considering the EIA and environmental management plans of the accomplished projects. In addition, the Fund evaluates the degree of consistency of the contractor's activity with the environmental management plans, EIAs, environmental standards and other obligations.
The domestic resources of MDF are sufficient for the administration and general environmental control of projects. In case of necessity, aiming at performing the environmental monitoring of specific projects, MDF will purchase proper services within the limits of a single project for technical-economic and environmental supervision.

60. **Constructing Contractor.** After appointment all Constructing Contractors should provide Constructing Contractor's Environmental Management Plan (EMP) developed on the basis of the EEI for the project. The necessity to develop Contractor/s management plan is normally fixed in the Construction Contract. The Constructing Contractor has the following obligations:

(i) to employ Environmental consultants (persons or company) responsible for developing and implementing the construction phase EMP and for provision of corresponding information to MDF;
(ii) to develop, if required, a Spoil and Rock Disposal Plan and Construction Waste Disposal Plan agreed with the MoE and its regional services;
(iii) to develop, if required, Reforestation and/or Biorestoration Plan or Compensation Plan agreed with the MoE (Forestry department; Biodiversity department);
(iv) Constriction Schedule;

(v) The EMP implementation costs should be included into the construction budget.

61. The Contract should also indicate that the Spoil and Rock Disposal Plan, as well as the Reforestation Plan, should be agreed with the Regional Services of the MoE, while the other chapters of the Constructing Contractor's Environmental Management Plan should be reviewed and accepted by MDF.

2. Other Responsible Governmental Institutions

62. The Ministry of Culture and Sports. The ministry is responsible for supervision of the construction activities in order to protect archaeological heritage. If construction is to be carried out in a historic site or zones of cultural heritage, consent of the Ministry of Culture, Monument Protection and Sport is also required for issuing a construction permit.

63. Management Unit for Food Safety and Risk Analysis of the Ministry of the Agriculture (MUFSRA). MUFSRA is responsible for implementation of complex sanitary protection measures in the case of identification of burial sites during earthworks. Information about suspicious burial sites should be delivered to the "MUFSRA" by the Constructing Contactor (field environmental officer).

3. Framework Environmental Legislation

64. The basic legal document in the country is "The Constitution of Georgia", which was adopted in 1995. While the Constitution 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.

65. Article 37, Part 3 states that "any person has the right to live in a healthy environment, and 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."

66. 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.

67. Legislative execution of constitutional requirements in the sphere of environmental protection is implemented through the framework "Law on Environmental Protection" (1996, as amended) and the set of specific laws developed on its basis. The framework law regulates environmental protection and in the use of nature on all Georgia's territory including its territorial waters, airspace, continental shelf and special economic zone. The law deals with education and scientific research in the scope of environment, environmental management aspects, economic levers, licensing, standards, EIA and related issues. It considers different aspects on protection of ecosystems, protected areas, issues of global and regional management, protection of ozone layer, biodiversity, protection of Black Sea and international cooperation aspects. In particular, the law addresses a broad spectrum of issues, like environmental management, environmental education and awareness building, licenses and permits, fines and enforcement, environmental impact assessment, which should be further regulated by specific laws. Below the environmental regulations most relevant to the project are summarized.

4. Legislation Related to Environmental Assessment and Environmental Permitting

68. At present, the environmental permitting procedure in Georgia is set out in three laws: (i) The Law on Licenses and Permits (2005); (ii) The Law on Environmental Impact Permits (EIP), and (iii) The Law on Ecological Examination (EE) 2008. Details the EIA process and required content of the EIA document is described in the Regulation on EIA issued by the MOEPNR (16.03.2009).

a. Law on Licenses and Permits, 2005

69. The Law on Licenses and Permits was adopted by the Parliament of Georgia on June 24, 2005. The Law regulates legally organized activities posing certain threats to human life and health, and addresses specific state or public interests, including usage of state resources. It also regulates activities requiring licenses or permits, determines types of licenses and permits, and defines the procedures for issuing, revising and canceling of licenses and permits (Article 1, Paragraph 1).

b. Laws on Environmental Impact Permits (EIP) and Ecological Examination (EE)

70. The Laws on Environmental Impact Permits and Ecological Examination were published on December 14th, 2007 and entered in force on January 1st, 2008. These new laws integrate all the amendments introduced in the legislation of Georgia during recent years.

71. The Law of Georgia on Environmental Impact Permits determines the complete list of activities and projects subject to ecological examination (clause 4 p.1) and the legal basis for public participation in the process of environmental assessment, ecological examination and decision making on issuance of an environmental impact permit.

72. Under the “activities” subject to the ecological examination, the law considers construction of new or upgrading of existing facilities imposing change of technology and operational conditions for the projects and activities included into the list. The routine maintenance works in relation with the same facilities do not require ecological examination and permit.

73. In case if the activity included in the list given in clause 4 p.1 at the same time requires a construction permit, the administrative body responsible for the issuance of the construction permit ensures involvement of the MOEPNR as a separate administrative body, in the administrative procedures initiated for the purpose of issuing a construction permit as it is envisaged by the Law on Licenses and Permits. In such cases, the MOEPNR is issuing the conclusion on the Ecological Examination of the project based on the documentation provided to MOEPNR by the administrative body issuing the Permit. The Conclusion on the Ecological Examination is adopted by the administrative (executive) legal act of the MOEPNR and compliance with the conditions of the conclusion is obligatory for the project proponent. The positive outcome of Ecological Examination is a part of conditions of the construction permit.

74. In case if the activity included into the list given in clause 4 p.1 does not require a construction permit, based on the conclusion on the Ecological Examination the MOEPNR will issue the Environmental Impact Permit, supported by the administrative (executive) legal act issued by the minister. The ecological examination is carried out in accordance with the law of

Georgia on Ecological Examination and the conditions set forth by the conclusion present the Conditions of the Permit.

c. Regulation on EIA

75. The requirements related to EIA studies and the EIA report are set forth in the Regulation on EIA issued by MOEPNR in March of 2009. The content of the EIA document is specified in the clause 5 of the Regulation as follows:

76. Article 5. Content of the environmental impact assessment

77. The Environmental impact assessment report should include the following information:

(i) Analysis of the existing state of the environment;
(ii) Identifying the sources, kinds and objects of impact caused by the activity;
(iii) Forecast of the changes of quantitative and qualitative characteristics of the environment;
(iv) Determining the probability of emergency situations due to the activity and evaluating the expected results;
(v) Evaluation of the environmental, social and economic results of the planned activity;
(vi) Specifying the reduction measures for the negative impact on the environment and human health and specifying the compensation measures as necessary;
(vii) Identifying the residual (cumulative) impact and measures for its control and monitoring;
(viii) Undertaking environmental and economic evaluation of the projects;
(ix) Analysis of the alternative variants of the project implementation, selection and forming new variants;
(x) Identifying the ways and means to restore the initial environmental condition in case of terminating entrepreneurship or other activity;
(xi) Informing the society and studying the public opinion;
(xii) Plan for the post-project situational analysis;
(xiii) Identifying the kinds and quantities of the expected emissions;
(xiv) Forecast of the expected environmental state gained through the environmental impact factors;
(xv) Developing the plan for the environmental monitoring during the implementation, in the course and by the end of the activity.

d. Procedures on Public Consultations

78. The 6th clause of the Law on Environmental Impact Permit provides detailed requirements and procedures for conducting public consultations and establishes timeframes for information disclosure and discussion.

79. A developer is obliged to carry out public discussion of the EIA before its submission to an administrative body responsible for issuing a permit (in case of activity requiring construction permit before initiating stage 2 procedure for construction permit issuance).

80. A developer is obliged to disclose (publish) information before conducting public discussion on the planned activity. Information is subject to publication in the central periodical as well as in the print media existing within the administrative territory of the same rayon (if such

exists) where an activity is planned. Information (advertisement) shall contain the following information:

(i) The objectives, title and location of the planned activity;
(ii) The location where interested individuals may obtain the activity related documents (including the EIA report);
(iii) Deadline for the submission of their opinions;
(iv) The place and time of public discussion.

81. A developer is obliged:

(i) To submit a hard copy and an electronic version of the EIA report to administrative body issuing a permit within a week from the date of the publication;
(ii) To receive and consider within 45 days from the date of publication from citizens written comments and suggestions;
(iii) Hold a public discussion on a planned activity not later than 60 days from the publication of an advertisement;
(iv) To ensure invitation to public discussion of the representatives of respective local administration and governmental agencies representatives; the Ministry and the Ministry of Economic Development and other interested administrative bodies.

82. Discussion shall be held publicly and any citizen has a right to attend it. Public discussion shall be held in the administrative center of the rayon where an activity is planned.

83. According to the article 7 of the law, during 5 days after conducting the public disclosure meeting, the minutes of the meeting should be prepared to reflect all the questions and comments raised and explanations, provided by the project proponents in response.

84. Appropriate corrections should be incorporated into the main text of the EIA, if required. If the comments and proposals of stakeholders are not accepted a letter of explanation should be sent to them. The minutes of the meeting, as well as response letters, explanations and corrections should be submitted to the MOEPNR or the administrative body responsible for issuing the Permit as supplementary materials to the EIA. The mentioned documents should be considered as an essential part of the EIA.

e. Procedures on Submission of EIA to MOEPNR

85. Article 8 of the Law on Environmental Impact Permit specifies the documents to submit to receive a permit:

(i) A developer, in order to receive a permit, shall submit a written statement to the Ministry. A statement to receive a permit is submitted, considered and processed under the rule established by the “Law of Georgia on Licenses and Permits”.

(ii) A developer is obliged, in addition to the information specified by the ‘Law of Georgia on Licenses and Permits’, to submit the following documents:

- An EIA report according to the standards specified by the legislation of Georgia (in 5 hard copies and 1 soft copy).
- A situation plan of the planned activity (with the indication of distances).
- Volume and types of the expected emissions (a technical report of inventory of the stationery sources of pollution and emitted/discharged harmful substances and project of maximum permissible concentrations of emitted/discharged harmful substances (in 4 copies)).
- A brief description of the activity (as a technical summary)
- A statement about the confidential part of the submitted statement.

(iii) A developer is obliged to submit a full diagram of the technological cycle to the permit issuing body even if the given activity contains a commercial and/or state secret. This part of the statement, according to sub-clause 'e' of clause 2 of the given Article should be submitted separately by the operator.

f. Issuance of Environmental Impact Permit

86. According to the law on "Licenses and Permits", the MOEPNR takes decision on issuing a Permit within 20 days after submission of request on permit by the project proponent. MOEPNR, in accordance with the law on Ecological Examination, ensures expertise of the submitted documentation and issuance of conclusion on Ecological Examination. The Permit (Environmental Permit or Construction Permit when the latest is required) is issued only in case of the positive conclusion of the Ecological Examination.

5. Other Environmental Laws

87. **The Law on the Environmental Protection Service (Agency).** In accordance with the 'Law on the Environmental Protection Service of 2008, an environmental protection control system has been established to ensure the following: (a) state control in the field of environmental protection and ecological systems safety, (2) observance of the proper laws by the subjects of regulation, (3) population's trust in the mentioned system and in state organs, generally in respect of performance of state obligations and transparency in the field of environmental protection. Under the same Law, there has been an environmental protection agency established (on the base of a former environmental protection inspection) and the functions of its employees specified. In particular, they are authorized to accomplish an environmental inspection of the objects of regulation (physical and legal entities, state authority and local self-governing bodies) and monitoring of their activities. Besides, the prerogative of the environmental protection agency is to calculate the damage to the environment to compensate it to the state, put forward the requirement to the objects of regulation to compensate the damage, and in case of non-meeting such a requirement, file a proper appeal before the court.

88. For the road project, a subject of inspection and monitoring may be the process of building (legal use of resources; environmental pollution, noise and vibration, etc.) and exploitation-related activity (waste management, emissions; safety etc.).

89. **Waste Management.** The following acts of the Ministry of Labour, Health and Social Protection of Georgia define the waste management rules to be met during the road rehabilitation projects:

The act on “Approval of the rules of collection, storage and neutralization of the wastes of preventive treatment establishments” 16 August of 2001, 300 (“Georgian Legislative Messenger” N90 24/08/2001);
The act on “Approval of arrangement of polygon/grounds for disposal of solid household wastes and adoption of sanitary rules and norms” 24 February, #36 (Georgian Legislative Messenger #17, 07.03.03);

90. **The Law of Georgia “on Ambient Air Protection” was put into effect from 1 January 2000.** The scope of the “Georgian law on Ambient Air Protection” is to protect ambient air on the whole territory of Georgia from harmful human impact. This law does not govern the field of air protection in work places. Main competences of governmental authorities in the field of ambient air protection (a) Development of environmental monitoring (observation) system; (b) Development and implementation of common policies and strategies; and (c) Development of integrated ambient air pollution control.

91. Types of harmful human impact include:
- (i) introduction of pollutants into the ambient air;
- (ii) radioactive impact on ambient air;
- (iii) ambient air pollution with micro-organisms and microbial toxins;
- (iv) physical impact of noise, vibration, electromagnetic field etc on ambient air.

92. Types of ambient air pollution are specified:
- (i) emission of pollutants into the ambient air from stationary pollution source;
- (ii) emission of pollutants into the ambient air from mobile sources of pollution;
- (iii) emission of pollutants into the ambient air from non-point sources of pollution;
- (iv) emission of pollutants into the ambient air from small-scale sources of pollution.

93. According to the Article 29[1], the inventory on emissions of air pollutants from stationary pollution sources is obligatory for physical and legal entities. The special inventory report is to be prepared for 5 years for each source of the atmospheric air pollution and each type of a harmful substance.

94. At preparing the EIA project, a full inventory on emissions (in case of existence) is to be carried out and maximum permissible concentrations or temporarily agreed permissible concentrations of the emitted harmful substances for stationary pollution sites are to be set. Maximum permissible concentration is an amount of permitted emissions of air pollutants from stationary pollution sources. Temporarily agreed permission concentrations can be approved for five years (maximum) without prolongation. The Maximum permissible concentration of the emitted harmful substances for stationary pollution sites is approved for 5 years for each source of the atmospheric air pollution and each type of a harmful substance.

95. Registration of emissions from stationary pollution sources comprises:
- (i) Self-monitoring of emissions;
- (ii) State emission registration system.

96. Self-monitoring of emission of pollutants from stationary pollution sources means that economical actor (operator) shall conduct adequate self-monitoring of pollutant emissions from stationary pollution sources. It includes:
- (i) Emission measurements (assessment);
- (ii) Registration of emissions;
- (iii) Reporting of emissions.

97. State emission registration system is a system of compilation, processing and analysis of emission reporting documentation. The Ministry of Environment Protection and Natural Resources of Georgia conducts state registration of emissions.

98. The Law of Minerals of 1996 provides provisions for the mineral resource exploration and management and establishes the requirement to obtain a license according to the procedures established under this law. The Law on Licensing and Permits (June 25, 2005) establishes the most recent regulations for licensing. According to the current legislation all quarries and borrow pits require to obtain a license.

99. The Wildlife Law of 1996 mandates the MoE to regulate wildlife use and protection on the whole territory of the country. The law empowers the MoE to issue hunting permits and licenses, declare hunting areas, control poaching, etc. Potential poaching by the workers should be controlled also during construction works, especially in sensitive ecological areas.

100. Forestry Code of Georgia (1999, including effective amendments). The Forestry Code of Georgia regulates the legal relations connected to looking after, protection, restoration and application of the forest fund and its resources. The aims of the Forestry Code of Georgia are as follows:

101. Looking after protection and rehabilitation of forests aiming at conserving and improving their climatic, water-regulating, protective, cultural, health, medicinal and other mineral wealth, conservation and protection of original natural and cultural environment and its individual components, including the vegetation cover and fauna, bio-diversity, landscape, cultural and natural monuments in the forests, rare and endangered plant species and others and regulation of their interaction in the benefit of the future generation.

102. Article 38 of the Forestry Code establishes the modes of protection of the state forest fund:

(i) Aiming at protecting the present state of the state economic forest fund and its biodiversity, originality of intact forests and relict, endemic and other valuable plant species, the general or special mode of protection of the state economic forest fund has been introduced by considering the priority functionality, historical, cultural and other values of the forest

(ii) The mode of protection of the protected territories of Georgia is defined under the Georgian Law ‘On the system of protected territories’.

103. **Article 41** defines the modes of protection to be used for different categories of the state economic forest funds:

(i) The mode of special protection applies to the resort and green zones of the state economic forest fund, as well as flood-plain forests and forest sub-alpine zone.

(ii) The mode of general protection applies to the soil conservation and water-regulation forests under the rule provided by Article 42 of the present Code.

104. **Article 39** specifies the special limitations to certain types of activity defined by the special mode of protection:

(i) The following activities are prohibited in the state economic forests and lands where a special mode of protection is applied:

(a) Cutting of a principal use;

(b) Activities of the first and second categories as defined by the Law of Georgia 'On environmental permits', except the programs for rehabilitation of the protected areas and founding the hunting firms (02.03.2001 749).

105. **Law of Georgia 'On the system of the protected areas' (1996).** The Law defines the categories of 'protected areas' and specifies the frames of activities admissible in the given areas. The permitted actions are defined by considering the designation of the areas and in accordance with the management plans and provisions of the international conventions and agreements to which Georgia is a party. As a general requirement, the following activities are prohibited in the protected areas:

(i) Disturbance or any other changes of the natural ecosystems
(ii) Demolition (destroy), arrest, disturbance, damage (invalidation) of any natural resource with the purpose of its exploitation or any other purpose
(iii) Damage of the natural ecosystems or species by reason of the environmental pollution
(iv) Bringing and breeding foreign or exotic species of living organisms
(v) Bringing explosives or toxic materials to the area.

106. According to the above-mentioned Management Plan, all kinds of economic and entrepreneurship activities are admissible in the support zone provided they do not hamper the functioning of the protected areas.

107. **Law of Georgia 'On the Red List and Red Book' (2003).** The Law 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.

108. 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. Possible harmful effect of anthropogenization on the endangered species should be taken into account when issuing the permit on environmental impact during the ecological expertise.

109. The Red List of Georgia was approved by the Presidential Decree No. 303 'On approving the Red List of Georgia' (May 2, 2006). In case when the road rehabilitation project is to be accomplished within the resort zone accordingly, the Law of Georgia 'On Tourism and resort' and Law of Georgia 'On the zones of sanitary protection of resorts and resort areas' should be considered.

110. **Decree No. 538;** There is a chance that the project activity may cause harm to the environment, which will be impossible to mitigate even through planning and realizing the preventive measures. The rules to estimate and compensate for the environmental damage have been developed for such cases under the Decree No. 538 'On approving the methods to estimate the environmental damage' of the Minister of Environmental Protection and Natural Resources of Georgia adopted on July 5, 2006. Below web site the clauses, which may be useful to estimate the damage within the limits of the project.

111. **Article 2.** The rule to estimate the damage caused by the harmful anthropogenic action on the atmospheric air

112. **Article 3.** The rule to estimate the environmental damage caused by the soil pollution

113. **Article 4.** The rule to estimate the environmental damage caused by the soil degradation

114. **Article 5.** The rule to estimate the environmental damage caused by illegal action with forest resources

115. **Article 6.** The rule to estimate the environmental damage caused by damaging the green plantations in the capital of Georgia, other cities and towns, regional centers and settlements

116. **Article 7**. The rule to estimate the damage caused by damaging the fish reserve and other biological forms

117. **Article 8.** The rule to estimate the damage caused by illegal acquisition of the animal life objects

118. **Article 9.** The rule to estimate the environmental damage during the fossil exploitation

119. **Article 10**. The rule to estimate the environmental damage caused by the pollution of water resources.

6. Environmental Standards and Norms

a. Environmental Quality Regulations and Standards

120. Within the context of a road project, environmental quality standards and norms are of primary importance. They define the quality of ambient air, admissible levels of surface water pollution and measures for their protection including zones of sanitary protection. The maximum admissible levels of air and noise pollution are also a certain importance to the stage of building. In accordance with the “Law on public health”, the environmental qualitative norms are approved by Decrees of the Minister of Labor, Health and Social Security of Georgia (Decrees Nos. 297/N of 16.08.2001, including the changes made to it by further decrees of the Ministry Nos. 38/N of 02.24.2003, 251/N of 09.15.1006, 351/N of 12.17.2007).

121. Ambient Air Quality Norms. The provisions for the protection of ambient air against contamination and the values of Maximum Admissible Concentrations of the harmful substances in the ambient air in the vicinity of the settlements is provided in the 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.

Table 3: Maximum Admissible Concentration of Pollutants (MAC) in Ambient Air mg/m^3

N	Substance	N according to CAS	Formula	MAC (mg/m^3)		Class of harmfulness
				Maximum fugitive	Average Daily	
1	2	3	4	5	6	8
6	Nitrogen (IV) Dioxide	10102-44-0	NO_2	0.085	0.04	2
111	Sulfur Dioxide	9/5/7446	SO_2	0.5	0.05	3
359	Carbone Oxide	630-08-0	CO	5	3	4
360	Soot (Carbone black)	1333-86-4	C	0.15	0.05	3

122. **Noise Standards**. The Georgian standards for noise control are approved by the Decree of the Minister for Health, Labor and Social Affairs (297n of August 16, 2001) on the 'Approval of Environmental Quality Standards', which specify the tolerable and maximum admissible levels of noise for different zones.

Table 4 Georgian Noise Quality Standards in Residential Areas

Time	Indicative Level La dBA	Maximum Admissible Level La max dBA
7am – 11 pm	55	70
11pm – 7am	45	60

7. Construction Permits

123. Terms and procedures for obtaining Construction Permit, as well as issues related to the State supervision are mostly covered by the following legal acts of Georgia:

(i) The Law of Georgia on Construction Permit 25.06.2004
(ii) Decree No 140 of the Government of Georgia on the Rules and Conditions for Issuing Construction Permit (11.08.2005) with amendments introduced by Government Decrees of 09/01/2005 N 151; 12/01/2005 N 214; 01/23/2006 N 16; 06/20/2006 N 115; 08/23/2006 N 160 and No 101 of 16.05.2007
(iii) The Law of Georgia on State Supervision over the Architecture and Construction Related Activities (14.11.1997) with amendments introduced by Government Decrees of 06/22/2001 N 992; 12/29/2004 N 857; 12/22/2005 N 2405

124. We will briefly review Construction Permit related procedures to address the environmental aspects of these procedures.

125. In case if the construction is carried out by a Ministry of the Government of Georgia or its structural unit, the preparation and agreement with the authorities of the project documentation should comply with the requirements stipulated in the Decree No 101 of 16.05.2007. In particular, the project documentation and its review procedures should comply with the requirements set forth for phase I, II and III of permitting cycle by the Decree No 140 of the Government of Georgia on the Rules and Conditions for Issuing Construction Permit. This provision is applicable

(i) Phase I. Pre-Design Stage

- Confirmation of the land plot ownership and preparation of related documents
- Agreement on SoW and ToR for the Architectural Design with the Architectural Department of local administration
- Preparation of the Design in accordance with the aforementioned SoW and ToR.

(i) Phase II. Consent of the Architectural Department of local administration

(ii) Phase III. Application for acquiring Construction Permit and permitting procedures

a. Pre-Design Phase

126. To obtain Construction Permit the project proponent should provide documents confirming land plot ownership or right for land use – extracts from the State Register or agreement with the land owner. This is relevant also for the construction activities to be carried out by the central or local governmental bodies.

127. Terms of Reference for Architectural Design is a complex of requirements determined by normative acts and defines:

(i) destination (residential building; industrial etc.)
(ii) parameters (number of floors, dimensions etc.)
(iii) layout
(iv) List of Technical Requirements - environmental, technical and organizational conditions for design and construction. Each of these conditions should be agreed with the appropriate service agencies and should be supplemented to the technical documentation.

128. Terms of Reference for Architectural Design should comprise requirements related to urban development planning; environmental protection and hygiene and sanitary safe conditions; protection of cultural heritage and historical sites etc. ToR for the architectural design should be issued by the Architectural Department of local administration and Project Design documentation should be prepared by the project proponent in accordance with this ToR.

b. Design Phase

129. Design should be prepared in accordance with all requirements set forth within the Terms of Reference for Architectural Design and in compliance with the relevant design and construction standards.

130. Design should be cleared by the Architectural Department of a local administration. In case if construction is to be carried out in a zone of cultural heritage protection, consent of the Ministry of Culture, Monument Protection and Sport is also required.

c. Phase III. Construction Permit

131. In case if the project is to be implemented in territories with special regime, appropriate consent of the relevant governmental body is required. This requirement is relevant for:

(i) protected areas
(ii) State border zone
(iii) sanitary protection zones of resorts
(iv) coastal zone

(v) Right of Ways of highways, railways, pipelines and electro-transmission lines
(vi) Sanitation-protection zones of water supply headworks, water reservoirs, hazardous waste disposal facilities etc.
(vii) Zone of historical or cultural heritage protected in accordance with the law of Georgia on Cultural Heritage Protection

132. **The 'Law of Georgia on Cultural Heritage'** was approved in May of 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, Monument Protection and Sport 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 submit 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.

133. Georgian Law on Regulation and Engineering Protection of Coasts of Sea, Water Reservoirs and Rivers of Georgia (27.12.2006, No. 4131)

134. Article 9. Rules regulating the economic activity within the coast protection zone

(i) The body issuing a building permit within the zone of coast engineering protection is obliged to engage the Ministry in the permit issuing process as a concerned administrative body and send it proper documentation for the obligatory conclusion.
(ii) The construction project of buildings and premises within the zone of coast engineering protection should envisage the compensation amounts for the expected coastal damage.
(iii) Extraction of inert material within the zones of strict supervision of sea, water reservoir or river is prohibited, unless this is done for the purposes of coast-formation or control of streams.

B. Environmental and Social Requirements of the ADB

1. The Asian Development Bank's (ADB) Safeguard Policy

a. ADB Environmental Guidelines

135. All projects funded by ADB must comply with ADB Safeguard Policy Statement (2009). The purpose of the Policy is to ensure that the projects undertaken as part of programs funded under ADB loans are environmentally sound, are designed to operate in compliance with applicable regulatory requirements, and are not likely to cause significant environmental, health, or safety hazards.

136. Safeguard policies are generally understood to be operational policies that seek to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process.
ADB's safeguard policy statement (SPS) sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

(i) The Involuntary Resettlement Policy (1995);
(ii) The Policy on Indigenous Peoples (1998), and
(iii) The Environment Policy (2002).

137. All three safeguard policies involve a structured process of impact assessment, planning, and mitigation to address adverse effects of projects throughout the project cycle. The safeguard policies require that (i) impacts are identified and assessed early in the project cycle; (ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and (iii) affected people are informed and consulted during project preparation and implementation. The policies apply to all ADB-financed projects, including private sector operations, and to all project components.

138. Affected people are consulted during project preparation and implementation and information is disclosed in a form, manner, and language accessible to them. Safeguard plans are disclosed to the general public and the information is updated at various stages in the project cycle.

139. ADB is committed to the principles of host-country responsibility for measures to mitigate adverse environmental and social impacts. ADB in funded projects shall therefore comply with host-country laws, regulations and standards, as well as requirements by which the host country is bound under international agreements.

b. EIA and Environmental Screening under ADB Guidelines

140. ADB carries out project screening and categorization at the earliest stage of project preparation when sufficient information is available for this purpose. Screening and categorization is undertaken to (i) reflect the significance of potential resources required for the safeguard measures; and (iii) determine disclosure requirements.

141. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

(i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
(ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and

in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.

(iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

(iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI (financial intermediary).

142. **Involuntary Resettlement[1].** ADB will screen all projects to determine whether or not they involve involuntary resettlement. For a project involving involuntary resettlement, a resettlement plan will be prepared that is commensurate with the extent and degree of the impacts.

143. **Indigenous Peoples.[2]** ADB will screen all projects to determine whether or not they have potential impacts on Indigenous Peoples. For projects with impacts on Indigenous Peoples, an Indigenous Peoples plan will be prepared.

144. **Information Disclosure.** In line with ADB's Public Communications Policy, ADB is committed to working with the borrower/client to ensure that relevant information (whether positive or negative) about social and environmental safeguard issues is made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation. ADB will post the following safeguard documents on its website:

(i) For environment category A projects, draft environmental impact assessment reports at least 120 days before Board consideration;

(ii) Draft environmental assessment and review framework, draft resettlement frameworks and/or plans, and draft Indigenous Peoples planning frameworks and/or plans before project appraisal;

(iii) Final or updated environmental impact assessments and/or initial environmental examinations, resettlement plans, and Indigenous Peoples plans upon receipt;

(iv) Environmental, involuntary resettlement, and Indigenous Peoples monitoring reports submitted by borrowers/clients during project implementation upon receipt.

c. Environmental Impact Assessment

145. EIA evaluates the potential environmental risks and impacts of a specific project in its area of influence, examines alternatives to the project, identifies ways of improving project selection, sitting, planning, design, and implementation by preventing, minimizing, mitigating, or

[1] Involuntary Resettlement involves physical displacement (relocation, loss of residential land, or loss of shelter) or economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas, including full or partial, permanent or temporary losses and involuntary restrictions.

[2] Indigenous Peoples refers in a generic since to a distinct, vulnerable, social and cultural group possessing the following characteristics: i) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (ii) collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; (iii) customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and (iv) a distinct language, often different from the official language of the country or region.

compensating for adverse environmental impacts and enhancing positive impacts. EIA includes the process of mitigating and managing adverse environmental impacts during the implementation of a project.

146. According the ADB policy EIA should:

(i) Be initiated as early as possible in project development and be integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project;
(ii) Resettlement, indigenous peoples and cultural Property, and trans-boundary global environmental aspects;
(iii) Also take into account specific host- country conditions – the findings of environmental studies, National Environmental Action Plans, national legislation, the capabilities of the entity implementing the project, as they relate to managing environmental and social impacts, and obligations of the country under relevant international environmental treaties and agreements.

d. Public consultation

147. In line with ADB's Public Communications Policy, ADB is committed to working with the borrower/client to ensure that relevant information (whether positive or negative) about social and environmental safeguard issues is made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation.

148. For policy application, meaningful consultation is a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of 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.

149. According the ADB policy public consultation process should:
(i) Describes the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders;

(i) Summarizes comments and concerns received from affected people and other stakeholders and how these comments have been addressed in project design and mitigation measures, with special attention paid to the needs and concerns of vulnerable groups, including women, the poor, and Indigenous Peoples; and
(ii) Describes the planned information disclosure measures (including the type of information to be disseminated and the method of dissemination) and the process for carrying out consultation with affected people and facilitating their participation during project implementation.

2. Comparison of the National legislation and ADB requirements

150. The above accounts of national environmental low and ADB policy indicate that the two systems are similar but then there are certain aspects in which ADB policy is more demanding or specified than the Georgian procedure. The main differences are as follows.
The Bank's guidelines provide a detailed description of procedures for screening, scoping and conducting EIA and explain a complete list of stages, which are not specified under the national legislation.

151. Considering ecological risk, cultural heritage, resettlement and other factors, the Bank classifies projects supported by them under categories A, B, C and FI. However in the Georgian legislation, EIA is carried out only if a developer seeks to implement projects listed in the Law on Environmental Impact Permit. This list is compatible with the category A projects of the Bank classification. According to the Georgian legislation EIA is not required in other instances, while Asian Development Bank guidelines requires limited EIA or IEE for the B category projects, and an environmental review of projects that are not expected to produce environmental impacts (category C).

152. Georgian legislation does not specify the format of environmental management plans (EMPs) and the stage of their provision for projects requiring EIA and does not require EMPs for projects not requiring EIAs. The Asian Development Bank guidelines require EMPs for all categories of projects and provides detailed instructions on the content.

153. According to Georgian legislation MoE is responsible for monitoring of project implementation and compliance with the standards and commitments provided in the EIA, and the role of the EMP is less clearly is defined.. The PIU or "Project Proponent" is responsible for implementing "self-monitoring" programs for projects requiring EIA. In contrast ADB guidelines stress the role of EMPs, which are important for all categories of projects, and the Project Proponent (in our case – MDF) is required to ensure inclusion of a monitoring scheme and plans into EMPs. Monitoring of performance compliance against EMPs is important element of ADB requirements.

154. The national legislation also does not take into account the issue of involuntary resettlement at any stage of environmental permit issuance. The Georgian legislation considers social factors only in regard to life and health safety (e.g. if a project contains a risk of triggering landslide, or emission/discharge of harmful substances or any other anthropogenic impact). While the Bank's document establishes the responsibility of a Borrower for conducting an environmental assessment, the national legislation provides for the responsibility of a project implementing unit to prepare EIA and ensure public consultation.

155. The role of the Ministry is restricted to participation in EIA consultation and carrying out state ecological examination required for the adoption of a decision on issuing an EIA permit as established under the legislation of Georgia. Under ADB regulations ADB carry out project screening and categorization at the earliest stage of project preparation when sufficient information is available for this purpose, also according ADB's Public Communications Policy, ADB is committed to working with the borrower/client to ensure that relevant information (whether positive or negative) about social and environmental safeguard issues is made available in a timely manner.

156. In regard with consultation: The Bank provides for consultations for A and B Category projects (at least two consultations for Category A projects) and requires a timetable of

consultations from the Borrower. The national legislation until recently contained only a brief reference to this issue without providing real tools of its fulfillment. The amendments to the Governmental Decree On the Procedure and Conditions of Environmental Impact Assessment established the requirement of public consultation of the EIA, which obligates a developer (i) to ensure public consultation of EIA, (ii) publication of information, (iii) receive comments within 45 days, (iv) arrange consultation not later than 60 days from the date of publication, invite stakeholders and determine the place of consultation.

Table 5 Table of Activities and responsibilities in EIA for national law and ADB policy

	Action	Georgian Legislation	ADB Requirements
1	Screening	Project Proponent in consultation with MoE	Bank and Consultant hired by Project Proponent
2	Scoping	Not required. Could be conducted voluntarily by Project Proponent.	Obligatory. Bank and Consultant hired by Project Proponent
3	Draft EIA	To be prepared by Environmental Consultant.	To be prepared by Environmental Consultant or borrower
4	Public Consultations	The EIA should be available for public review during 45 days. Publication of information in central and regional mass-media. Arrange consultation not later than 60 days from the date of publication.	At least two consultations for Category A projects – one at the scoping stage and one for the draft EIA. Normally only one consultation for IEE
5	Final EIA	Consider all comments received during public consultations, incorporate accepted remarks and explain rationale when the comments are disregarded.	Consider all comments from Bank and public. Incorporate accepted public comments and explain rationale when the comments are disregarded.
6	Management Plans	No clear guidelines on format, content and timing	Incorporate Monitoring and Management Plans in the EIA.
7	Review and Approval	MoE	Bank and separately - MoE (if the EIA is required by Georgian legislation)
8	Disclosure of final EIA	Not requered	Publication of the final EIA in the project area and on ADB website.

3. Harmonization of the ADB and Georgian Legislation Requirements

157. In order to comply with the both regulations – the ADB and Georgian legislation – the content of the EIA should comprise issues required in both regulations, thus complementing each other. The EMPs should therefore be elaborated in details as required by the ADB regulations. The assessment of the stationary sources of emission (e.g. diesel generators) should be executed according to Georgian regulations: “Inventory of the Stationary Sources of Emission” and “Approval of the Emission Limits”. For the category a projects the first public

consultation (requested by ADB guidelines but not by Georgian regulations) will be held at the Scoping stage. The second one will be executed according to Georgian requirements. Disclosure will be conducted as required by ADB.

III. PROJECT DESCRIPTION

A. Introduction

158. Rehabilitation of Zugdidi-Jvari-Mestia-Lasdili motor road was initiated by the Department of Motor Roads of Georgia. The road is of national significance and connects upper Svaneti region with Tbilisi-Senaki-Leselidze main motor road.

159. The secondary road Zugdidi-Jvari-Mestia-Lasdili links the villages located in Zeda Svaneti region, Daba Mestia and Mestia with the region Zugdidi as well as with the trunk road Tbilisi-Senaki-Leselidze, which is the main road in the region. Currently the road needs significant rehabilitation in order to restore its operational capacity and ensure traffic safety. It should be noted that the present project will significantly contribute to the socio-economic development of Zeda Svaneti region and facilitate development of tourism infrastructure

B. Location of Project Area

160. Georgia – a country in Caucasus, Eurasia, at the Black Sea coast. Russia borders Georgia from the North, Turkey and Armenia from the South and Azerbaijan from the South-East. Georgia is situated at the crossroad of South-East Europe and West Asia and it is a transcontinental country by its location although it is part of Europe by its socio-political situation and culture (Figure 2).

Figere 3 Location of Georgia on the crossroad of South-East Europe and West Asia

161. Administratively there are 12 administrative units (Figure 9). Each administrative unit is divided into Municipalities (64 municipalities in total). According to the constitution territorial

arrangement of the country should be defined after restoration of central authority on whole territory of Georgia.

162. Each municipality represents self-governing unit with homogenous physical-geographic conditions and defined natural boundaries as well as ethnic-cultural characteristics of population and historically established territorial-administrative function.

Figure 4 Administrative units of Georgia

163. The Zugdidi-Jvari-Mestia-Lasdili motor road section is located on the territory of Mestia Municipality in Samegrelo-Zemo Svaneti administrative region.

164. Samegrelo-Zemo Svaneti is located (Firure 3) in the West part of Georgia. The distance from Kolkhet'is Dablobi (Kolkhida Lowland), which is summer resort zone, to the highest and most difficult peaks for mountain-climbers – Ushba – is only 80 km and the distance to the world known settlement located at the highest elevation in Europe – Ushguli (Mestia Municipality) – is 120 km.

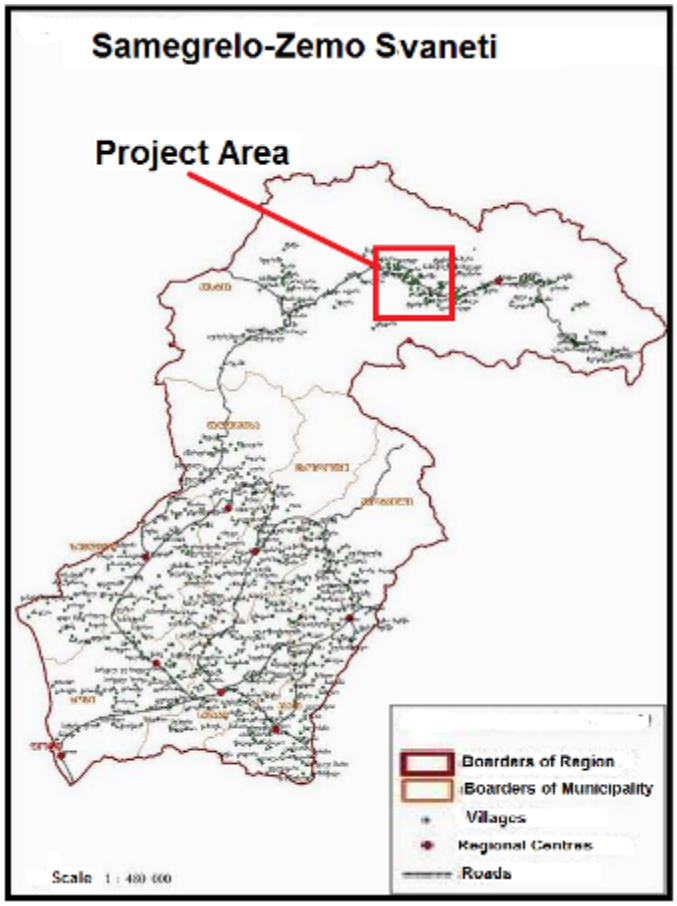

Figure 5 Samegrelo-Zomo Svaneti administrative unit

C. Project Concept

165. Mestia Municipality is located in the upper part of river Enguri basin. The Municipality is located at elevations from 800 m to 3600 m. The area of the municipality is 3,044.5 km^2, which is 4.4% of the territory of Georgia.

166. The secondary road Zugdidi-Jvari-Mestia-Lasdili links the villages located in Zeda Svaneti region, Daba Mestia and Mestia with the region Zugdidi as well as with the trunk road Tbilisi-Senaki-Leselidze, which is the main road in the region. Currently the road needs significant rehabilitation in order to restore its operational capacity and ensure traffic safety. Certain sections and infrastructure facilities of the road need significant reconstruction.

167. Maintaining of the existing axis and longitudinal profile is stipulated under the present project due to the fact that the project section is located in highland, on steep slopes of the river Enguri (making not feasible to change the road plan significantly). Minor changes are done on some sections to improve traffic safety conditions.

168. The roadbed shall be restored under the project to meet the technical requirements. The existing engineering structures repaired and restored, new engineering structures constructed if necessary. Construction of new road pavement instead of heavily damaged asphalt-concrete pavement is stipulated under the present project

169. Design and bidding documents for the rehabilitation of secondary road Zugdidi-Jvari-Mestia-Lasdili, section were carried out by Transproject Ltd based Agreement with RDMRDI signed on 25.07.2008 and Terms of Reference issued on 11.02.2009.

170. The present "Preliminary Environmental Impact Assessment" is prepared for the aforementioned project comprising the following components (subprojects):

(i) Section 1 – motorway section from km 74 to 80;
(ii) Section 2 – demolition of the existing balcony (260 m long) at km 89 and construction of a new tunnel instead;
(iii) Section 3 - from km 91 to 203 of the motorway;
(iv) Section 4 – from km 121 to km 125 of the motorway.

1. Present and Forecasted Traffic Intensity

171. The surveys to determine the traffic intensity will be carried out in the sections with the highest traffic volume near Khaishi (the pass from the village to Mestia). Table No 3 shows the passenger traffic and Table No4 – the heavy construction machinery and freight traffic.

Table 3: Forecasted Intensity of Passenger Traffic (number of vehicles/24 hr in both directions

Year	Khaishi Section		
	Motor car	**Minibus**	**Large vehicles**
2009	618	128	11
2015	1351	89	21,6

Table 4: Khaishi Section: Total Freight Traffic (vehicles/24 hr in both directions)

Year	Light trucks	Medium trucks	Heavy trucks	Trailed	Total
2009	19	19	18	1,6	57,6
2015	12,4	18	15	5	50,4

2. Applied Regulatory Documents and Standards

172. The road bed is designed to meet the requirements of guidelines SNiP 2.05.02-85 and typical design decisions 503.0-48-87.

173. The actual condition of each pipe and bridge was inspected on site. They were designed based on the former Soviet standard SNiP 200-62.

174. The method of works is typical. The works should be executed in compliance with the design specifications and the requirements of BCH 24-88 (Technical Rules of Motorway Repair and Maintenance), SNiP 3.06.03-85 (Motorways) and SNiP 3.06.04-91 (Bridges and Pipes).

175. During the rehabilitation works traffic diversion and fencing of the works sites should be carried out in accordance with the requirements of BCH 37-84.
For Tunnels

176. Design is based on the following technical documentation:

SNiP 32-04-97	-	"Railway and road tunnels"
SNiP II 44-78	-	"Railway and road tunnels"
SNiP III 44-77	-	"Railway and road tunnels"
SNiP 2.05.03-84	-	"Bridges and culverts";
SNiP 3.06.04-91	-	"Bridges and culverts";
SNiP 2.05.02-85	-	"Roads";
SNiP III 4-80*	-	"Construction safety";
SNiP III 3.1.01-85	-	"Construction organization";
SNiP II 7-81	-	"Construction in earthquake-prone regions".
VSN 126-90	-	"Holding the holes by anchors and shotcrete"

3. Subproject 1: Rehabilitation of section km 74 – km 80 of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili,

a. Subproject Location and Background

177. Design and bidding documents for the rehabilitation of secondary road Zugdidi-Jvari-Mestia-Lasdili, section km 74 – km 80 were carried out by Transproject Ltd based on Terms of Reference issued by the State Department of Roads of Georgia on 08.05.2008.

178. The project section is located in Mestia, mainly on uninhabited area. The project section starts at PK 73+200 of Zugdidi-Jvari-Mestia- Lasdili road corresponding the PK 0+00. The end section is PK 80+200 corresponding with project PK 70+00. Design does not consider the tunnel and gallery reconstruction works and under construction bridge section.

179. The separate sections of the roadway are damaged and ruptured requiring rehabilitation. Mainly the pavement is of gravel, on some sections there are remains of asphalt concrete pavements characterised with frequent mesh cracks and heavily damaged.

180. Structures require repair and cleaning. Construction of new structures is required as well. Considering the general technical state of the project section performance of rehabilitation works is necessary. Types of works were determined in accordance with "Classification of road works".

181. Technical norms applied in the design are as follows:

Width of road bed	- 7.0 - 8.0 m;
Width of carriageway	- 6.0 m;
Width of shoulder	- 2 m;
Pavement type	- asphalt concrete

182. Design works are based on computer aided production of documents by use of CAD-CREDO software.

b. Existing Conditions and Design Solutions

183. The rehabilitation road section passes the shelf of the right slope of the river Enguri.

184. From PK 0+00 to PK 5+70 the existing and rehabilitation road passes the rocky shelf of a steep slope of the river Enguri. The slope is structured with mid strength tuff sandstones and tuff breccias.

185. The 15-20 cm thick pavement mainly of gravel and crushed aggregates is constructed on rocky soils. There are fragments of 5-6 cm thick asphalt pavement. The right side of the road at PK 0+83÷PK 0+92; PK 0+97÷PK 1+05, PK 1+10÷1+26, PK 2+35 ÷PK 2+47 and PK 2+67÷PK2+77 experiences wash off the shoulders to surface run-off. It is required to construct the concrete walls to restore the shoulders. Concrete walls can be constructed on rocky deposits.

186. On the left side of the road, along the total length at the foot of slope the ditch shall be constructed. Slopes require clearing of the slid boulders as they are products of weathering they may drop down the roadway.

187. There are screes of 2-3 m diameter boulders PK 4+40 ÷PK 5+25 reaching the road shoulder. The slope requires cleaning.

188. Due to incorrect blasting of road left slope, the big size boulder screes originated on PK 5+70 – PK 8+10 covering the whole area of roadway. At present the slope is stable and roadway is covered with gravel material. The slid material reaches the shoulders. It is required to clean the slope and construct the ditch on slope side.

189. PK 8+10 – PK 8+70 road passes the rocky, steep shelf of the slope structured with tuff sandstones and tuff breccias. Within the margins of this section PK 8+35-PK 8+70 the road carriageway is narrowed and widening is possible at the expense of cutting into the slope. Slope is heavily fissured weathered and disintegrated into the big size blocks.

190. At the foot of the right slope ditch shall be constructed.

191. PK 8+70 – PK 9+80 road passes the rocky shelf originated by the rocky slopes weathering, the slope is table. The road contains fragments and remains of asphalt pavement with 6-7 cm thickness.

192. The road is mainly covered with gravel and crushed aggregates with thickness 20-25 cm. No deformations and settlements are noted there on the road. The existing right retaining walls are in good condition.

193. PK 16+80 – PK22+60 road passes the stable rocky shelf structured with boulders with insertion of broken stones and loam. Size of some boulders reaches 3-5 m diameter. The road contains fragments and remains of asphalt pavement The thickness of gravel-crushed stone material is 25-30 cm. No deformations and settlements are noted there on this road section. The left slope of the road requires clearing and construction of ditch.

194. PK 22+60 – PK 23+05 road passes the rocky, steep shelf of the slope structured with tuff sandstones and tuff breccias. The left slope of the road requires clearing and construction of ditch in rocky slopes.

195. PK 23+05- PK 23+50 on the left side of the existing road, the retaining wall is constructed 10 m inside the road. Retaining wall is rested on rocky soils. At present the top side of the wall is failed and the back of the wall is filled. The slid material covers the road carriageway, at the same time the rivulet inflows on the carriageway. It is required to clean the back of the wall from the screes and construct the culvert discharging the water at PK 23+23. It is required as well to restore the washed out section with construction of boulder fill.

196. There is no asphalt pavement at all on this road section. The roadway is covered with gravel and crushed stones.

197. PK 23+50– PK28+55 road passes the stable rocky shelf structured with boulders with insertion of broken stones and loam. Size of some boulders reaches diameter 3-5 m. The road contains fragments and remains of asphalt pavement with thickness 6-7 cm. The thickness of gravel-crushed stone material is 20-25 cm. It is required to restore the washed out sections on the right side of a road and construct the ditches on the left side of a road.

198. PK 28+55 – PK 29+67 the existing and project road section passes the steep shelf of the slope structured with tuff sandstones and tuff breccias. Rocky deposits are heavily weathered and fissured. The boulders (1-3 m diameter) with insertion of crushed stones and loam filler are placed on the upper side of the slope. The existing retaining wall on the right side of the road on PK 28+88-PK 29+04 is damaged.

199. PK 29+04 – PK 29+30 the right side of a road is washed out, the right shoulder and gradient is nearly vertical. the rocky deposits are covered with boulders. Widening of road is possible at the expense of cutting into the left rocky slope.

200. PK 29+45 – PK 29+67 the wall on the right side of a road is in failed condition. Widening of road is possible at the expense of cutting into the left rocky slope. There are mentioned multiple 0.1-0.3 m thick cracks and fissures both the longitudinal and transverse in rocky tuff sandstones and tuff breccias. Mostly the rocky deposits are divided into blocks.

201. PK 29+67– PK30+05 the road passes the rocky shelf structured with boulders with insertion of broken stones and loam. Size of some boulders reaches diameter 2-5 m. Slope is stable and the slope slid material is accumulated on the left side of a road. Widening of road is possible at the expense of cutting into the left rocky slope as the right side is almost vertically washed out.

202. The road contains fragments and remains of asphalt pavement with thickness 6-7 cm on PK 28+55 – PK 31+30. The thickness of gravel-crushed stone material is 20-25 cm.

203. PK 30+05– PK42+00 the road passes the right shelf of the river Enguri slope. The slope is stable and is structured with boulders with insertion of crushed stones and loam filler.

204. The road contains fragments and remains of asphalt pavement with thickness 6-7 cm.

205. The thickness of gravel-crushed stone material is 25-30 cm. No deformations and settlements are noted there.

206. Within the margins of this road section PK 33+00 it is required to construct a culvert to discharge the ravine water and to clear the ravine bed off boulders.

207. PK 33+10-Pk 33+30 the road is washed out due to surface run-off and narrowed. It is required to restore this road section with gabion wall. It is required as well to restore the washed out sections with gabion walls within PK 33+65-PK33+80.

208. PK 42+28 – PK 45+10 the road section passes the steep shelf of the slope structured with tuff sandstones and tuff breccias. Along the slope, on the right side of the road the gallery is constructed to widen the road. Due to intensive rock fall the railings of the gallery are damaged.

209. PK 46+00 – PK 48+80 the road contains fragments and remains of asphalt pavement with thickness 6 cm. The thickness of gravel-crushed stone material is 15-20 cm.

210. PK 46+00– PK48+80 the road passes the right shelf of the river Enguri slope structured with tuff sandstones and tuff breccias.

211. PK 47+50 –PK 48+10 the road is constructed on boulders with insertion of crushed stones and loam filler. No deformations and settlements are noted there.

212. PK 48+80 – PK 63+50 the existing road section passes the shelf of the inclined slope. (Slope is inclined to the river Enguri floodplain). The slope is structured with boulders (1-2.5 m diameter) with insertion of crushed stones and loam filler. Slope is stable.

213. The road contains fragments and remains of asphalt pavement with thickness 6-7 cm. Mostly the road is covered with gravel-crushed stones with 25-30 cm thickness. No deformations and settlements are noted there.

214. It is required to construct the ditch on the left side of a road on PK 51+40 – PK 60+00, due surface run-off. The culvert shall be cleaned. Small size wash out shall be filled on the right side of the road on PK 52+80.

215. PK 59+78 – PK 60+00 the road crosses the ravine where the bridge construction works are on.

216. Within the margins 62+00 – PK 60+20 the road requires clearing off stone gravel material.

217. The existing and project road section passes the high terrace of the river Enguri on PK 63+50 – PK 65+70, which is structured with shingle-pebbles with insertion of sandy loam and loam, 3-5 m thick.

218. The roadway is covered with gravel and crushed stones with 25-30 cm thickness. The road contains fragments and remains of asphalt pavement with thickness 6-7 cm. No deformations and settlements are noted there.

219. Within the margins of PK 67+75 – PK 67+85 the right side of the road is washed out and road is narrowed. It is required to restore the shoulder as well.

220. The culvert located on PK 68+23 is in good condition. The boulder fill shall be constructed to protect the left side of the road experiencing the inflow of the rivulet. The bed of water stream shall be cleaned as well. On the left side of this road section ditches shall be constructed and regulated.

221. Find attached table of soil specifications and linear diagram.

222. **Road plan.** As it was mentioned above the project section is located in the mountainous region, on the bench of the right steep slope of the river Enguri. The project section starts at km 73+200 of Zugdidi-Jvari-Mestia-Lasdili road and ends at km 80+200. Road plan is completely maintained, except of some separate sections where the roadbed is narrowed and ruptured. In such places the route is shifted to the left on slope side. The alignment passes entirely the shelf of the right slope of the river Enguri. The left side of road is represented by the inclined slope, in separate cases by vertical or back slope.

223. **Road bed.** The width of road bed is 6÷8 m, width of design roadbed is 7÷8 m. As it was mentioned above some sections roadway is ruptures and require restoration. Lower concrete retaining walls on some sections shall be constructed where the road bed is ruptured. The road lacks ditches actually on the project section, due to this situation the water removal from the roadway is complicated . Achieving standard road bed parameters is stipulated in the project at the expense of cutting into slopes and construction of ditches.

224. Loosening of rocky soil shall be done by blasting works. Design includes the clearing of ditches and construction of new ones.

225. **Road Pavement.** The width of the existing carriageway is 5-6 m, width of the project carriageway is 6 m. Pavement is mostly of gravel, on separate sections there are remains of asphalt-concrete pavement with frequent mesh cracks, which is totally worn.

226. Design includes the removal of the existing damaged asphalt concrete pavement with cold milling method, levelling and compaction. Design considers works providing the restoration and strengthening of pavement structure.

227. The structure of pavement accepted is as follows:

(i) construction of leveling layer of sand an gravel
(ii) constriction of base (0-40 mm) crushed aggregates recycled layer with addition of cement 5% and bitumen emulsion 2.5, h=16 cm
(iii) construction of lower layer of pavement with coarse graded porous asphalt concrete hot mix, 6 cm thick, class II
(iv) construction of surface layer with fine graded dense asphalt-concrete hot mix, 4 cm thick, type B, class II.
(v) Construction of shoulders with sand and gravel mix

228. **Engineering structures.** Water removal is considered by the design with construction and clearing of ditches. From PK 0+00 to PK 5+35 to restore the damaged places of the roadbed design considers construction and repair of retaining walls. Design considers as well repair of the existing reinforced concrete and steel pipes and reinforced concrete bridge. The new reinforced concrete culverts are stipulated as well.

229. **Road furniture and equipment.** The following activities shall ensure traffic safety:

- Installation of road signs -
  - Standard - 54 unit
  - Individual - 52 unit
- Marking of carriageway
  - Horizontal - 413 m^2
  - Vertical - 5750 m^2
- Installation of plastic guide posts ,,MB"(signal) - 220 unit
- Cast in situ concrete parapets of special profile (with steel cable) - 220 unit

c. Construction Works

230. The following works shall be performed upon the completion of preparatory works: repair and cleaning of culverts, construction of new culverts, repair of bridge PK 68+00 repair and construction of retaining walls.

231. Whilst construction of retaining walls the pit shall be removed in rock massive from the technological platforms by suspended buscket of the 10 t crane with jack hammers. Following the construction of the retaining wall the waterproofing at the contact areas with soil and drainage shall be constructed. The wall backfilling shall be done manually.

232. Rising of the retaining wall requires: top surface of the wall shall be cleaned; wall body bored in the direction from the top with boring device, reinforcement bars shall be installed in boreholes and concreted. The wall shall be waterproofed at the contact areas with soil. Soil shall be filled behind the wall.

233. Roadbed shall be cleaned off the rockfall and surplus soil, soil in cut and ditches shall be excavated and reshaped mechanically. These works shall be done with excavator and grader. To carry out these works the following shall be done: 8400 m3 rocky soil shall be loosened by blasting works 8690 m3 and jack hammers 3100m3 fixed on the excavator.

234. Excavation of cut shall be done from top to down by horizontal layers, along the total width. Soil shall be transported to the dumpsite.

235. Construction of ditches shall be done properly to avoid any of the water to penetrate into soil and cause deformation. Ditch slope shall meet design requirements; ditches of proper cross-sections shall be constructed in accordance with time schedule. Excavation of ditches in soft soil shall be done with excavator and manually, whilst processing of rocky soil shall be done with jack hammers.

236. Construction of ditches shall be done in the direction opposite to water flow ensuring corresponding slope.

237. Blasting works are stipulated in the design .

IN LOW CUTS:

N	Denomination of works	unit measure	Quantity	Note
1	2	3	4	5
1	Loosening of rocky soil with blasthole charges 0.5 – 1.0 m deep	m^3	400	Rock 28^v VII/29^v VII
2	Loosening of rocky soil with blasthole charges 1.0-2.0 m deep	m^3	830	Rock 28^v VII/29^v VII

25 M HIGH CUT PK 29+00÷PK 29+80

N	Denomination of works	unit measure	Quantity	Note
1	2	3	4	5
1	Removal of upper part of the cut by rock climbers to construct the working shelf			
	- Cutting of trees up to diameter 24 cm	u	25	soft species
	- Removal of soil manually on site handling	m^3	60.0	33^v
	- Manual removal of rocky soil with jack hammers	m^3	130.0	28^v
2	Boring of pits with hand hammer drill Ø56 mm, 3.5 m deep, to construct the benches	m/m^3	2500/7.0	altitude working
3	Blasting the 2 m high benches with blasthole (pit) small charges with 5 times delayed blast			altitude working 28^v
	- Loosening of the front side of the bench with blasthole charge	m^3	150.0	
	- Blasting of the back side of the bench with on site dropping	m^3	1620.0	
	- Controlled blasting of slopes of benches	m^2/m^3	340.0/200.0	
	- Preparation of sand and clay mix and hauling to the construction site for construction of plug	m^3	6.5	
4	Crushing of remained rock mass after blasting by small blasthole charges	m^3	400.0	20% of blasted rock
5	Discharge of remains of blasted rock manualy on the existing road	m^3	400.0	28^v
6	Manual clearing of the slope from unsafe hanging rocks with jack hammers	m^2/m^3	340.0/20.0	
7	Supply of drilling equipment at altitude 22 m by 25 t pneumatic crane, reloading on previously constructed bench with following delivery	t/times	108.0/36	Drilling equipment СБМК-5 Weight 3.0t

				Dimensions 1.9x3.1x1.6
8	Blasting the 2 m high benches with blasthole charges with 5 times delayed blast - Loosening of the front side of the bench with blasthole charge - Blasting of the back side of the bench with on site dropping - Controlled blasting of part of slope of benches - Preparation of sand and clay mix and hauling to the construction site for construction of plug	 m^3 m^3 m^2/m^3 m^3	 380.0 1630.0 1160.0/290 14.0	altitude working 28^v
9	Crushing of remained rock mass after blasting by small (pit) blasthole charges	m^3	730.0	20% of blasted rock
10	Manual clearing of the slope with unsafe suspended rocks with jack hammers	m^2/m^3	950.0/40.0	
11	Discharge of remains of blasted rock on the existing road by dozer with displacement up to 10 m	m^3	730.0	
12	Shutdown of high voltage 35 thousand Kw cables during the blasting works	times man hour/veh. h	30 360/90	1 call – 3 hours Team – 4 men

4. Subproject 2: Reconstruction of section km 89 (Tunnel and Gallary) of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili

a. Subproject Location and Background

238. Design and bidding documentation for the reconstruction of secondary road Zugdidi-Jvari-Mestia-Lasdili section km 89 at KP 77+68 to KP 83+65 was carried out by Transproject Ltd based on Agreement signed with State Department of Roads of Georgia on 25.07.2008 and Terms of Reference issued on 11.02.2009.

239. The project section is located on a secondary road Zugdidi-Jvari-Mestia-Lasdili, linking the Zemo Svaneti region, Mestia town and Mestia region villages with region Zugdidi as well as with the trunk road Tbilisi-Senaki-Leselidze, which is the main road in the region. It is worth to mention, that the implementation of works stipulated by this project will significantly contribute to the socio-economical development and facilitate development of tourist infrastructure of Zemo Svaneti region.

240. This section of a road is characterized with intensive rock falls (on the total length of balcony) and snow avalanches (From the end of balcony to Mestia direction, within the vicinity of small waterfall, see the photo).

241. Reconstruction of this section includes the construction of tunnel and gallery against snow slide with length 84 m.

242. In order to tie to the previously executed project for rehabilitation of the existing road the KP 77+68 is accepted as a start point for the reconstruction section and KP 82+65 is accepted as an end point.

243. Required types of works are defined in accordance with “classification of road works”.

244. Technical parameters applied in the design are as follows:

- Road category - IV;
- Width of road bed - 7.0÷8.0 m
- Width of carriageway - 6.0 m
- Width of shoulder - 0.5÷1.0 m
- Pavement type - asphalt-concrete;

245. Design works are based on computer aided production of documents by use of CAD-CREDO software.

b. Existing Conditions and Design Solutions

246. On 89 km of the existing road the 260 m long balcony is located, structure of which is mainly represented by wide flange beam steel #40 span structure, where the precast reinforced concrete slabs are fixed on. Girders are rested on the massive concrete piers, height of which alter from 7-to 18m. Along the total length of the balcony the concrete wall is constructed to conjugate the superstructure and the roadway. Due to the narrowness of the study balcony traffic is frequently interrupted, should be mention as well the fact that the balcony in profile sharply changes the slopes.

247. Elements and details of the existing balcony are significantly damaged and can not be rehabilitated. As it obvious from the photo the highest pier of the balcony and the wall conjugating the part of the balcony and roadway is in unsafe condition to carry the modern loads.

Fig.6. Existing Balcony located on km 89

248. Actually, for reconstruction of the balcony is only possible if remove completely the existing balcony and construct the new one, in addition it should be covered in order to protect it from falling of rocks and snow avalanches, so it means the gallery shall be constrcuted.

249. In addition, for total reconstruction of balcony (removal of old and construction of new one) temporary bypass road will be required because of small width of roadway (changes from 4-6m), which, within the given topograhic conditions can be constructed only by boring of small size opening tunnel, considerably increasing the cost of reconstruction of balcony.

250. Due to mention above, the question arises to construct a tunnel on this section of the road and what can be considered as question having no alternative for the given case. The length of the project tunnel is 260 m.

251. The same section is characterized with intensive falling of rocks (along the total length of the exisitng balcony) and snow avalanches. As it was defined during the field survey works by the interview of local inhabitants and road maintenance agency workers, this road section is dangerous for the traffic during the spring time (fatal accidents are noted). On the area where snow avalanches are spread the construction of galleries are considered. The length of project gallery is 84 m.

252. Design considers total reconstruction of the road section at kp 77+68 to kp 83+65 including the following works

(i) construction of project road in semi cut from kp 77+68 to kp 79+24 (shifting of the project axis from the existing road to the mountain slope)

(ii) construction of 260 m long tunnel , kp 79+24÷kp 81+84 :

(iii) construction of gallery kp 82+00÷ kp 82+84

253. In order to design the road in plan and profile previously the topographical and geological measurements have been done. In order to tie to the previous project for rehabilitation of the existing road, developed by the Institute "Transproject" the KP 77+68is accepted as a start point for the reconstruction section, accordingly the 260 m long project tunnel starts at PK 79+24 and ends at PK 81+84. In profile the tunnel is located on the unilateral slope 28‰, in plan the tunnel is located on the transition curve (minimum radius at the entrance of the tunnel 260 m), the 84 m long gallery starts at PK 82+00 and ends at PK 82+84.

254. Design includes two way traffic in the tunnel; width of carriageway is 8.5 m, what corresponds to the clearance active in Georgia, on the both sides of tunnel traffic way service ways are stipulated.

255. **Road plan and profile.** The project section length is 607 m. Minimum radius is R=70 m, maximum R=200m.

256. The project axis is fixed in plan and in height on permanent objects. Fixing schemes and route axis coordinates are attached to present design.

257. The project road profile is located on 19÷50‰ gradient and on vertical curves R=3500 (concaved)

258. **Road pavement.** The project section links the regions Zemo Svaneto, Daba Mestia and villages located in the regions with lowlands and with trunk highway. The road operation is done in severe weather conditions characteristic for mountainous regions, especially in winter.

259. The following type of pavement is adopted in the design:

Sub-base – sand and gravel, thickness 20 cm	-	1743	m^3
Base course – crushed aggregates 0-40 mm, thickness 25 cm	- -	5021	m^2
Pavement – reinforced cement concrete, thickness 22 cm	-	4443	m^2
Including cement concrete B35 F200 W6	-	995	m^3
Construction of seams	-	680	L.m

260. **Engineering structures.** Design includes construction of 260 m long tunnel and 84 m long gallery on the rehabilitation road.

261. For tunnel lining material design includes cast-in –situ reinforced concrete with class B30F200W6. Reinforcement is of class A-I VST and A-III 25 G 2C. Before construction of permanent lining double layer of waterproofing material of foreign manufacturing shall be applied. (Drainage layer and water resistant membrane). In order to eliminate the development of hydrostatic pressure beyond the tunnel lining on the surface of tunnel hole the radial and contour drainage is considered (within the places where the water inflow takes place), this drainage connects with design drainage beyond the tunnel lining. Tunnel structure in accordance with its static work considers two types of structure, which internal geometry is represented by horseshoe shape circle. Tunnel resistance against the seismic activity is designed for 8 point magnitude earthquake. (According to statement 7.09.91-N-42of the Ministry

of architecture and construction of Georgia and in accordance with the Georgia geophysical zoning the village Khaishi belongs to 9 point magnitude zone). Because the tunnel is constructed on the road of IV technical category its seismic stability is reduced by one point in accordance with the norms and adopted as 8 point of seismic activity.

262. According to design norms the tunnel lining is adopted as closed contour cast in situ reinforced concrete. Tunnel lining is of two types and represented by 36 m long sections which are differ from each other only by armoring diameter.

263. In total, the volume of reinforced concrete works for the tunnel lining is 4169.4m3; during the selection of lining type the armoring by the spatial form is considered as section, the length of section in order to facilitate ease of technological process of armoring is 12 m.

264. To guide the longitudinal waves during the seismic activity, between the sections of the lining 1 cm wide movement joints are considered, which shall be covered by at least 15 cm wide additional layer of water resistant membrane on the total perimeter of the joint. The surface along the length of the joints shall be worked out in accordance with the specifications (see specifications). In joints, between the surfaces of sections gaskets from flexible material (rubber) will be constructed.

265. While construction of movement joints requirements of insulation material manufacturer shall be considered.

266. Service sidewalks (adopted as 1.15 m long) .Clearance 5 m.

(i) Volume of earthworks for tunnel excavation in rocky soils is 22965 m3 (including the normative excessive volume 1390m3);

(ii) Volume of cut excavation for access roads in rocky soils – 14520m3;

(iii) Tunnel in profile is located on unilateral 34 ‰ slope and gallery on 34÷50‰ slope.

267. Gallery is represented by arched cast-in-situ reinforced concrete structure, the internal shape of the gallery is similar of tunnel shape. In order to spill the water fall over the gallery design considers construction of reinforced concrete channel and spillway.

268. The structure of gallery is adopted taking into consideration the fact that the moving formwork used for construction of tunnel lining can be used as well for gallery lining structure, giving possibility to construct the gallery without traffic closure (gallery will be built only with traffic minor limitation as the dimensions of form Calculations for tunnel lining were performed in accordance with requirements of SniP 32-04-97 and SniP II 47-78 considering the main and particular stresses correlation.

269. Seismic stability is designed for 8 point magnitude of seismic activity.

270. For compensating the seismic longitudinal deformations, along the total length of tunnel 1 cm wide movement joints are designed with flexible material (rubber) gaskets between them.

271. Calculation of internal pressure of a tunnel lining was performed using the software “Lira Windows”. Stability of tunnel lining sections was checked in accordance with SniP 2.03.01-84 requirements.

272. Ground pressure was defined on the basis of condition when the space between cracks within any plane of lining surrounding mountain massive exceeds 0.04 B=0.04x12 M=0.6 m and tunnel lining coefficient is 2-4. For this case , tunnel lining shall be calculated as locating in flexible surrounding affected with vertical loads raised from separate failures and failures on total width of arch.

273. According to geological conditions the surrounding ground back pressure coefficient exceeds 40kg/cm3.s used for tunnel lining gives possibility to pass the traffic with 4.5 m height).

c. Construction Works

274. **Road bed.** Construction of ditches shall be done properly to avoid any of the water to penetrate into soil and cause deformation. Ditch slope shall meet design requirements; ditches of proper cross-sections shall be constructed in accordance with time schedule. Excavation of ditches in soft soil shall be done with excavator and manually, whilst processing of rocky soil shall be done with 2 m deep blast holes.

275. **Engineering Structures.** Design includes construction of temporary construction site for tunnel construction between km 79 and km 80, where can be installed the temporary buildings and facilities necessary for construction.

276. For Gallery construction 4.5 m wide bypass road is considered, providing the uninterrupted traffic for one direction during the construction period.

277. For construction needs at the south portal mobile el.power station and compression installation is required.

278. Excavation of tunnel to its design shape shall be done by blasting with small charge blast holes and by use of pneumatic hammers.

279. In order to maintain the stability of excavated tunnel opening along the 18 m length from the portals ground support is provided consisting of initial reinforced concrete lining, armored with N14 channel bar stiff reinforcement (previously manufactured vault) and reinforcement mesh 100x100/8diameter A-I and 6 m long concrete drive in type anchors, working together to take the ground pressure.

280. For the rest areas of the tunnel to be constructed the excavation shall be performed without stabilization of excavated arc and walls not more than 5 m on two tiers with following sequence:

(i) at first the upper part of the hole will be blasted bringing it to its project shape, following the 6 m long anchors are installed (in arc place 8 units) in staggered position not more than 2-3 m space between.

(ii) On the following 10 segments the lower part will be worked out and concrete type anchors will be rammed in the walls.

(iii) To forward the lining form is possible until the concrete type drive in anchors reach its carrying capacity.

281. Construction of concrete drive in anchors shall be performed in accordance with specifications (see the specifications). The total surface of tunnel lining shall be finished with shotcrete, therefore before the tunnel lining installation it is necessary to carry out of the lining the control injection.

282. The permanent lining will be construction with initial stabilization, length of each segment of stabilization shall not exceed 30m.

283. Sequence of works for gallery construction is as follows:

(i) At first the foundation shall be constructed, during of which the traffic is partially limited. (periodically traffic will be directed to one direction)
(ii) At the second stage the upper part of the gallery will be concreted by means of the movable forms used in tunnel, giving possibility to construct the gallery without traffic closure (gallery will be built only with traffic minor limitation as the dimensions of forms used for tunnel lining gives possibility to pass the traffic with 4.5 m height).
(iii) At the second stage the sol will be placed on the gallery which is excavated by the dozer from the top side of the mountain.

284. It is necessary to develop the work performance detail plan which shall be agreed with the Client and with other regional institutions as approved.

285. The volume of reinforced concrete works for gallery is 4023m3;
The volume of soil to be placed on top of the gallery is 10800m3

286. BlastingWorks. Pre-loosening by blasting is required on the road Zugdidi-Jvari-Mestia-Lasdili km 89. Blasting works generally shall be done by specialized authorities and team and only when the corresponding Works Productions Plan is available, in accordance with the Project of Production and Organization of Blasting works.

287. Blasting works shall be altogether done by specialized agency, teams. The works shall only be done upon the delivery of Works Production Plan.

288. Optimal quantity of explosives shall be determined and defined on site by means of advanced blasting (test explosion), taking into account properties and geological structure of soil. Blasting works shall be performed in the direction opposite to the protected object.

289. Charges in the holes shall achieve the depth of 0.7 m. The rest of the space is used for placing soft soil (do not use gravel and crushed stones for this purpose). Charges shall be initiated by power, which is safer and is more effective.

5. Subproject 3: Reconstruction of section km 91- km 103 of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili

a. Subproject Location and Background

290. The present Project contains design and bidding documents for the rehabilitation of the road section km 91-km 103.

291. The roadbed shall be restored under the project to meet the technical requirements. The existing engineering structures repaired and restored, new engineering structures constructed if necessary. Construction of new road pavement instead of heavily damaged asphalt-concrete

pavement is stipulated under the present project. Types of works were determined in accordance with “Classification of road works”.

292. Technical norms applied in the design are as follows:

- Width of road bed - 7.0 - 8.0 m;
- Width of carriageway - 6.0 m;
- Width of shoulder - 0.5-1.0 m;
- Pavement type - cement-concrete.

293. Design works are based on computer aided production of documents by use of CAD-CREDO software.

b. Existing Conditions and Design Solutions

294. The rehabilitation road section starts on the bench of the right slope of the river Enguri. The slope is mainly structured by clay-slates of weak and mid strength, separate sections are noted by volcanic deposits, mainly represented with tuff sandstones and porphiritis. The surface of slope compose predominant deposits are covered by alluvial and diluvial pebbles with insertion of boulders and loam and loam with rare insertions of shingle and boulders.

295. From PK93+91 to PK 108+80 roads passes the shelf of slope composed of pebbles with insertion of boulders and loam. The slope is stable. Slope compose deposits are represented by volcanic tuffogenous deposits. Existing road is constructed on the sub grade composing of pebbles with insertion of boulders and loam fill. Widening of road is possible at the expense of cutting into the slope.

296. Road carriageway is mainly covered by gravelly soil, thickness is 25-35 cm.

297. The road is located on the bench of a stable slope composed of clay-slates from PK 108+80 to PK 111+00, the road carriageway is constructed on rocky deposits. Slope shall be cleaned of slid material.

298. From PK 110+00 – PK 119+10 road passes on the foot of slope which is covered by strong, 4-5 m deep slid material shingle with boulders and loam fill. Run off the surface and slope water causes the scour of the carriageway and the right steep slope of the road.

299. Slope shall be cleaned, ditch and ditch side shelf shall be constructed.

300. From PK119+10 to PK 120+00 the road crosses the river, where the existing bridge is under repair, the access roads to bridge are constructed on the slope shelf structured with rocky clay-slates.

301. The road is covered with gravel and crushed aggregates, 25-35 cm thick.

302. From PK 120+00 to PK 124+10 the road passes the bench of a stable slope composed of clay-slates. The front side where the carriageway passes is covered with slid shingle with insertion of boulders and loam fill. Slope shall be cleaned of slid material and ditch side shelf shall be constructed.

303. On the right side of a road minor size washed out sections shall be restored.

304. From PK 124+10 to PK 125+30 road passes the shelf of the slope structured with volcanic porphiritis. Road carriageway is constructed on the shelf of predominant deposits.

305. The road is covered with gravel and crushed aggregates.

306. From Pk 125+30 to PK 128+80 road passes the shelf of a slope structured with glacier deposits represented with boulders with shingle insertion and broken stones filled with loam. on the left side of a road some slid materials are noted. Widening of road is possible at the expense of cutting into the slope. It is required to construct ditch and ditch-side benches. On the right side of the road the small size washed out sections shall be restored.

307. Road carriageway is mainly of gravel and crushed aggregates. No deformations and settlements are mentioned on the road.

308. From PK128+80 to PK 131+80 road passes a shelf of slope composed of mid strength clay-slates, Widening of road is possible at the expense of cutting into the slope.

309. From PK 131+80 – PK 138+20 road passes the slope shelf structured with rocky clay-slates. The slope is covered by strong, 2-5 m deep slid material pebbles with boulders and loam fill. On the left side of a road the slope requires cleaning. It is required to construct ditch and ditch-side benches. On the right side of the road the small size washed out sections shall be restored.

310. Road carriageway is mainly of gravel and crushed aggregates.

311. From PK 138+60 to PK 140+70 road is located at the foot of the slope which is covered with pebble-boulder with loam fill, the road is constructed on this ground. The slopes on the left side of the road shall be cut and cleaned, ditch side bench shall be constructed. On the right side of a road the washed out sections shall be restored. Some remains of asphalt pavement with 5-7 cm thickness are noted there. Carriageway is covered with gravel and crushed aggregates with 30-35 cm thickness. No deformations and settlement are mentioned there.

312. Widening of road from PK 140+70 to PK 145+00 is possible at the expense of cutting into the left rocky slope. The rocky slope is represented by mid strength clay slates. Existing right side walls are stable.

313. The left side slope of road from PK 145+00 to PK 150+20 is structured with clay slates, dissectioned by separate blocks, where the block movements are mentioned. Blocks are big size boulders slid on the left side of a road, on gully relief originated by the surface water run off, due to it the right retaining wall is failed. The same situation is on the left side of road due to run off the surface slope water. The rest retaining walls on the steel slope of road right side are in failed condition. The failed blocks of rocky deposits, with various degree of weathering are hanged on the slope with separate big size boulders (diameter 3-5 m) and can be fell down at all times. The situation is same for the total slope.

314. From PK 150+20 to PK 156+00 the road passes the bench of a stable slope composed of pebbles with boulders and loam fill. Left side of a slope shall be cleaned and ditch side shelf shall be constructed. On the right side of a road washed out sections shall be restored.

315. There is no asphalt pavement on the road, only some remains are noted. Carriageway is covered with gravel and crushed aggregates with 30-35 cm thickness. No deformations and settlement are mentioned there.

316. From PK 156+00 to PK 165+90 road is located on the shelf a slope which is structured with rocky clay-slates, the foot is covered with slid material. Widening of road is possible at the expense of cutting into slope. Some remains of asphalt pavement with 5-7 cm thickness are noted there. Carriageway is covered with gravel and crushed aggregates with 25-30 cm thickness. Retaining walls located on the both sides of the road are stable.

317. From PK 165+90 to PK 178+20 road passes the shelf of a slope structured with pebbles with insertion of boulders with loam fill. Slope is stable. Along the road, to the side of the slope slid soil is noted. Slope shall be cleaned, ditch side bench shall be constructed. Small size settlements are noted there on the road, caused by the inflow of the surface water into the road foundation. Such sections require new road structure. The impact of surface water is mentioned on some sections of the right side of a road, which shall be restored.

318. On PK 172+35 to discharge the run off the surface and slope water, culvert shall be constructed. Some fragments of asphalt pavement remains with 5-7 cm thickness are noted there. Carriageway is mainly covered with gravel and crushed aggregates with 30-35 cm thickness.

319. The road is located on the bench of a slope composed of heavily disintegrated clay and slates from PK 178+20 to PK 185+20. The weathered material collects at the foot of the slope. Slope is stable. Surface and slope water flows on the carriageway. The right slope of the road is washed off. Restoration of washed off areas shall be done. Widening of road is possible at the expense of cutting into the slope. Slope shall be cleaned and ditch side bench shall be constructed. There are remains of asphalt pavement on the road. The carriageway is of gravel and crushed aggregates.

320. From PK 185+20 to PK 187+50 road is located on the shelf of the slope which is covered with pebble-boulder with loam fill. Carriageway is covered with gravel and crushed aggregates. No deformations and settlement are mentioned there.

321. From PK 187+50 to PK 192+64 road is located on the shelf of the stable slope structured with clay slates. Carriageway is covered with gravel and crushed aggregates with thickness 30-35 cm. No deformations and settlement are mentioned there.

322. The road section km 101-km 103 starts on the bench of the left slope of the right tributary of the river Enguri and goes along the right slopes of the river Enguri until the end of the gorge. The slopes are formed by clay-slates, with rare insertions of sandstone.

323. Clay-slates are easily weathered and contribute and are exposed on slopes. The weathered material (crushed stone with boulders, with loam fill) is gathered at the feet of slopes and the road is mainly constructed on crushed stone soil with loam fill up to 30-35%.

324. The road is located on the severely weathered (at the surface) bench of slope composed of clay-slates from PK 0+00 to PK 14+20. The front part of the slope on which the road structure is located is covered with slid crushed aggregates with boulders with loam fill. The slope is stable.

325. Widening of road is possible at the expense of cutting into the slope. The slope shall be cleaned, and benches constructed. The right side of the road is steep. Surface and slope water flow onto the carriageway on some sections. Those sections require restoration. The asphalt pavement remained on some sections, thickness 7-8 cm. The road is mainly paved with gravel and crushed aggregates. Settlements and deformations are not detected on the road.

326. The road is located on the bench of heavily weathered slope composed of weak loam from PK 14+20 to PK 17+60. The slope is covered with weathered material (crushed aggregates with loam fill), thickness 1 m at the surface. Widening of road is possible at the expense of cutting into the slope as the right slope is steep and the village Lakhamula is situated at the foot of the slope. Settlements and deformations are not detected on the road. The road is covered with gravel and crushed aggregates.

327. The road is located on the bench of a stable slope composed of crushed aggregates with loam fill from PK 17+60 to PK 23+60. The weathered material of slope slides and is gathers along the road, at the foot of the slope and carriageway. There are some springs on the slope. Construction of water drains is required on such sections. Widening of road is possible at the expense of cutting into the slope. It is required to construct ditch-side benches. Thickness of asphalt concrete is 7-8 cm. Thickness of gravel and crushed aggregates is 25-30 cm.

328. The road is located on the weathered slope, composed of clay-slates from PK 23+60 to PK 25+10. The weathered material, containing crushed aggregates with boulders is gathered at the foot of the slope. Widening of road is possible at the expense of cutting into the slope. The carriageway is of gravel and crushed aggregates, thickness 25-30 cm. There are remains of asphalt pavement on the road.

329. The road is located on the bench of stable slope composed of weathered crushed aggregates with boulders and loam from PK 25+10 to PK 30+00. There are remains of asphalt pavement on the road thickness 6-7 cm .The carriageway is of gravel and crushed aggregates, thickness 25-30 cm.

330. The project section, which corresponds to PK 93+91 starts at km 90 from marking post of the road Zugdidi-Jvari-Mestia-Lasdili and ends at km 103. Length of rehabilitation section is 12.837 km.

331. Staking has been done separately from 25 m distance of the marking post within the margins of the sections km 91- km 100 and km 101-km 103.

(i) km 91-km100 corresponds to PK 93+91 – PK 192+64
(ii) km 101-km 103 corresponds to PK 0+00 – PK 30+00

332. Staking is finished at the existing 100 km post (PK 192+64) with following of new staking (PK 0+00).

333. The project section is located in the mountainous region, on the bench of the right steep slope of the river Enguri. Project road axis mainly coincides with the existing axis, enabling to maintain the existing right-of-way and engineering structures. The project axis was so fixed that

restoration of normative parameters should be done at the expense of cutting into the slope and to apply concrete or gabion walls only in case of need.

334. There are 184turning angles of various degrees on the project section. They mainly meet technical requirements. Minimum staking radii are 30 m. However, the radii of 20 degrees are applied when crossing narrow and deep ravines in case of sharp bends. Exceptions are angles 173, 174, 246, and 247 which are staked by 12 m radii. Situation Plan with turning angles, Tables of Curves and Straights are attached to the design. The alignment is staked by means of bench marks. Schemes of fixing of the alignment at the beginning and at the end are given on plans.

335. The road bed is designed to meet the requirements of guidelines SNiP 2.05.02-85 and typical design decisions 503.0-48-87.

336. The width of road bed is mostly 8 m, width of carriageway is 6 m. Construction of gabion and lower concrete retaining walls on some sections shall be done where the road bed is narrowed due to washing away of shoulders. The road lacks ditches on the project section, thus water flowing on the carriageway damaging the pavement and the road bed.

337. Achieving standard road bed parameters is stipulated in the project at the expense of cutting into slopes, construction of ditches and berm outside the ditch, width 1 m.

338. **Road Pavement.** The project section links the regions Zemo Svaneti, Daba Mestia and villages located in the regions with lowlands and with trunk highway. The road operation is done in severe weather conditions characteristic for mountainous regions, especially in winter.

339. The structures of pavement accepted are as follows: sections where asphalt-concrete pavement is partially maintained (see photos) - milling of surface, construction of leveling layer of sand an gravel, constriction of base 0-40 mm h=25 cm, construction of reinforced cement-concrete pavement h-22 cm; sections where cut and fills shall be constructed – construction of sub-base of sand and gravel mix in rocky and in hard soil h=20 cm and soft loamy soil h=30 cm, crushed aggregate base and reinforced cement-concrete pavement.

340. Three types of pavement are adopted in the design:

Type I

-	Construction of leveling layer of sand and gravel	- 7231 m^3;
-	Base course – crushed aggregates 0-40 mm, thickness 25 cm	67676 m^2
-	Pavement – reinforced cement concrete, thickness 22 cm	59497m^2
	Including:	
-	cement concrete B35 F200 W6	13327 m^3
-	reinforcement fabric Ø-8 mm	235 t
	Construction of seams:	
-	longitudinal seam	9624 L.m
-	transverse seam	11890 L.m
-	reinforcement Ø-18 mm	17.33 t
-	Filling shoulders of sand and gravel	11720 m^3

Type II

-	Sub-base – sand and gravel, thickness 20 cm	-	6467m^3
-	Base course – crushed aggregates 0-40 mm, thickness 25 cm	-	18345 m^2
-	Pavement – reinforced cement concrete, thickness 22 cm	-	16135m^2
	Including cement concrete B35 F200 W6	-	3614 m^3
	reinforcement fabric Ø-8 mm	-	63.71 t
-	Construction of seams longitudinal seam	-	2599 L.m
	transverse seam	-	3222 L.m
	reinforcement Ø-18 mm	-	4.69 t
-	Filling shoulders of sand and gravel	-	3525 m^3

Type III

-	Sub-base – sand and gravel, thickness 30 cm	-	2127 m^3
-	Base course – crushed aggregates 0-40 mm, thickness 25 cm	-	4057 m^2
-	Pavement – reinforced cement concrete, thickness 22 cm	-	3572 m^2
-	Including cement concrete B35 F200 W6	-	800 m^3
	reinforcement fabric Ø-8 mm	-	14.10 t
-	Construction of seams longitudinal seam	-	570 L.m
	transverse seam	-	708 L.m
	reinforcement Ø-18 mm	-	1.02 t
-	Filling shoulders of sand and gravel	-	711 m^3

341. Structure of road pavement and consumption of materials are given on drawing. Find attached Table of Road Pavement Construction to the project.

342. **Structures.** There are 53 engineering structures on the project section, including:
(i) 49 culverts;
(ii) 4 reinforced concrete bridges;

343. It is required to repair 16 culverts and 2 bridges from the listed above structures; Design considers construction of 30 culverts of various opening.

344. 3 existing culverts are canceled.

345. Design considers restoration of the road bed on separate sections of the rehabilitated road with construction of retaining walls by gabion boxes. Repair of the existing retaining walls shall be done as well. Walls repair include rising in height, filling with stones and construction of reinforced concrete casing.

346. In total design considers:

(i) Gabion lower retaining walls –589/2738 linear m/m^3;
(ii) Gabion upper retaining walls–62/275 linear m/m^3;
(iii) Gravity gabion walls – 101/1702.5 linear m/m^3;
(iv) Repair of the existing concrete retaining walls– 32/1005 u/linear m;

347. road furniture and equipment
(i) Repair of junctions – 10 units
(ii) Repair of bus stop sites and shelters - 4 units.

348. Safety requirements:

Construction of road signs:		
- standard	-	210 units;
- individual design	-	16 units;
Marking of carriageway		
- horizontal		1028 m^2;
- vertical		1801 m^2;
Installation of plastic guide posts	-	517 units;
Previously dismantled parapets of special profile		
- two-sided	-	12 units/10.08 m^3;
Fencing with steel cable	-	9309 linear m.

c. Construction Works

349. The following works shall be performed immediately upon the completion of preparatory works: repair and cleaning of culverts, construction of new culverts, repair of bridges, repair and construction of gabion retaining walls.

350. Earthworks are carried out with bulldozers, excavators, whilst loosening of rocky soil shall be done by blasting works. Excavator-mounted hydraulic hammers shall be used instead of blasting in the inhabited areas, when there is danger to harm local population and cause damage to buildings.

351. The following earthworks shall be done under the project:

- Excavation of soil by bulldozer (96 kilowatt) and displacing to the fill to 30 m on the average	-	100 m^3
- Excavation of soil with excavator V=1.0 m^3, loading on dumps trucks and transportation to the fill to 1 km	-	690 m^3
- Excavation of soil by bulldozer (96 kilowatt) and displacing to the dumpsite to 30 m on the average	-	21130 m^3
- Excavation of soil with excavator V=1.0 m^3, loading on dumps trucks and transportation to the dumpsite	-	78150 m^3
- Excavation of soil by bulldozer (228 kilowatt), displacing to 30 m on the average, loading on dump trucks by excavator V=1.0 m^3 and transportation to dumpsite	-	157310 m^3
- Excavation of soil by excavator-mounted pneumatic hammers, loading on dump trucks by excavator V=1.0 m^3 and transportation to dumpsite	-	5400 m^3

- Excavation of soil with excavator V=0.5 m^3, loading on dumps trucks and transportation to the dumpsite - 5240 m^3
- Excavation of soil in ditches manually, loading on dump trucks and transportation to dumpsite - 1450 m^3
- Cleaning of unstable boulders from slopes along the road by rock climbers, loading with loaders V-2.5 m^3 and transportation to dumpsite - 700 m^3
- Loading of boulders slid from shoulders and ditches with loader V-2.5m^3 and transportation to dumpsite - 1260 m^3
- Crushing of larger boulders with blasthole charges, loading of boulders with loader V-2.5 m^3 and transportation to dumpsite - 355 m^3
- Piling of soil in shoulders with bulldozer (96 kilowatt), displacing to 30 m, loading with excavator V-0.5 m^3 and transportation to dumpsite PK 19+50÷PK 20+00 1990 m^3
- Construction of hillside canal PK 19+50 ÷ PK 21+50
  - Excavation of soil displacing by bulldozer to 40 m - 40 m^3
  - Excavation of soil with excavator V-0.5 m^3, loading and transportation to dumpsite - 170 m^3
- Construction of benches on fill slopes mechanically - 200 m^3
- Reshaping of fill slopes mechanically - 3850 m^2
- Reshaping of cut slopes mechanically - 54800 m^2

352. Volumes of earthworks are determined in accordance with the cross-sections surveyed on the site.

353. Within the margins of project section PK 158+40÷PK 160+40 has been developed the design for preventive measures, where the works for road bed restoration were stipulated. (While designing earthworks were on) therefore, the works for construction of roadbed are not considered by the design. Design considers construction of concrete ditches on 97 linear m.

354. Types of excavations and transportations are given in a separate Table of Distribution of Earthworks in Accordance with kilometers.

355. **Blasting Works.** Blasting of 63905 m^3 rocky soil (31^a, 31^g , 28^b) is required on the road Zugdidi-Jvari-Mestia-Lasdili km 91-km 103.

356. There are power lines located along the project road. The owners of the power lines shall be notified on blasting works, the works shall be agreed with them, and some representatives shall be present whilst performing the works. The requirements that may arise on their side shall be considered. Power lines shall be disconnected whilst performing of works.

357. Blasting works stipulated in the design are as follows:

N	Names of works	Meas. unit	Quantity	Notes
1	Blast holes charges in rocky soil, depth – 0.5-1.0 m	m^3	3540	Soil 31[a]
		m^3	20540	Soil 31[g]
		m^3	1230	Soil 28[b]
	depth – 1.0-2.0 m	m^3	5300	Soil 31[a]
		m^3	30800	Soil 31[g]
2	Blast holes in ditches depth – up to 0.5 m	m^3	1040	Soil 31[a]
		m^3	1000	Soil 31[g]
		m^3	100	Soil 28[b]
3	Breaking of large boulders with blast holes	m^3	15	Soil 31[a]
		m^3	340	Soil 31[g]
	Total	m^3	63905	Soil 31[a]

6. Subproject 4: Reconstruction of section km 121-km 125 of the Secondary Road Zugdidi-Jvari-Mestia-Lasdili

a. Subproject Location and Background

358. The present Project contains design and bidding documents for the rehabilitation of the road section km 121-km 125 (section I). The length of the project section is 5.14 km.

359. The project section is located in Mestia, mainly on uninhabited area. The region is characterized as highland. Along the project section the village Becho is located, at 23 km the road junction is located directing the way to the villages Magarduli, Lezgara, Tskhumari and etc

360. Maintaining of the existing axis and longitudinal profile is stipulated under the present project due to the fact that the project section is located in highland, on steep slopes of the river Enguri (making not feasible to change the road plan significantly). Minor changes are done on some sections to improve traffic safety conditions.

361. The roadbed shall be restored under the project to meet the technical requirements. The existing engineering structures repaired and restored, new engineering structures constructed if necessary. Construction of new road pavement instead of heavily damaged asphalt-concrete pavement is stipulated under the present project. Types of works were determined in accordance with “Classification of road works”.

362. Technical norms applied in the design are as follows:

- Category of road - IV;
- Width of road bed - 7.0 - 8.0 m;
- Width of carriageway - 6.0 m;
- Width of shoulder - 0.5-1.0 m;
- Pavement type - cement-concrete.

363. Design works are based on computer aided production of documents by use of CAD-CREDO software.

b. Existing Conditions and Design Solutions

364. The existing road section starts on the right slope of the river Enguri. The slope is mainly structured by clay-slates of weak and mid strength, along the road clay-slate exposures are noted. Clay-slates belong to easily weathered deposits and mainly the slid material as a product of weathering is collected at the foot of the slopes.

365. The Quaternary age deposits are represented by eluvial and dialluvial deposits and the alluvial deposits are noted in gorges of rivers.
From PK202+60 to PK 203+70 road crosses the river Dolra, where the existing bridge is in good condition.

366. From PK 203+70 – to 216+80 road passes the shelf of a very steep slope structured with glacier deposits represented with boulders with shingle insertion and broken stones filled with loam.

367. The10-12 cm thick asphalt concrete pavement is heavily damaged and maintained on the whole width of the carriageway. The bedding layer is represented by gravel and crushed aggregates, 25-30 cm thick.

368. The ditch locating on the left slope of the road is actually blocked, the surface and slope run-off penetrates into the road base impregnating the base material, resulted from the run-off multiple small size settlements are developed on the roadway.

369. The right slope of the road is very steep and characterised with small size scour due to surface run-off. It is required to construct ditch on the left side of the road, construction of new pavement structure within the settlement places. Some places require water culverts.

370. From PK 224+50 to PK 232+75 road passes a shelf of slope composed of clay-slates. Weak strength clay-slates are weathered from PK 224+50-PK 226+30. Slope is stable. Mainly the slopes are covered with shingle with insertion of boulders and loam fill. Road is structured on these soils.

371. On PK 228+30 the wall existing on the right side of a road is moved and the selltlement is developed within the area of the wall. It is required to resore the wall.
The10-12 cm thick asphalt concrete pavement is damaged and pot-holed. The bedding layer is represented by gravel and crushed aggregates, 25-30 cm thick.

372. From PK 232+75 to PK 249+86 the road passes the shelf of stable slope composed of heavily weathered, disintegrated clay-slates. At the foot of a slope the slid broken stones , boulders are collected. There are noted as well on the slope the eluvial aggregates with boulders and loam fill. Depth is 2-3 m. Widening of road is possible at the expense of cutting into the slope and ditch-side benches.

373. Due to the surface run-off the road base experiences setllement of some places. For this case it is required to construct the culverts and new pavement structure.

374. The 12 cm thick asphalt concrete pavement is damaged. The bedding layer is represented by gravel and crushed aggregates, 25-30 cm thick.

375. The right slope of a road is wahed out due to surface and slope run-off.. Widening of road is possible at the expense of cutting into the slope Slope shall be cleaned, ditch side bench shall be constructed.

376. The 12 cm thick asphalt concrete pavement is fissured and damaged. The bedding layer is represented by gravel and crushed aggregates, 25-30 cm thick. No deformations and settlements are noted there.

377. Widening of road is possible at the expense of cutting into the slope Slope shall be cleaned from the slid material, terraced, hillside ditches shall be constrcuted to remove the water, on the left side of a road shelf shall be constructed.

378. The road is mainly covered with gravel and crushed aggregates.

379. The road carriageway is narrowed, the surface water inflow damages the 10-12 cm thick asphalt concrete pavement, on some sections there is no pavement at all. The bedding layer is represented by gravel

380. **Road Plan.** The project section starts at km 120 (from marking post – PK202+60) of the road Zugdidi-Jvari-Mestia-Lasdili and ends at PK 254+00 . Length of rehabilitation section is 5.14 km.

381. The project section is located in the mountainous region, on the bench of the right steep slope of the river Enguri. Project road axis mainly coincides with the existing axis, enabling to maintain the existing right-of-way and engineering structures. The project axis was fixed so that restoration of normative parameters should be done at the expense of cutting into the slope and to apply concrete or gabion walls only in case of need.

382. There are 77 turning angles of various degrees on the project section. They mainly meet technical requirements. Minimum staking radii are 30 m. However, the radii of 15-25 m degrees are applied in case when crossing narrow and deep ravines in case of sharp bends. Situation Plan with turning angles, Tables of Curves and Straights are attached to the design. The alignment is staked by means of bench marks. Schemes of fixing of the alignment at the beginning and at the end are given on plans. and crushed aggregates, 25-30 cm thick.

383. **Road Bed.** The road bed is designed to meet the requirements of guidelines SNiP 2.05.02-85 and typical design decisions 503.0-48-87.
The width of road bed is mostly 8 m, width of carriageway is 6 m. Construction of gabion and lower concrete retaining walls on some sections shall be done where the road bed is narrowed due to washing away of shoulders. The road lacks ditches actually on the project section, thus water flowing on the carriageway damaging the pavement and road bed.

384. Achieving standard road bed parameters is stipulated in the project at the expense of cutting into slopes, construction of ditches and berm outside the ditch, width 1 m.

ROAD PAVEEMNT

385. **Road Pavement.** Three types of pavement are adopted in the design:

TYPE I				
Construction of leveling layer of sand and gravel		-	2725	m^3
Base course – crushed aggregates 0-40 mm, thickness 25 cm		-	27979	m^2
Pavement – reinforced cement concrete, thickness 22 cm		-	24629	m^2
Including	cement concrete B35 F200 W6	-	5517	m^3
	reinforcement fabric Ø-8 mm	-	9227	t
Construction of seams	longitudinal seam	-	3940	L.m
	transverse seam	-	4728	L.m
	reinforcement Ø-18 mm	-	7.07	t
Filling shoulders of sand and gravel		-	4922	m^3
TYPE II				
Sub-base – sand and gravel, thickness 20 cm		-	344	m^3
Base course – crushed aggregates 0-40 mm, thickness 25 cm		- -	927	m^2
Pavement – reinforced cement concrete, thickness 22 cm		-	816	m^2
Including	cement concrete B35 F200 W6	-	183	m^3
	reinforcement fabric Ø-8 mm	-	3.22	t
Construction of seams	longitudinal seam	-	130	L.m
	transverse seam	-	156	L.m
	reinforcement Ø-18 mm	-	0.23	t
Filling shoulders of sand and gravel		-	160	m^3
TYPE III				
Sub-base – sand and gravel, thickness 30 cm		-	4192	m^3
Base course – crushed aggregates 0-40 mm, thickness 25 cm		-	7530	m^2
Pavement – reinforced cement concrete, thickness 22 cm		-	6636	m^2
Including	cement concrete B35 F200 W6	-	1486	m^3
	reinforcement fabric Ø-8 mm	-	26.21	t
Construction of seams	longitudinal seam	-	1051	L.m
	transverse seam	-	1261	L.m
	reinforcement Ø-18 mm	-	1.89	t
Filling shoulders of sand and gravel		-	1382	m^3

386. **Engineering Structures.** 16 reinforced concrete and steel structures are detected on this section of the project road:

(i) 1 reinforced concrete bridge over the river Dolra;
(ii) 12 reinforced concrete pipe-culverts of different openings
(iii) 1 reinforced concrete box-culvert
(iv) 2 steel pipes d-0.7m

387. 9 reinforced concrete pipe culvert and one box-culver 1.0x1.0 s from 16 require repair. Remained 6 structure require removal and construction of new box culverts of different dimensions.. Culverts shall be cleaned, the damaged body and heads shall be removed and replaced with the new ones. Dismantling and installation of deformed sections of the culverts are foreseen by the project. Water intake concrete wells and wingwalls shall be constructed as well.

388. Elevation of heads and wings with cast in situ concrete is required, construction of spillway apron and cutting of bed are required on repairing culverts.

389. In total 7 new box-culverts of 1x1.5 m shall be constructed under the present design.
At 121 km of the rehabilitation road PK 203+40 crosses the river Dolra bridge. Design considers bridge repair, in proper:total removal of bridge deck and construction of new one, replacement of steel railings, sidewalk blocks, movement joints and pavement.

390. Repair of 17 existing down retaining walls shall be done under the present project. They shall be elevated, and reinforced concrete casing shall be constructed on them, as well as damaged sections shall be removed and restored. The total length of walls is 659 L.m. Retaining walls with gabion boxes shall be constructed:

- Construction of lower gabion retaining walls	201.0/508.0	L.m/m^3
- Repair of existing retaining walls	488/169.1	L.m/m^3

391. The drawings and volumes of works are adopted in the design.

c. Construction Works

392. Earthworks are carried out with bulldozers, excavators, whilst loosening of rocky soil shall be done by blasting works.

393. The following earthworks shall be done under the project:

- Excavation of soil by bulldozer (96 kilowatt) and displacing to the fill to 30 m on the average	-	60 m3	31[a]
- Excavation of soil with excavator V=1.0 m^3, loading on dumps trucks and transportation to the fill	-		
-to 1 km		450 m3	31[a]
- -to 2km	-	130 m3	31[a]
- Excavation of soil by bulldozer (96 kilowatt) and displacing to the dumpsite to 30 m on the average	-	5470 m3	6[g]
-	-	1890 m3	31[a]
		4540 m3	33[g]
- Excavation of soil with excavator V=1.0 m^3, loading on dumps trucks and transportation to the dumpsite	-	25940 m3	6[g]
-	-	3280 m3	31[a]
-	-	8330 m3	33[g]

-	Excavation of soil by bulldozer (228 kilowatt), displacing to 30 m on the average, loading on dump trucks by excavator V=1.0 m^3 and transportation to dumpsite	- 15180 m3	31[a]
		7400 m3	33[g]
-	Excavation of soil in ditches by excavator V=0.5 m^3, loading on dump trucks and transportation to dumpsite	- 1500 m3	6[g]
-		- 620 m3	31[a]
-		- 190 m3	33[g]
-	Excavation of soil in ditches manually, loading on dump trucks and transportation to dumpsite	- 500 m3	6[g]
-		- 200 m3	31[a]
-		- 80 m3	33[g]
-	Cleaning of unstable boulders from slopes along the road by rock climbers, loading with loaders V-2.5 m^3 and transportation to dumpsite	- 20 m3	31[a]
-	Loading of boulders from shoulders and ditches with loader V-2.5 m^3 and transportation to dumpsite	- 10 m3	31[a]
-	Crushing of larger boulders with blasthole charges to 1m, loading of boulders with loader V-2.5 m^3 and transportation to dumpsite	- 15 m3	31[a]
-	Construction of benches on fill slopes mechanically	- 100 m3	6[g]
-	Reshaping of road bed mechanically:		
	- Fill	5980 m2	6[g]
-	- Cut	- 5570 m2	6[g]
-	Reshaping of fill slopes mechanically:	- 7020 m2	6[g]
-	Reshaping of cut slopes mechanically:	- 28160 m2	6[g]
-	Construction of concrete ditches	50/19	L.m/m^3

394. Volumes of earthworks are determined in accordance with the cross-sections surveyed on the site.

395. Types of excavations and transportations are given in a separate Table of Distribution of Earthworks in Accordance with kilometers.

396. Under the present design is considered:

397. The following works shall be performed upon the completion of preparatory works: repair and cleaning of culverts, construction of new culverts, repair of bridge over the Khipa, repair and construction of gabion and reinforced concrete retaining walls.

398. Volumes of works of engineering structures are attached in corresponding Tables of Volumes of Works.

399. Start cleaning of culverts from outlet, clean the bottom of culvert from debris and mud and then start washing from inlet along the total length of culvert. Extension of culverts should

be done with similar sections. Replacing of culverts requires removal of the existing pavement by pick-mattock and transportation of the removed material to sites specified in the project. Pit shall be excavated, crushed aggregates bed laid and compacted, base shall be constructed and culverts rings shall be placed into the pit with their following monolithing. New culvert heads shall be installed, waterproofing applied, soil backfilled and compacted, inlets/outlets strengthened in accordance with the project.

400. Marking of culvert axis shall be done prior to the construction of culvert. Start construction from outlet. Trench shall be excavated in layers by excavator along the total width. Pit shall be strengthened and treated manually; base shall be filled with crushed aggregates and compacted. Concrete shall be supplied in concrete mixer. Installation of precast elements is done by cranes. Culvert is filled with soil simultaneously from both sides in 15-20 cm horizontal layers and compacted upon the completion of waterproofing.

401. Raising of the retaining wall requires: top surface of the wall shall be cleaned; wall body bored in the direction from the top with boring device, reinforcement bars shall be installed in boreholes and concreted. The wall shall be waterproofed at the contact areas with soil. Soil shall be filled behind the wall.

402. Construction of gabion walls requires that each gabion box shall be placed in its place indicated in the design with another box placed beside, which is connected to the previous one by wire. Covers shall be placed on gabion boxes after filling them with stones and they shall be tied to gabion walls by wire. The same sequence shall be applied whilst placing the proper quantity gabions and rows of gabions. Edges shall be interconnected.

403. The sequence of works for repair of Dolra bridge is as follows: removal of damaged bridge deck, reinforced concrete sidewalk blocks and transportation to the dumpsite. Steel railing shall be cut and transported to the production base as scrap metal. The following shall be constructed: deformations joints, bridge deck, sidewalks and railings.

404. Excavation of soil in cut and ditches: with bulldozer - 34540 m^3; with excavator - 40440 m^3; in cut and ditches; excavation of soil in ditches manually - 780 m^3; crushing of large boulders (blast holes) - 15m^3; construction of benches on fill slope - 100 m^3cleaning of road slopes of boulders, cleaning of extra soil in shoulders. Construction of concrete ditches 50/19 l.m/m3, reshaping of road bed and slopes mechanically – 46730 m^2, resoration of deformed roadbed 150 l.m;

405. Construction of ditches shall be done properly to avoid any of the water to penetrate into soil and cause deformation. Ditch slope shall meet design requirements; ditches of proper cross-sections shall be constructed in accordance with time schedule. Excavation of ditches in soft soil shall be done with excavator and manually, whilst processing of rocky soil shall be done with 0.5 m deep blast holes.

406. Construction of ditches shall be done in the direction opposite to water flow ensuring corresponding slope. Construction of ditches requires excavation of trenches first with excavator and finally manually, construction of crushed aggregates base, which shall be compacted, followed by concrete works with the construction of expansion joints.

407. From PK 221+00-PK 222+50 Excavation of soil in the deformed sections shall be done with excavator and bulldozer up to the design level (shall be transported to the dumpsite). Rubble stone shall be delivered upon the reshaping of trench bottom – application of larger

fractions is required in the lower layer – d-0.3-0.5 m, whilst d-0.1-0.3 m shall be required for the upper layer. Construction of gravel coating shall be done on top

408. **Blasting Works.** Blasting of 19770 m^3 rocky soil is required on the road Zugdidi-Jvari-Mestia-Lasdili km 121-km 125.

409. There are power lines located along the project road. The owners of the power lines shall be notified on blasting works, the works shall be agreed with them, and some representatives shall be present whilst performing the works. The requirements that may arise on their side shall be considered. Power lines shall be disconnected whilst performing of works.

410. Blasting works stipulated in the design are as follows:

N	Names of works	Meas. unit	Quantity	Notes
1	Blast holes charges in rocky soil,			
	depth – 0.5-1.0 m	m^3	2310	Soil 31[a]
		m^3	5180	Soil 31[g]
	depth – 1.0-2.0 m	m^3	3500	Soil 31[a]
		m^3	7600	Soil 31[g]
2	Blast holes in ditches depth – up to 0.5 m	m^3	820	Soil 31[a]
		m^3	270	Soil 31[g]
3	Breaking of large boulders with blast holes	m^3	15	Soil 31[a]
	Total	m^3	19770	

7. Spoil and Other Construction Waste

a. Inert Construction Waste

411. The following types of inert waste are anticipated to be produced from these activities:
(i) Natural materials (soil, stones, rock, chippings); spoil residue left after construction of the access roads and backfilling of the pipeline trenches.
(ii) Contaminated soil (low probability and amounts).

412. The estimated quantity of spoil from drilling and demolition works totals to 47,000m^3 and is about the same for all four sections.

b. Other Non-hazardous Construction Waste

413. In summary the main non-hazardous construction wastes will include the following:
(i) Timber (small amount of removed trees and bushes).
(ii) Metals (including scrap metal and wire) – negligible amount of metal waste is expected.

c. Hazardous Construction Wastes

414. Small quantities of the hazardous wastes will arise mainly from the vehicle maintenance activities. A number of hazardous wastes, which could be generated, include:

(i) liquid fuels;
(ii) lubricants, hydraulic oils;
(iii) chemicals, such as anti-freeze;
(iv) contaminated soil;
(v) spillage control materials used to absorb oil and chemical spillages;
(vi) machine/engine filter cartridges;
(vii) oily rags, spent filters, contaminated soil, etc.

415. The hazardous waste is expected to constitute in average about 0.1% of total amount of the wastes. According to local legislation (Order #36/N of the Minister of Labour, Health and Social Protection of 24.02.2003) small amounts of certain types of hazardous wastes could be disposed on municipal landfills. Currently there are no hazardous waste disposal and treatment facilities in Georgia.

416. The used lubricants and filters go to providers. Disposal of the most part of hazardous wastes should be agreed with the MoE. The Constructing Contractor should inform Department of Integrated Environmental Management of the MoE about the amount and type of hazardous waste, to be disposed. The Department of Integrated Environmental Management will provide their recommendations on treatment mode or disposal site and facilities. As the hazardous waste produced during construction does not fall into the highly dangerous category and the amount of the waste is small, it is common practice to dispose the waste on municipal landfills.

8. Quarries, Delivery of Construction Materials

417. The existing quarries and asphalt concrete plants will be used during the motorway rehabilitation. The materials are to be supplied from the following sources:

418. **Sections 1 and 2.** the asphalt concrete plant near Jorjkvali Village (at km 80);
the quarry near Ipari Village (at km 85) at the Enguri River (about 30,000-35,000 m^3);
the quarry between Jorkvali and Ipari Villages (at km 82) at the Enguri River;

419. **Sections 3 and 4.** the gravel quarry in Mestiachala near Mestia the asphalt concrete plant near Mestia

Table 5. Main Required Machinery and Equipment

N	Item	Unit of Measurement	Quantity
1	2	3	4
1	Motor grader	piece	2
2	Binder distributor 3500 liter	piece	1
3	Truck crane of 5 t lifitng capacity	piece	1
4	Truck crane of 10 t lifting capacity	piece	2
5	Truck crane of 16 t lifting capacity	piece	2
6	Portable compressor	piece	6
7	Pick hammers	piece	6

N	Item	Unit of Measurement	Quantity
1	2	3	4
8	Drill hammers	piece	6
9	Road harrow	piece	1
10	Water pump with 30m^3/hr capacity	piece	2
11	Concrete pump	piece	2
12	mortar-supercharger	piece	2
13	5 ton loader	piece	2
14	Shotcrete machine	piece	2
15	Sandblast apparatus	piece	2
16	Drilling machine CP	piece	3
17	Excavator with 1m^3 bucket capacity	piece	1
18	Excavator with 0.5 m^3 bucket capacity	piece	2
19	Bulldozer of 96 kilowatt	piece	2
20	Bulldozer of 228 kilowatt	piece	1
21	Loader with 2.5 m^3 bucket capacity	piece	2
22	Asphalt spreading machine	piece	2
23	Asphalt concrete plant	piece	1
24	Electric vibrator	piece	4
25	Truck concrete mixer	piece	3
26	Pneumatic roller of 16-20 tons	piece	1
27	Vibroroller of 4 tons	piece	2
28	Plain roller of 18 tons	piece	1
29	Combined roller	piece	1
30	Recycling machine	piece	1
31	Hand-held drill	piece	1
32	Marking machine	piece	1
33	Sprinkler	piece	2
34	Road finishing machine	piece	1
35	Dump truck of 10 ton load carrying capacity	piece	20
36	Dump trucks of 20 ton load carrying capacity	piece	5
37	Platform truck of 10 t load capacity	piece	2
38	Platform truck of 7 t load capacity	piece	1
39	Excavator mounted hydraulic hammer	piece	1
40	Hand-held drill	piece	1
41	Bus	piece	1

9. Construction Camps

420. Each construction camp (one per lot) will serve about 30 builders. The camps will be equipment storage yards with 1 or 2 trailers and not full-scale construction camps with the temporary living accommodation for builders. Neither the space required for construction of the large construction camp is available, nor does the need for such facility exist. The workers will lodge in the nearest villages, where they will be provided with hygienic facilities. Installation of the hygienic facilities in the camps has not been considered. The workers will not live in the trailers intended for storage of the part of equipment and accommodation of one security guard. The construction yards will be used for storage of the construction equipment and machinery, as well as for fuelling and performance of the simple repair works.

421. The exact location will be selected by construction Contractor based on the following criteria:

(i) The transformed urban or rural landscapes shall not be sensitive in terms of ecology;
(ii) The fuelling facilities shall be at least 50 m apart from the nearest water bodies;
(iii) The camps shall not be closer than 350 m from the settlements. The clearance shall be sufficiently large to reduce the acoustic impact to the allowable level, but at the same time shall not be excessive assuming that the workers will stay overnight in the villages.

422. The project does not envisage construction of fixed sources of emission or water supply systems in the construction camp. Consequently there is no need for preparation of the regulatory documents (e.g. MAC and MAD).

IV. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

A. Physical Resources

1. Climate

423. Climate conditions of Zemo Svaneti are developed by its Geographic location. High-mountainous location and proximity of nival zone, and the fact that it is orthographically locked, with inverse of temperature, as well as the system of multi-story, high mountainous landscape belts from mountain-forests to nival zone have bearing on the climate. Complex climate conditions have bearing on livelihood of the population and on plethora of aspects of spontaneous geological processes. The description of the climate of the region is based on Mestia Metrological Station's data (8,9,10).

424. Average annual temperature of air is $+5,8^0$ (Mestia) $10,6^0$ (Khaishi), temperature of the coldest months (I, II, III, XII) fluctuates from $-1,4$-$2,7^0$ (XII) to $-4,9$-5^0 (I, II). The temperature during the warmest periods (VII, VIII, IX) is in the following range $10,3$-$13,1^0$. Direct and total radiation of sun at horizontal surface is as follows: in January 26/61 kvt/h/m^2 month; April _ 69/146; July _ 128/205; October _ 62/102 kvt/h/m^2 month. Total radiation on vertical surface changes correspondingly. It changes by exposition as follows: January: North _ 22 kvt/h/m^2 month; North-East North-West _ 22; East-West _ 35; South-East South-West _ 67, South _ 85; April: North _ 48, North-East North-West _ 61, East-West _ 80, South-East South-West _ 92, South _ 91 kvt/h/m^2 month; July: North _ 88, North-East North-West _ 206, East-West _ 104, South-East South-West _ 104, South _ 92; October: North _ 31 kvt/h/m^2 month, North-East North-West _ 37, East-West _ 58, South-East South-West _ 95, South _ 113 kvt/h/m^2 month. Absolute minimum air temperature is -35^0, absolute maximum $+35^0$, average minimum temperature is $-0,3^0$, and average maximum temperature is $+12,9^0$; Air temperature amplitude fluctuates within the following range $10,4$-$15,9^0$, and the fluctuation is the lowest in December and the highest in August.

425. Average annual relative humidity is 75% and daily amplitude of the relative humidity for the coldest month is _ 23%, and for the hottest months _ 45%; humidity coefficient is _ 2,0.

426. Average multi-year precipitation in Mestia is 970-992 mm, in Khaishi _ 1421 mm (7,8). It fluctuates in the range of 243-307 mm in summer and in the range of 226-429 mm in winter. Amount of precipitation is positively correlated to the elevation on the slopes of the mountainous ridges and reaches maximum amount at 2000 m and higher elevations. Number of annual precipitation days in Mestia is 168 days and 175 days in Khaishi. According to the Mestia metrological station's data daily maximum of precipitation is 105 mm, however heavy rain on June 17, 1982 amounted to 145 mm precipitation; something similar happened in July 1986, when precipitation in one day was 106 mm and in July 2004 – 100 mm. Heavy floods were developed at those times at river Enguri basin. Number of snowy days is 160 and the highest average of snow height for decades is 67mm. Water reserve of snow is 106 mm and weight of snow per m^2 is 1,47 kpa.

427. Average annual speed of wind is _ 0,9 m/s, and the highest and lowest speed of wind in winter is _ 1,4 m/s and 0,2 m/s respectively and in July _ 2,0 m/s and 0,8 m/s respectively. The highest speed of wind was identified in April and May (1,4 mm).
Annual number of clear and cloudy days is 120 and 32 respectively and they are distributed by months as follows: January 10,4/3,9; March _ 8,8/5,6; April _ 8,4/5,1; May _ 6,3/3,7; June _ 6,4/2,8; July _ 7,8/2,1; August _ 9,5/2,1; September _ 10,2-3,3; October _ 12,1/4,8; November _ 13,0/4,5; December _ 14,3/4,9. Average annual number of foggy days is 6 and the highest is 13. Out of these 4 days comes in months X-III and 2 days in months IV-IX.

2. General Physical-Geographic Characteristic

428. Khaishi-Mestia motor road section entirely goes through river Enguri basin, which structurally belongs to central Caucasus unit and its nature is represented by extremely difficult high-mountainous landscape. This section of river Enguri morphologically represents high-mountainous, locked (so called Zemo Svaneti depression) depression, which is surrounded by Southern slopes of Caucasus's main ridge from the North and by Svaneti ridge from the South.

429. Main ridge of Caucasus Mountains surrounding river Enguri basins depression is the highest crystal foundation stripped Horst-Anticlin. It's orthographic and Anticlinoria direction axis coincide each other. The Southern border of the morpho-structure morphologically is defined by sudden change of relief at the boundary of old crystal and meta-morphological complexes and slate type sets. "Main Overthrust" in the relief among the rivers Gvandri, Nenskri, Nakrisa and Dolri creates contrast; here huge monolith block like so called "Shtavreli Block" is crept on the layers of Jurassic and calcareous sediments, whose horizontal movement reaches 15 km.

430. Average absolute elevation of the main ridge is over 4,000 m, and maximum elevation is above 5,000 m. The number of mountain massives whose hypsometric indicators exceed 4,000 m reaches 36 and the elevation of the passes among them fluctuates in the following range: 3161-3866 m. This section of the Caucasus ridge is known as Svaneti Caucasus. Its length is about 125 km and its height gradually increases towards East and reaches maximum elevation at Shkhara massive, which is known as "Bexingi Kedeli (wall)". The highest peaks of the main ridge of Caucasus Mountains are here: Gistola, Tetnuldi, Shkhara, Namkvani, Ushba and etc. The longest glaciers with biggest area of the Southern slope of Caucasus mountains – Tsaneri, Tviberi, Adishi, Khalde, Ushba, Dolra, Shkhara and etc - are situated here as well; total area of the glaciers is 181.9 km^2.

431. Svaneti Caucasus Mountains has a lot of branches including Kodori, Shtavleri, Tsaldmili, Ushba, Namkodri, Kreta and etc. All those branches, whose absolute elevation gradually

increases towards North and reaches maximum elevation at the top zone, where it is transformed into eternal snow and glaciers zone, represent divisors of river Rioni tributaries.

432. Character of the landscape of Svaneti Caucasus Mountains is defined by its layers' characteristics and hypsometric location. Its Northern part is formed by layers that are especially stable with regard to denudation-erosive processes; surface of the relief is modified by pleistocenic glaciers exertion, where tense freezing-mechanical exhaustion and nivation processes are undergoing on the background of glacier-nival climate. As a result rocky-serrate landscapes with steep surfaces dominate. Svaneti Caucasus Mountains Southern slope with crystal sub-strata and regional overthrust in the South, which is mainly formed by almost homogenous slate type set, which is easily complaisant to erosive- denudation processes; upper Pleistocene glacier forms and deeply cut mountains/gorges erosive forms, whose macro-morphologic extension is the right slope of river Enguri gorge itself, dominate in the relief's morphology.

433. Upper Svaneti depression's river Enguri gorge is bordered by Svaneti ridge from the South; morphological-structural formation started in the Quaternary and its (divisor ridge of river Enguri and river Tskhenistskali) upside movement has been undergoing since then.

434. Morpho-structuraly Svaneti ridge represents anticlinoria, which has sub-latitude orientation on 90 km. It is divided from the Caucasus ridge at mountain Ailama (4,547 m) surroundings (sources of river Enguri and river Tskhenistkali) an ends on the left side of river Enguri in the West, at village Khaishi surroundings. This, the central, the highest part (3500-4000m) of the morpho-structure is partially formed by Paleozoic age "Disy Set" layers (quarzous sandstones, marbelized limestones, marble) that are stable with regard to denudation processes; clay-slates of Jurassic period that are very sensitive towards erosive processes dominate in the composition of its slopes, however, there are middle Jurassic period so called "porphyrites set" of volcanogenic in its structure at the end, at village Khaishi territory. All these sets are intensely located and they are separated from each other by tectonic overthrusts and faults. The highest, central part of the ridge has rocky-serrate relief and deeply cut troguli gorge is occupied by modern glaciers; there are about 30 glaciers. Old glacier formations are widespread. Old glacier relief in the area where Jurassic slates are widespread is modified by modern erosive forms – deeply cut V type gorges and their narrow water divisor ridges. It is noteworthy that significant part of the river gorges are situated at the Caucasus ridge or close to it (rivers Kasleti, Khelra, Khumpreris Dzveli Dineba, Dasavluri Lailachala, Arshiris Zemo Dineba, Mukhri and etc.), which must be due to tectonic faults and non-homogenous lithology. Tectonic-seismic gravity formations are widespread in this set of slates. Rocky, steep slope relief forms, with narrow and deeply cut erosive gorges and widespread gravity dump materials, are dominant at volcanic set of layers.

435. River Enguri gorge, which is known also as Zemo Svaneti depression, is characterized by sub-latitude direction and morphologically it represents tectonic-erosive cavity.

436. River Enguri, which originates at Namkvani glacier at 2,800 m elevation, experiences 2,550 m fall over 150 km distance to townlet Jvari. Its canal at lower part of Ushguli is at 2,000 m elevation, at the intersection with river Mulkhuri tributary its elevation is 1,200 m, at village Khaishi its elevation is 550 m, and at townlet Jvari its elevation is 250 m. Main tributaries of river Enguri are the following: Odichala (length 15 km), Mulkhura (27 km), Dolra (20 km), Nakra (22 km), Nenskra (46 km), Tkheisha (18km), Larakvava (17km), Magana (24km), Rukhi (21km), Jumi (61km). Apart from the above listed main tributaries about 232 tributaries fall into river

Enguri and their total length exceeds 601 km and all of them divide river Enguri slopes with coefficient 0.59km/km^2-ze.

437. River Enguri flows from its origin source to Ushguli community through quite wide Pleistocene glaciers developed at the trogul gorge. Fauna at this section of the river is largely absent. Below Ushguli the river enters woody erosive gorge, which is being squeezed by secondary water divisor ridge legs and this kind of morphology is maintained until Ipari. At this point river Enguri continues flow in typical erosive asymmetrical profile gorge, whose right slope was developed at Ugviri ridge's lower and latitudinal slopes and the left slope is Svaneti ridge's high elevation steep slope. At the river Mulkhuri mouth River Enguri enters wide erosive gorge with quite vast and significant steep erosive terraces. Villages Becho, Etseri, Pari and others are situated on those terraces. Original vegetation is almost extinct at the populated area; vegetation is mainly represented by secondary bushes and small plots of deciduous wood. Significant woods exist only on higher elevation slopes of Caucasus and Svaneti ridges. Such type of vegetation exists in the gorge till village Lakhamuli. River Enguri gorge gradually becomes narrower and deeper below; terraces are gone, slopes are very steep and mainly rocky and such characteristics are maintained till townlet Jvari.

438. River Enguri gorge, which belongs to high mountainous depression type, is characterized by complex morpho-genetic characteristics. It main axis is 130 km long river Enguri gorge itself, with curvature coefficient 1.42; river Enguri gorge separates from each other Oni and Svaneti ridges, although tectonically both of them belongs to Caucasus mountains Southern slope system's zone. The slopes of river Enguri itself represent extension of lower morphologic levels of Caucasus ridges North and Svaneti ridge's South slopes whose boundary almost coincides with the zone covered by forest.

439. In the area of upper Svaneti depression the gorge of the Enguri River is mainly carved in the slate type set of lower and middle Jurassic age. Metamorphic stratum of Paleozoic layer follows in a narrow strip the area crossing the Svaneti ridge; and at upper Jurassic carbonate flish from East of village Lakhamuri, Mestia, the river crosses a set formed by volcanic layers at Western end of Svaneti ridge, at village Khaishi territory, where cliff type gorge is formed.

440. The morphology of the Enguri River is very much diverse depending on which stratigraphic lithologic layers and morpho-structure it crosses. But it is dominated by erosive, glacial-accumulative and selective-denudation macro and mezzo forms of the surface. In the stratum of Jurassic rock the Enguri river has predominantly carved an asymmetric "V" type gorge with highly elevated and steep sloping left bank, and relatively small right bank the surface of which is significantly modified and complicated by landslide-gravitational steps. The width of the river gorge, starting from 10-20 meters from the bottom, increases gradually and exceeds 1000-1500 meters. Besides, steepness of the river slopes increases in top-down direction within the range of 30-40^0 and it is characterized by concave profile. This definitely indicates that in the area of upper Svaneti depression the rate of morpho-structural rise and the dept of erosive intrusion of the Enguri River is much less than that of its neighboring Paleozoic, metamorphic and Jurassic structures consisting of volcanogenic structures. In the same area of the river there must have been large number of sets of river terrains but most of them are masked by slope and flood sediments. But their existence at different altitudes is evidenced by precipitation. The river Enguri, just before river Nakra mouth sharply changes the direction towards South-West and crosses a set of Paleozoic metamorphic complex near Jvari. It maintains such conditions in a set of volcanogenic layers as well. In such layers the Enguri has been carving out its deep and narrow canyon type gorge. In this area in many places the

automobile road is carved out of the rocky banks, but at certain places the rocky slopes are so complex the road goes through artificial structures.

441. The slopes of river Enguri are significantly partitioned in the depression boundaries; tributaries are almost symmetric and all of them, excluding river Mulkhura, are oriented towards reversed current directions towards meridian; they flow through trogul gorges and cross modern glaciers. Mulkhuri gorge is especially interesting as the motor road goes on its right side. River Mulkhuri gorge is latitudinal and water flowing from Tviberi and Tsaneri glaciers flow in the river gorge. Geologically upper and middle parts of the gorge are strictly troguli type and the troguli bottom is deeply cute by erosive processes and becomes narrower at lower part, however its bottom is completely filled with glacier-fluvioglacialuri and lake type floorings, which creates inclined pseudo terrain close to river Enguri mouth. River Mestiachala, which originates at Lekhziri and Chalaati glaciers, flows in river Mulkhura at the territory of townlet Mestia, at 1,380 m elevation. This gorge is a typical troguli gorge, which widens at the river mouth; it has pseudo terrain surface and villages Lami, Vanashi and Matskvarishi are located at the terrain.

442. River Dolra's gorge connects to River Enguri at 2,140 m elevation. This gorge is a typical troguli gorge with wide bottom completely filled with glacier and water-glacier floorings. The ridge parallel to the river slope (Bali ridge) is characterized by steps created by old glaciers. River Dolra is deeply carved in glacier and fluvioglacialuri floorings with significantly inclined vast surface.

443. River Neskra's, tributary of river Enguri, gorge, which flows in river Enguri from the right side at village Khaishi territory, represents significant morphological unit. Its length is 40 km and its upper part is formed in crystal layers and lower part in Jurassic slates and volcanogenic layers. This gorge is a typical troguli gorge and its bottom is filled with glacier sediments and its middle part on the territory of village Chuberi is represented by hilly relief formed at the end of upper quaternary age.

3. Surface water

444. Enguri River originates from Namkvani Glacier, at 2800 m above sea level. The riverbed's elevation drops by 2,550 metres along the 150 km section from the river head to town of Jvari. Elevation of the riverbed downstream of Ushguli Comunity is 2,000 m, at the mouth of R. Mulkhura – 1,200 m, at village of Khaisi – 550 m, and at town of Jvari – 250 m. The major tributaries of Enguri River are Odichala (length 15 km), Mulkhura (27 km), Dolra (20 km), Nakra (22 km), Nenskra (46 km), Tkheisha (18 km), Larakvava (17 km), Magana (24 km), Rukhi (21 km), Jumi (61 km). Besides the major tributaries, R. Enguri mouths 232 other minor watercourses with total length exceeding 601 km. All these watercourses compose the drainage density of Enguri watershed (slopes) of 0.59 km/km^2.

445. By chemical composition, the river water belongs to hydrocarbonate class, calcium groups. The water mineralization rate varies from 129.5 to 252.6 mg/l. The highest measured contamination in Enguri River revealed at the cross-section downstream of vil. Abastumani, and is extended downstream along the entire remaining length of the river. Disruptions of the oxygen regime were identified downstream of village of Abastumani with dissolved oxygen rate reduced to 5.25 mg/m and chemical oxygen demand (COD) not exceeding 3.20 mg/l.

446. The maximum concentrations of pollutant substances were as follows: at village of Abastumani Station – ammonia nitrogen – 0.41 mg/l, nitrite nitrogen – 0.040 mg/l, phosphates –

0.090 mg/l; at vil. Darcheli Station – ammonia nitrogen – 0.44 mg/l, nitrite nitrogen – 0.200 mg/l (10 MAC), phosphates – 0.031 mg/l.

447. The major pollution source was Enguri Pulp and Paper Mill (Ministry of the Forestry and Paper Production of USSR).

448. Enguri River basin comprises the following rivers: Mulkhura, Mestiachala, Magana and Chkhoushi. These rivers' waters belong to hydrocarbonate class, calcium groups. The water mineralization rates changed during year from 76.5 mg/l to 210.3 mg/l. Organic matter content (CAD) did not exceed 3.1 mg/l.

449. The maximum concentrations of contaminating substances were as follows: ammonia nitrogen – 0.45 mg/l, nitrite nitrogen – 0.116 mg/l, phosphates – 0.057 mg/l.

450. **Brief Hydrographical Overview of Enguri River.** Enguri river originates by merging of the two creeks originating from the glaciers of Skhara (5058 m) and Nuamkuani (4278 m) summits, at 2520 m absolute elevation, and mouth into the Black Sea at village of Anaklia.
Total river length is 213 m, total elevation drop – 2520 m, average gradient – 11.8%, watershed area – 4060 km2, average altitude of the river catchment basin – 1840 m.

451. Enguri River mouths 242 tributaries with total length of 872 km. The major tributaries are Odichala (15 km), Mulkhura (27 km), Dolra (20 km), Nakra (22 km), Nenskra (46 km), Tkheisha (18 km), Larakvava (17 km), Magana (24 km), Rukhi (21 km), Jumi (61 km).

452. The watershed has asymmetric shape, with areas of the right and left sides of 2316.9 km^2 and 1743.1 km^2 respectively. The highland area composes 74.5% of the watershed, while remaining 25.5% is expanded over the foothills and plain. The highland watershed zone includes 174 glaciers with total area of 333 km^2.

453. The river is fed by glaciers, snow, rainfall and groundwater. The snow, rainfall and glacier waters provide the considerable contribution to the annual river runoff. The river regime is characterised by floods during the warm seasons and lower fluctuating baseflow levels during the colder periods. The floods caused by snow and glacier melting are often coincided with the rainfall floods. Also, the rainfall floods occur often during the dry periods. From 80% to 82% of the annual runoff occurs in the warmer period with extensive melting of the snow and glaciers, and only 7-8% falls to the cold period.

454. The river is employed for power generation using 271.5 m high arch dam, which creates Enguri Reservoir with total and effective storage capacities of 1,100 million and 680 million cubic metres respectively. From this reservoir water is supplied to the Enguri Hydro Power Plant and further downstream to the cascade of four other hydros (Vardnili Cascade) built in Eristskali River basin with total designed capacity of 1640 MW and average multi-annual output of 5460 million kWh.

455. Enguri River's runoff was studied in various periods using the data of 20 water stations. From these, currently one station is in operation (at village of Khaishi), where only water levels are recorded, but no flow rates are monitored.

456. Flow regime of Enguri River is estimated using the daily water levels and flows measured at Ipari and Khaishi water stations in 1986, which are the most recent officially published data. The tables with water levels/flows provide the average levels/flows (means of

the 8 hr and 20 hr records), while the appropriate maximum values recorded at 8 and 20 hours during specific months are given in the 'Max' and 'Min' fields under respective tables.

457. Ipari water station is located at km 180 from the river mouth. Watershed area corresponding to this station is 362 km^2. The average annual water level based on 1986 data at Ipari station was 139 cm. The maximum level of 237 cm was recorded on 26 July, and the minimum level of 112 cm on 1 February. In 1986, the average, maximum and minimum flow rates in the same section were 11.8 m^3/s, 93.0 m^3/s and 4.24 m^3/s respectively.

458. Khaishi water station is located at km 114 from the river mouth. Watershed area corresponding to this station is 2780 km^2. The average annual water level based on 1986 data at Ipari station was 184 cm. The maximum level of 349 cm (absolute altitude 530.92 m) was recorded on 7 July, and the minimum level of 100 cm (absolute altitude 530.08 m) on 18 December. In 1986, the average, maximum and minimum flow rates in the same section were 123 m^3/s, 555 m^3/s and 21.0 m^3/s respectively.

459. **Maximum Flows of the Rivers Crossing the Rehabilitated Khaishi-Mestia Road**. In accordance with 1:25,000 topographic map, the rehabilitated Khaishi-Mestia motor road is crossed by 16 watercourses, including 5 rivers, 6 creeks and 4 dry gorges. Based on analysis of the data collected during 54 year long intercepted observations, the absolute maximum flow rate recorded in 1948 did not exceed 99.5 m3/s. It means that the actual maximum flows could occur in the interim periods between the observations and thus should be missed from the records. Due to such reason, processing of the measurement records for determining the rated flows was not considered as reasonable.

460. Therefore, the maximum flow rates in the rivers crossing the Khaishi-Mestia rehabilitated road alignment have been determined using the method recommended by Technical Guidance for Calculation of the Maximum River Flows in Caucasus Conditions for estimation of the maximum flows in rivers with catchment basins smaller than 400 km2, and Hydrology Handbook – Surface Water Resources of USSR, vol. IX, edition I.

461. The values of morphometric elements required for calculation of the maximum flows in the rivers crossing the rehabilitated motor road determined based on the 1:25,000 scale topographic map are given in Table 8.

Table 8 Morphometry elements of the rivers crossing the rehabilitated motor road

River	F Km^2	L L	i_{Kal}	i_a %	Σl_{Km}	ξ	φ	K	δ
Kazax-tvibi	14.7	5.80	0.276	62.0	5.60	0.27	0.26	6	1
luxra	15.6	8.20	0.221	54.4	4.20	0.27	0.34	6	1
Nakra	169	22.7	0.102	63.1	33.0	0.27	0.34	6	1
ManSura	22.7	8.40	0.244	52.6	6.80	0.27	0.34	6	1
Ladlina	16.3	8.30	0.263	52.2	5.60	0.27	0.34	6	1
Kini	14.3	7.30	0.253	48.2	3.00	0.27	0.34	6	1
LeSta	9.00	7.10	0.220	42.3	2.00	0.27	0.34	6	1
Soledra	5.70	4.96	0.192	48.0	2.40	0.27	0.34	6	1
Dolra	182	19.8	0.082	59.8	14.2	0.27	0.34	6	1
LaSkudiaSara	12.1	7.50	0.189	41.1	4.60	0.27	0.34	6	1
PuSkueri	16.0	7.20	0.258	59.6	4.40	0.27	0.34	6	1

462. All necessary parameters determined based on the specific morphometry elements, as well as the maximum water flow rates are given in Table 9 below.

Table 9 Maximum water flow rates of the rivers crossing the rehabilitated motor road

Riwer	P%	τ year	T m	H mm	i mm/m	α	β	v m/sek.	v m/sec.color	Q m^3/sek	Q m^3/sek Calc.
Kazax-tvibi	1	100	72.7	78.6	1.08	0.54	0.738	2.17	0.38	105	105
	2	50	81.2	67.5	0.83	0.51	0.764	2.05	0.32	79.3	79.5
	10	10	104	47.0	0.45	0.44	0.815	1.78	0.22	39.6	40.0
Luxra	1	100	100	86.9	0.87	0.53	0.767	2.09	0.32	91.9	92.0
	2	50	109	74.0	0.68	0.50	0.788	1.98	0.28	69.7	70.0
	10	10	133	50.8	0.38	0.44	0.832	1.74	0.19	36.2	36.5
Nakra	1	100	209	109	0.52	0.51	0.555	2.77	0.39	415	415
	2	50	218	91.7	0.42	0.48	0.581	2.64	0.34	330	330
	10	10	260	62.6	0.24	0.43	0.654	2.37	0.25	190	190
ManSura	1	100	100	86.9	0.87	0.53	0.726	2.24	0.34	127	127
	2	50	109	74.0	0.68	0.50	0.750	2.12	0.30	96.5	97.0
	10	10	135	51.1	0.38	0.44	0.801	1.86	0.21	50.7	51.0
Ladlina	1	100	95.9	85.7	0.89	0.53	0.759	2.13	0.31	97.3	97.5
	2	50	107	73.6	0.69	0.50	0.782	2.01	0.26	73.3	73.5
	10	10	131	50.5	0.38	0.44	0.826	1.76	0.18	38.0	38.0
Kini	1	100	92.5	84.7	0.92	0.53	0.768	2.09	0.33	88.8	89.0
	2	50	104	72.9	0.70	0.50	0.792	1.97	0.28	66.1	66.5
	10	10	129	50.4	0.39	0.44	0.835	1.72	0.20	34.2	34.5
LeSta	1	100	95.8	85.7	0.89	0.54	0.814	1.91	0.27	59.0	59.0
	2	50	103	72.8	0.71	0.50	0.830	1.80	0.23	44.0	44.0
	10	10	127	50.0	0.39	0.44	0.866	1.58	0.16	22.5	22.5
Soledra	1	100	71.1	78.1	1.10	0.55	0.825	1.83	0.28	47.4	47.5
	2	50	75.0	65.9	0.88	0.51	0.839	1.73	0.24	35.8	36.0
	10	10	93.0	45.5	0.49	0.45	0.873	1.51	0.17	18.3	18.5
Dolra	1	100	212	110	0.52	0.51	0.545	2.76	0.52	439	440
	2	50	229	93.2	0.41	0.48	0.577	2.63	0.44	345	345
	10	10	287	64.5	0.22	0.43	0.657	2.34	0.31	193	195
LaSkudiaSara	1	100	95.2	85.8	0.90	0.54	0.785	2.01	0.27	77.0	77.0
	2	50	104	72.9	0.70	0.50	0.805	1.89	0.23	56.8	57.0
	10	10	131	50.6	0.39	0.44	0.846	1.66	0.16	29.3	29.5
PuSkueri	1	100	91.4	84.4	0.92	0.54	0.755	2.14	0.36	100	100
	2	50	97.8	71.5	0.73	0.50	0.775	2.02	0.31	75.4	75.5
	10	10	126	50.0	0.40	0.44	0.824	1.77	0.21	38.7	39.0

4. Groundwater

463. The water-bearing formation built by contemporary alluvial deposits is characterized by free groundwater table declined along the general flow of the rivers. The water table depths vary from 0.5 m to 5.0 m. At some locations nearby riverbeds and groves, groundwater depths are reduced to 0.3 m. The aquifer is characterized by rich water resources, with debits of the springs varying in the range of 0.1-3.5 l/s. The aquifer is mainly fed from river and precipitation waters. Despite the aquifer is rich with water, its practical water use is limited due to restricted distribution of the alluvial deposits. In addition, it shall be stated that impact on this aquifer should be minimal due to limited work quantities to be performed within the grove.

5. Geology/Seismology

464. The gorge of River Enguri within the Zemo Svaneti depression area tectonically belongs to the areas of Mestia-Tianeti and Chkhalta-Laili shelled folded zones of the Caucasus folded

system, the boundaries between which are separated by the tectonic overthsursts and faults characteristic for the region. These tectonic areas are built of Lower-Mid Jurassic Period slates, with the Upper Jurassic and Lower Cretaceous Period carbonate flysch and Mid Jurassic volcanogenic sedimentary rocks. All these rocks are tectonically intensively dislocated and have produced many significant folded structures. Among them Mestia-Shovi synclines, Khibiani, Lukhumi, Kheshuri, Dabieri-Tviberi, Dizi-Ushuri, Lablakhi-Tchviberi, Khaisi anticlines, etc are to be highlighted.

465. Within the study territory so called 'Dizi Series' of the earliest Paleozoic age which form the tallest elevated largest two anticline folds of coulisses disposition towards the general Caucasus direction. The folds are stretched sub-meridianly from the West to the East at 60-65 km on the right bank of Riv. Nenskra and in the areas of Virari continuing to the East on the Svaneti Ridge up to the Lasili Ridge.

466. Lithologically, 'Dizi Series' are represented as green corrugated filets, light grey sandstones, pyro-clastoliths of andezite-dacite content, marble streaks, flint slates and silicite interlayers, dark grey gravilites and silicite interlayers, and streaks of internal formation conglomerates.

467. 'Dizi Series' developing rocks with their engineering-geological properties, as a whole, belong to the hard rocks of high metamorphic strength and are dislocated so intensively that they extend to the secondary fine folds. All the developing rocks of 'Dizi Series', in the sound condition, notwithstanding their intensive folding and fracturing, are characterized by the high strength and stability. (6) The volumetric mass or these rocks fluctuate between 2.6-2.8 gr/cm^3, the porosity is 0.40-1.5%, the water absorbency is 0.1-0.5%. The strength of the rocks in the natural condition - from 30.6-36 MPa (from 30-135 MPa the metamorphic slates, marble) – to 215-219 MPa (metamorphic sandstones). The strength of these rocks after the water absorbance drops from 26-33-95 MPa (marble, clay-shales) to 125-130 MPa (sandstones). Their strength consequently drops to 20-65 MPa from 120 MPa after 15 freezing cycles.

468. The 'Dizi Series' complex, notwithstanding the fact that it is characterized with high strength and stability, under the circumstances of severe climate of high mountainous places, in the area of contacting with the atmosphere it experiences intensive mechanical- freezing weathering, especially in the area of high fracturing. However, the 'Dizi Series' still maintain a significant strength. The strength of the weathering crust fluctuates from 2-4 m to 18-20m and mainly the weathering areas of coarse block talus and broken rocks are prevalent. Since these rocks are dominated by the relief forms of nivation glacier and erosive character with strongly inclined surfaces (more than 30-60^0), the intensive gravitational processes of permanent renewal are underway in almost all the exposed areas of the rock surfaces and strong coluvial material is being accumulated at the foot of the exposed slopes and in the area of the motorway (Figures 11,12).

Figure 7. Material acumulated at the foot of the exposed slopes

Figure 8. Material acumulated at the foot of the exposed slopes

469. The Lower and Mid Jurassic Period slate type sets of sediments dominate the study territory. These sediments continuously build the South slope of the Svaneti Caucasioni, to the South of the Regional overthrust and both wings of Svaneti anticlinorium ridge.

470. The Lower Jurassic Period sediments start with the plizebach floor which is represented by the aspide slates and clay-shales, by the interlayers of siltstones and sandstones and internal formation conglomerates streaks which are transgressively located on the substratum of the crystal rocks.

471. On these series of Lower Dizi the black clay-shales, aleuroliths of Mid Lias toarse floor are transgressively located and rarely there are internal formation conglomerates streaks and interlayers, and there are some thick-layer and massive limestone thick packs.
The Lower Lias slate type set is consequently followed by the Mid Jurassic Period flysch which is also represented by clay-shales, sandstones and conglomerate layers in the Mestia and Tianeti area.

472. Unsegmented sediments of Mid Jurassic Period, that is clay and clay-shales, argillites, sandstones and siltstones build the North edge of Enguri depression at the Mestia-Tsna section. Lower and Mid Jurassic age slate type sets with their engineering-geological properties are combined in the single terrigenous- metamorphic formation complex, which is represented by the aspide slates, clay-shales, siltstones, thin and thick-layer sandstones, the interlayers of conglomerates and streaks rarely dominated with slate rocks. The whole sets are intensively dislocated up to the narrow, frequently isoclinic folds, with strong tectonic faults and are disrupted in blocks the fractures of which are frequently filled in with quartz and calcite lodes.

473. The slate type complex mainly belongs to the group of semi-hard rock and low strength hard rocks. In this respect the aspide clay-shales whose physical and mechanical properties fluctuate within the following parameters: the volumetric mass is 2.55-2.60gr/cm^3, and it is 137-138 MPa in the upper part of the log of natural environment. In the water saturated environment it is 49 MPa; after freezing it is 82-87 MPa. In the weathered environment to some extent the strength of these rocks significantly decreases: the density is 2.45-2.55 gr/cm^3, the strength in the natural environment is 105-115, and in the water saturated environment it is 40-68, while in the freezing regime it is 63-64 MPa.

474. The sandstones occupy a limited position in the set and are represented by the Carsian - Arkosic, Arkosic - Quartz consisting of the polymictic composition; it is mostly fine-grained, and mostly with the contact cementation, and rarely with the contact-porous; the density of clay-lime sandstones in the natural environment 2.70 gr/cm^3, in the averagely weathered condition it is 2.60 gr/cm^3; its density consequently changes and drops from 205 MPa to 95 MPa, and in the water saturated condition it drops from 169 to 76 MPa, and after freezing – from 134 MPa to 61 MPa. Notwithstanding a significant decrease in the strength of the sandstones in the weathering area, the rocks still maintain stability and in the form of interlayers they are presented as rock extensions in the slate sets.

475. Overall, the slate type sets easily subject to exogenous agents and in the weathering area their natural bearing capacities decline by 4-5-times, especially in the tectonically fragmented areas, whose capacity is measured in tens of meters. Not only their granular content changes in the weathering area, where the fine grained (2-10mm) thin-layer slate detritus dominates in the slate type set (up to 70-85%), - but also the geo-chemical content changes with the silicates exceeding 10%, sodium dioxide increases 2 times and the potassium dioxide increases 2 times.

476. In the area of the slate type sets there is a significantly favorable environment created for the development of landslide and especially mudflow processes.

Mid Jurassic Period volcanogenic rocks surround the depression of the gorge from the South-West and develop the anticline structure of Khaishi. Lithologically, they are represented by the calc-alkali basalts, Andesibazalt, Andesite and Dacite lavas, with breccias and pyro-clastoliths, tuffites, with some tuffo turbidites, tuffoargillites, while in the upper log there are tuffo-conglomerates, tuffo sandstones, tuffo-alevrolites and clay-shales. The porfirite set dominates in the lower part of the log.

477. By its engineering-geological properties the volcanogenic set belongs to the high strength and stability group, where its density is within the range of 2.57-2.82gr/cm3, and the strength does not drop below102-210 MPa even in the water saturated environment, and even in the weathered condition it maintains the high figures within the range of 88-128 MPa. Tuffs and sandstones on the clay cement are the exception to this and their strength in the natural environment ranges within 68-81 MPa, and drops to 57-72 MPa in the water saturated environment. Though, their place is limited within 1-5% in the geological log.

478. According to the geophysical surveys the strength of weathering crust of volcanic set does not exceed 15-20m and as a whole is represented by the block talus and fractured area. In the relief it maintains the profile of rock morphology and everywhere creates the background of active gravitation.

479. They flysch deposits of Lower Cretaceous terrigenous-carbonate form the sinclinic structure of tectonic unit, which is sub-meridian oriented and almost to the direction of the Caucasioni. Lithologically, it is represented by the interchange of clastic limestones and sandstone turbidites, pelagic marls, limestones, argivites and clay-shales. As a whole, the layers of this stratum are intensively dislocated and extended to the fine folds and blocks.

480. The engineering-geological properties of the rocks consisting of these layers differ significantly from each other in terms of stability and strength and belong to the group of low strength hard rocks and semi-hard rocks.

481. Marl limestones are characterized with relatively high strength whose density is within the range of 2.6gr/cm^3 , while the strength under the natural conditions is 96-120 MPa and drops to 73-90 MPa under the water conditions, and in case of freezing it amounts to 57 MPa. The softening coefficient of limes is 0.75. The strength of limestones, under the relatively weathered environment, drops to 60-54 MPa.

482. The marls and carbonate clay-shales belong to the group of semi-hard rocks whose stability and strength quickly drop in the process of contacting the atmosphere. The density of these rocks vary within 2.4-2.6 (clay-shales); 88-2,42gr/cm^3 (marls), Consequently, their strength in the natural conditions and in the water conditions change: for clay-shales the strength changes from 98-72 MPa to 62-51 MPa; for marls the strength changes from 32-34 MPa to 28-29 MPa.

483. These layers of stratum are distinguished with the selective dependency to the weathering process and the weathering products are distinguished with a different geometry and granular content. Marl limestones are relatively stable and produce coarse broken products, where those beyond 50-200 mm account for 45-60% of the total content.

484. In the rocks of marl and clay-shales a strong weathering area of detritus and broken rock is developed which produces thin-layer slates.

485. The above described main rocks under the conditions of relevant relief and with the surface inclination less than 45^0, are covered from above with the Quaternary slope, alluvion and glacier deposits.

486. Slope deposits are particularly common whose lithological and fractional content and thickness depend on the petrography of main rocks, and on their strength and resistance to the weathering and denudation processes.

487. Usually, a coarse detritus colivial formations are produced in the area of usual 'Dizi Series' metamorphic and Bajocian volcanogenic complex, as well as in the Lower Cretaceous Age carbonate rocks, at the foot of slopes. Their thinness mostly fluctuates within the first 10 m. The Cretaceous land slide material is characterized by a completely different geometry and is dominated by the block talus material, where the fractions above 100 mm account for 33-55%; the fractions less than 2 mm amounts to 2.5-7% in the 'Dizi Series'; 4,5-11% - in the volcanogenic rocks; and 8-18% - in the Cretaceous carbonate flysch.

488. Of the slope complex, in respect of the extent of spread of lithological-facies content and the landslide and mudflow developments therein, the Eluvial and Deluvial deposits draw a special attention. These kinds of deposits are distinguished by its thickness, and low engineering-geological characters. They are products produced on the slate and marl rocks of Lower and Mid Jurassic Period slate type sets of sediments and Cretaceous carbonate flysch. Their thickness is particularly significant in the areas of tectonic fault of slate type layers of rocks. Under the conditions of significant inclination the weathered material of these rocks create cone character loop shapes of thin-layer easily movable taluses and in the areas where they are being deeply disintegrated and the dispersive material is subject to torrential surface washes, strong formations of clay deposits are being formed on the low inclination relief which represent a key factor in provoking landslide process. As usually, given these types of genesis formation, and because of the lithological content of bed-rocks, the content of clay facies ranges within 30-38% and the detritus ranges within 25-40%. The clay facies is of clay and clay-like composition whose physical and mechanical properties are as follows: volumetric mass is 1,6-2,0gr/cm^3, the porosity is 20-43%, the natural humidity is 25.5% (the formations developed on the clay-slate layers of stratum are especially distinguished with their high humidity); Ten plasticity numbers range within 18-24 and the saturation number range within 0.8-6.0%. The displacement resistance is as follows: the cohesion - 0,450-1,250f.kg/cm^2, the angle of internal friction is $7\text{-}32^0$, the porosity coefficient is 5kg/cm^2-0.510-0.700, and the settlement coefficient is 2.75-95. It is noteworthy, that the characteristics of displacement resistance of clay deposits and deformation significantly decreases and respectively the angle of internal friction ranges within $5\text{-}24^0$ and the cohesion is 0,100-0,300f.kg/cm^2.

489. The pluvial mantles on the study territory are presented by the alluvial–fluvioglacial and proluvial genesis.

490. Alluvial–fluvioglacial mantles construct the riverbeds of river gullies and low terraces which are facially represented by shingle and boulders, coarse-grained sands and rarely - by the sandy-loam. According to the geophysical characters their thickness is within the range of 2-25 m. The granular content of alluvial deposits examined in the river gorges shows that the fractions higher than 2000 mm (25-41%) dominate everywhere in the area and those less than 2mm are within 2-5% range. An exception to this is the content of II terrace where this fraction (that is less than 2 mm) increases up to 9.5%.

491. Proluvial mantles, the majority of which is of mudflow genesis, mainly structure the detrital cone of Riv. Enguri tributaries. The lithological-fractional content of proluvial mantles and their thickness depends on the petrographic content of the bed-rocks, their stability and the energy of the Rivers. According to the geophysical surveys the thickness of these deposits ranges from 2-5 to 30-50 m. These deposits mainly are the mix of mud-and-stone flows and block talus - broken rock - clay facies mass. Since the proluvial mantles are of mudflow genesis, the formation of these deposits and sedimentation in the area of detrital cones periodically takes place and we encounter not only renewable mantles, but also the old mantels on the high terrace like surfaces cut by the Rivers. Besides, their granulometric-facies content is somehow different. Though the coarse block talus and broken rock material is dominant in the proluvial mantles, their existing fine grained material significantly increases in the structure of the old detrital cones. For instance, if the fraction which is less than 2 mm, ranges within 5-10% in the current mantles, in the structure of old detrital cones it increases to 15-30%.

492. The Pleistocene glacier deposits are quite significantly spread in the study territory. All large tributaries of the Riv. Enguri (such as, Mestiatchala, Mulkhura, Nenskra, Nakra, Dolra, etc), and the upper line of the gorges are structured with these deposits. Almost all the settlement areas existing at the Riv. Enguri tributaries are located on the upper morainal sediments. The same type of glacial sediments are widely maintained on the slopes of the Riv. Enguri gorge itself at 50-500 m relative height from the current riverbed where several stages of pleistocenic freezing stages are clearly observable (7). Glacial deposits and their morphological forms are described for the villages of Nakri, Lamshori, Ushkhvanari, Murkmeli, Becho, Etseri and other villages and the town of Mestia territories. Glacial deposits in all of these territories are presented by coarse block talus and broken rocks, and by the mixed and unsorted clay and clay-like facies. In the glacial deposits the fractions above 100 mm ranges from 27-35% to 55-60%, and the fractions less than 2 mm range from 2.5-5 to 15-19%. Such a big difference in terms of fractions of the glacial deposits is directly dependent on the petrographic content of the bed-rocks and their stability characters. In the crystal slates and morainal mantles contained in the 'Dizi Series' the percentage of fine fractions is less compared with those created in the Jurassic and Cretaceous age slate and flysch layers of stratum.

493. A complex geological structure of Zemo Svaneti and its climatic and relief conditions precondition large scale development of dangerous geological processes in the regions and frequent occurrences of these processes at certain time. Below we include a short description of dangerous geological processes that pose risks for the motor road.

494. The biggest danger is created by mudflow processes, landslides and snowslides. Similarly dangerous are earthquakes and landslide and gravitational events provoked by them. The maximum magnitude of earthquakes is 9 points. It is noteworthy, that in the above mentioned areas the earthquakes of 6-9 points' magnitude have been observed 20 times after 1930. These earthquakes were accompanied with the significant activation of landslide and gravitational processes.

495. Zugdidi-Mestia Motor Road runs all along the Riv. Enguri gorge. In respect of geodynamics, this section of Khaisi-Mestia is the most difficult section. This section is structured of the strongly dislocated and presented by tectonically intensively faulty and fragmented areas of Jurassic period layers of clay slates. For this section of the road Annex 4 includes the maps showing the areas where the landslide and gravitational processes can spread.

496. **Danger of Mudflow and Avalanches**. In the area where the Jurassic period clay slates are spread the mudflow processes develop almost in every secondary tribute and gorge. The

mudflow forming areas fluctuate within 0.1-0.5 km^2 ; mudflows of Riv. Enguri belong to the high active and risk zone.
The threat of avalanches is high on the existing sections of the road: km 90; km 95; km 135; km 138. On the100-120km highway the avalanche threat is relatively low. The danger is increases at the sections of the alternative route (km 0; km 3.5; km 6.5 of Tskhumari; and km 9)

497. **Landslides.** A normal functioning of the motor road is particularly hampered by the wide spread of landslide and gravitational processes. Surface landslides mainly emerge on the slope mantles and in the areas of active weathering and do not pose a significant threat to the motor roads. One of the most hazardous landslides is located on KM 109 and is developed on the eroded right slope of the r.Enguri gorge.The relief is wavy and hilly with the stepped stable landslide processes being in dynamics. The slope is covered with the shallow forest and bushes with the slope surface inclination ranging within $15\text{-}50^0$. 3 landslide steps with the total surface inclination of $15\text{-}20^0$ and the inverted topography in the landslide steps, covered with grass and bushes, are observed.

498. The total spread area of landslide relief along the slope exceeds 300 m and the landslide body in the dynamics is within 170 m. The geometry of the landslide body is of circular character. The landslide body existing above the road is of blocking and creeping character whose central part transforms into the creeping and plastic dynamics and it covers both the subgrade of the road and its lower small section as well.

499. The landslide area of 'Malaia Tvibra' is located on the right slope of Riv. Enguri, on the territory of Village of Pari, at km 114 of the motor road. The slope of Riv. Enguri on this area is characterized with fractured profile.

Fig 9. Landslide "Malatvibra" (114 km)

Fig10. Landslide "Malatvibra" (114 km)

500. Above the road the relief is presented with the linear morphological hillock the surface of which is modified by the pleistocenic freezing, An average inclination of the slope is 25-350 and is covered with the shallow forest and weakly dissectioned by the gorges (see photo 10). In this area of the slope morphologically there are three landslide steps out of which two landslide steps are currently in the stable condition and the lower one, which immediately adjusts to the motor road , is in the active dynamics and is characterized with the frontal morphology and spreads along the gradient of the road subgrade. The spread length of the landslide body along the surface in the second half 1980s amounted to 150 m, and by 2008 it increased up to 700 m out of which the landslide body which is in the significantly active dynamics spreads up to 200 m, in where the processes engaged the road subgrade and the lower part of the slope, where the packages of faulted layers of broken rock-clay-slates in the landslide body are displaced. Within the boundaries of the landslide body the layers of stratum of clay slates is so deeply faulted and disintegrated tectonically that the bed-rocks are mixed and turn into the black clay facies. The gorge existing in the North-West part of the landslide body which actually gives a landslide contour is developed in the immediate area of tectonic faults. Springs of various flow rates emerge in many places of the landslide body in the active dynamics.

501. The landslide at Vill. Becho is to be highlighted out of the landslides developed in the slope deposits, periodic activations of which hamper the movement on the motor road to some extent.

502. There are two such landslide bodies on the right slope of the Riv, Enguri gorge, in the territory of Vill. Becho (km 120). One of the landslide bodies is to the South-West at 4.5 km from the village and the other is at 2 km to the West. Both of the landslide bodies are developed in the slope deposits of the Lias clay slates. The area of one of the landslide bodies is 7.8 ha and that of the other is 1.5 ha. The deformation depths of the landside bodies respectively amount to 5 m and 2 m. A dynamic activity of these types of landslides is directly related to the increase of humidity in the soils due to the precipitation and they have the fluidity nature with the

activation periods mostly coming on early spring and Fall. Every activation of landslides threaten the normal functioning of the motor road.

503. The landslide areas are out of the sections included in the proposed investment project. The reconstruction of landslide-prone sections is separated as special subprojects and will be funded by other donors.

B. Ecological Resources

1. Forests

504. From its source Riv. Enguri flows to the Ushguli community via the quite wide gorge, which was developed as a result of pleistocenic freezing. In this section of the gorge there is almost no trees and vegetation.

505. From the mouth of Riv. Mulkhuri, Riv. Enguri enters a wide, erosive gorge though quite big and significantly inclined erosive terraces. Vill. Becho, Etseri, Pari and others are located on these terraces. The primary vegetation in the settlement area is no longer observed and is mainly represented by the secondary bushes and of deciduous plants on small areas. Signficant forests are observed only on the high slopes of the Caucasusioni and the Svaneti Ridges.

506. Thus, based on the review of the literature and the field surveys the following sensitive areas has been found in the corridor of planned Khaisi-Mestia motor road. They are mainly the forests along the road and immediately adjusting to it:

(i) A small section at 100 km (Riv. Manshura Gorge);
(ii) A small section at km 104 (Riv. Ladlina Gorge);
(iii) The territory between 120-126 km to the left of the road (from Village Dolasvip up to Village Martskhvarishi).

Table 10 The species from the red list of Georgia which are observed in the areas of the planned motor road of Khaishi-Mestia Corridor

	Latin	Category of the protected area
1	*Castanea sativa* Mill.	VU
2	*Quercus macranthera* Fisch. et Mey.	VU

507. It needs to be noted that the red list species of Georgia consisting of 56 species is not a complete list. At now the list is being modified. Specifically, the grass plants are being identified according to the IUCN categories (the categories showing their conditions and vulnerability statuses are being identified). By using these data the actual number of the species on the red list of Georgia will be significantly increased).

2. Rare or Endangered Species

508. The highway corridor to be reconstructed is located in two main landscapes: there are deciduous and mixed forests and the secondary meadows surrounding the settlements and which are used as pastures and cornfields. A main landscape in the road reconstruction corridor is represented by the forest. In the hardly accessible areas the forest is well preserved and in the easily accessible areas it is quite degraded by the human impact (cutting) on it. The road

from Khaisi to Mestia is located in the Enguri Gorge and runs along Riv. Enguri. The highway crosses or passes in the immediate vicinity of many large or small rivers and brooks, among which Riv. Enguri, Khaishura, nenskra, Nakra, Khumproeri, Dolra, Mulkhura and Mestiatchala need to be highlighted.

509. According to the zoo-geographical division the South Caucasus belong to the Sub-County of East Meditation Sea of Paleractic County. The highway crosses the Caucasus part of this Sub-County (Vereshagin, 1958; Gazhdiev 1986).

510. The species included in the red list of Georgia (here we include the species which dwell or may present in the corridor impacted by the Khaisi-Mestia highway).

511. The land area of Kolkheti Park consist of 28571 ha, the sea area is 1574 ha. The Paliastomi Lake located in the territory of the Park is be highlighted. Its total area is 18.2 sq.m., and the maximum depth reaches 3.2 meters. The Paliastomi Lake is rich with fishes, especially with pike perch and grey mullet. The Paliastomi Lake can be considered as one of the significant reservoirs for pike perch. Overall there are 88 known fishes in the territory of the Kolkheti National Park among which 44 dwell in the Black Sea, 21 dwell in the fresh waters and 23 fishes travel from one place to another. Out of other fishes in the Black Sea salmons, herrings, Atlantic sturgeons need to be highlighted. The Paliastomi Lake along with the Black Sea water area are one of the significant regions for migration of birds from Africa and Eurasia and swamp birds. There are 194 species of birds that nest and winter in the moist forests, swamps and rivers, out of which 76 species are migratory, 62 are inhabitants, and 56 are winter species. Out of the winter specifies the goose, white- fronted goose, wild goose, whooper swan, Dalmatian pelican, black stork, small white heron, and white tailed eagle.

Table 12 The species which are observed in the areas of the planned motor road of Khaishi-Mestia Corridor

№	Species	Status	Location
Mammals			
1	Barbastella barbastellus	**VU**	*Construction Area*
2	Sciurus anomalus	**VU**	*Construction Area*
3	Sicista kluchorica	**VU**	*Nearby Construction Area*
4	Prometheomys schaposchnikovi	**VU**	*Nearby Construction Area*
5	Lynx lynx	**CR**	*Construction Area*
6	Lutra lutra	**VU**	*Construction Area*
7	Ursus arctos	**VU**	*Construction Area*
8	Capra caucasica	**EN**	*Nearby Construction Area*
9	Capra cylindricornis	**VU**	*Nearby Construction Area*
10	Rupicapra rupicapra	**EN**	*Nearby Construction Area*
Birds			
11	*Aquila chrysaetus*	***VU***	*Construction Area*
12	Buteo rufinus rufinus	**VU**	*Construction Area (Hunting Zone)*
13	Neophron percnopterus	**VU**	*Construction Area (Hunting Zone)*
14	Gypaetus barbatus	**VU**	*Construction Area (Hunting Zone)*
15	Aegypius monachus	**EN**	*Construction Area (Hunting Zone)*
16	Gyps fulvus	**VU**	*Construction Area (Hunting Zone)*

17	Aegolius funereus	**VU**	*Construction Area*
18	Tetrao mlokosiewiczi	**VU**	*Construction Area*
19	Panurus biarmicus	**VU**	*Nearby Construction Area in aquatic zone*
Reptilian			
20	Vipera kaznakovi	**EN**	*Construction Area*
21	Vipera dinniki	**VU**	*Construction Area*
Fishes			
22	Salmo fario	**VU**	Medium and big size rovers
23	Varicorhinus sieboldi	**VU**	River Enguri
Invertebrate			
24	Phassus shamil	**EN**	***Construction or Nearby Area***
25	Eudia pavonia	**VU**	***Construction or Nearby Area***
26	Manduca atropos	**EN**	***Construction or Nearby Area***
27	Callimorpha dominula	**VU**	***Construction or Nearby Area***
28	Callimorpha quadripunctata	**VU**	***Construction or Nearby Area***
29	Axiopoena maura	**EN**	***Construction or Nearby Area***
30	Parnassius Apollo	**VU**	***Construction or Nearby Area***
31	Parnassius nordmanni	**EN**	***Construction or Nearby Area***
32	Allancastria caucasica	**VU**	***Construction or Nearby Area***
33	Erebia iranica	**VU**	***Construction or Nearby Area***
34	Polyommates daphnis	**VU**	***Construction or Nearby Area***
35	Zygaena fraxini	**VU**	***Construction or Nearby Area***
36	Bombus eriophorus	**VU**	***Construction or Nearby Area***
37	Bombus alpigenus	**VU**	***Construction or Nearby Area***
38	Bombus persicus	**VU**	***Construction or Nearby Area***
39	Xylocopa violacea	**VU**	***Construction or Nearby Area***
40	Rosalia alpine	**EN**	***Construction or Nearby Area***
41	Onychogomphus assimilis	**VU**	***Construction or Nearby Area***
42	Astacus colchicus	**VU**	***Construction or Nearby Area***
43	Eisenia transcaucasica	**VU**	***Construction or Nearby Area***
44	Dendrobaena faucium	**VU**	*Construction or Nearby Area*
45	Helix buchi	**VU**	*Construction or Nearby Area*

3. Protected Areas

512. In Georgia the history of Protected Areas dates back many centuries. The first Protected Area – Lagodekhi Strict Nature Reserve was established as early as 1912. At present the total area of Protected Areas is 495 892 hectares, which is about 7 % of the country's territory. About 75 % of Protected Areas are covered by forests. There are 14 Strict Nature Reserves, 8 National Parks, 12 Managed Nature Reserves, 14 Natural Monuments and 2 Protected Landscapes in Georgia. Primary function of the Protected Areas is protection of natural heritage of the country.

Table 11 Date of protected areas of Georgia

Protected Area	Management type	Size in hectares	Marine area	IUCN Category	Latitude	Longitude
Ajameti	Nature Reserve	4,845		IV	-14.519105	22.573145
Akhmeta	Nature Reserve	16,297			-12.260223	30.86119
Algety	Nature Reserve	6,822		III	-17.875123	25.81281
Bichvinta-Miusera	Nature Reserve	3,645			-8.659493	29.44296
Borjomi	Nature Reserve	17,948			-11.125663	30.57781
Kazbegi	Nature Reserve	8,707			-12.517351	32.23696
Kintrishi	Nature Reserve	13,893		IV	-12.582472	30.21586
Kolkheti	Nature Reserve	500		IV	-12.7526	32.58976
Lagodekhi	Nature Reserve	17,932		IV	-16.397579	25.984675
Liakhvi	Nature Reserve	6,388		IV	-10.6	33.61
Mariamjvari	Nature Reserve	1,040		IV	-12.16	24.83
Pskhu-Gumista	Nature Reserve	40,819		IV	-15.98	27.25
Ritsa	Nature Reserve	16,288		IV	-12.98	27.85
Saguramo	Nature Reserve	5,359		III	-9.86	28.95
Sataplia	Nature Reserve	354			-10.11	30.58
Vashlovani	Nature Reserve	8,034		III	-8.6	31.25

513. The nearest protected area from project area is Kolxeti National park (Distance from construction area 200 km), which is located in West Georgia, in the Kolkheti coastal plain lying between the mouths of the Tikori and Supsa. The Kolkheti National Park covers an area of 28 940 ha of land, spread over the administrative districts of Zugdidi, Khobi, Lanchkhuti, Senaki and Abasha and includes 15 742 ha of marine territory. The park was established in 1999 as part of Georgia's Integrated Coastal Management Project with the financial support of the World Bank (WB) and the Global Environmental Fund (GEF). The National Park includes the Kolkheti State Nature Reserve established in 1947 (500ha) and the adjacent wetlands, including the Paleastomi Lake.

C. Socio-Economic Resources

1. Power sources and transmission

514. After Georgia became independent, the process of energy sector rehabilitation was started, and this brought together the formation of electric power system as a separate independent structure. In particular, the generation plants were formed as independent electric power stations. Munisipality of mestia is a part of the system and in difference with the last year's energy crisis, now the limit on electric energy and accidents in the area per day decreased. The quality of reliable energy supply, also price rate indicator of electric energy use increased.

2. Tourism Facilities

515. Svaneti is the most beautiful region not only in Georgia but in whole Caucasus. There are lots of feudal era monuments, icons and churches.

516. Main peaks of the Caucasus Mountains and biggest glaciers, whose area reaches 300 km^2, are located in Svaneti. The most important peaks are the following: Tsurungala (4220 m), Ailama (4550m), Shkhara (5068 m), Janga (5060 m), Gestola (4860 m), Tikhtingeni (4620 m). Tetnuldi (4860 m), Mazeri (4010 m), Chatini (4370 m). There is also Ushba's world famous two peak steep rocky massive (4700 m). The benchmark for difficulty and beauty in the Caucasus Mountains is Ushba and in the Alps - Matterhorn (4478 m).

517. Average absolute height of Svaneti Caucasus Mountains peak part is 4,125 m, the maximum height is 5,068 m (Shkhara), and the lowest is 3,168 m (Dongozuroni pass). There are about 20 passes of various difficulties in the section of the Caucasus Mountains; they are the passes to the North, to Russian Federation. The height of the passes fluctuates within the following range: 3,160-3,860 m.

518. Svaneti Ridge is the highest (the highest peak is Lahali, 4,010 m) among Southern ridges of the Caucasus Mountains, which represents divisor of rivers Enguri and Tskhenistkali. Its length is 120 km.

519. Svaneti vegetation is diverse. Coniferous forests start at 800-900 m elevation and alpine belt is from 2450-2500 m to 3100-3200 m. There are also broad-leaved forests with such tree species as Georgian oak, Caucasian hornbeam, lime-tree, mountain maple and etc. Central, 125 km section of the West Caucasus Mountains from Kodori ridge to Pasi Mountain is called Svaneti Caucasus Mountains. The region with highest elevation – Svaneti Region – is located on its South slopes; Svaneti Region's territory includes area from middle part of Rivers Enguri and Tskhenistkali gorges till their origins

Figure 12 Areas in Svaneti for verious types of tourism

Lakes	Ugviri, Koruldi, Meziri (Tvebishi)
Cave	Zargashi (Mestia), Shgedi, Budebrivi Gamokvabuli
Picnic spots	In Mestia: Kakhuri, Hatsvali, Ugviri Pass, Ipari, Kali gorge.
Rafting	Mestia grove, Becho (Shikhi grove), Nekra (upper part), Ushguli
Fishing tourism	Chuberi, Lakhamula, Ipari (Adishura)
Horse riding	Mestia-Jabeshi-Adishi-Iprali-Ushguli (5 day tour, GEL 20 per horse, GEL 40-50 for a guide)
Mineral waters	Ushguli, Kala, Ipari, Mulakhi, 7 spots in Mestia, lenjeri, Tskhumari, Etseri.
Natural monuments	River Adishura, upper part; River Galde-Chaladi basin's upper part ("Perkhuli's Stone").
Hiking	Tviberi-Jabeshi, Chalaadi-Mestia, Ushguli-Shkhara glacier, Zuruldi-Mestia, Mazeri-Tvibeshi, Ushba glacier.
Camping sites	Everywhere
Skiing	_
Waterfalls	Dizshi, Mazerashi-Shdugvra
Viewpoints	Mestia, Zuruldi, Hatsvali, Gvaldi, Tskvzagari, Kheshkildi

3. Agricultural Development

520. Agriculture represents the major economical activity of Samegrelo-Zemo SvaneTi Region. During formation of the market relationships, the regional agriculture has established as a free market-oriented sector. Meanwhile, it shall be noted that the transfer from the planned economy to the market oriented system was very painful due to the weak agricultural strategy implemented in the end of 20th century, as well as in result of constraints associated with structural changes of the regional agricultural units with the later provoked by the loss of traditional trade markets. All above reasons leaded to amendment of the structural pattern of regional agriculture during 1990-2000. The land area used for production of the commercially viable tea declined by 91% accompanied with the drop of production value from 200 to 1 million US dollars (USD). In the same period, the cultivated crop area increased from 29.2 thousand to 70.2 thousand hectares, and the area of hazelnut plantations expanded to 19.4 thousand Ha, turning this fruit into the major export product of the regional agriculture. In addition, the new species as kiwi and feijoa entered the sector and currently the local production of these fruits effectively satisfies entire demand of the country's population.

521. Despite the considerable part of regional cattle breeding assets was concentrated in the former public sector – collective farms and Sovkhozs (state-owned farms), the total head of cattle and hogs had not reduced after liquidation of these facilities. Specifically, based on 2009 data, the total large cattle and hogs inventory comprised 214,913 and 17,217 heads respectively. However, the head of hogs and pigs significantly declined during the last two years due to spread of Montgomery disease.

522. Also, the ownership pattern of regional agriculture changed considerably. Replenishment of the homestead land parcels followed by the ambitious privatization carried out during the recent years significantly amended proportion between the private and state sectors. In accordance with 2009 statistics, 90,213 hectares, i.e. 33.6 percent of agricultural land was in the private ownership.

523. In result of considerable changes in distribution of the arable land within the region, at present 78.9 percent, i.e. 555,625 Ha of arable lots are privately owned, 4.3 percent is leased to farmers and only 14,796.8 Ha are in the state ownership.

524. The similar changes were implemented in distribution of the perennial crop lots leaded to transfer of 62.4 percent (27,455 Ha) of total area under perennials to private landowners, with 37.5 percent (16,518.3 Ha) remained in the state ownership, from which almost 10,000 Ha is used for tea farming.

525. In addition, it shall be noted that almost 100 percent of hayfields and pastures in the region belong to the state sector.

526. The regional agricultural sector has possibility of both extensive and intensive development with the later meaning inclusion of the state-owned wild ground (abandoned land) and unused agricultural lots into agricultural production process through privatization.

527. All abovementioned resulted in gradual growth of the agricultural production as evidenced in the following diagram.

4. Mineral Development

528. The region is distinguished by abundance of mineral water sources comprising more than 200 springs. Mestia District is known by its gold, silver, molybdenum, barite, arsenic, wolfram and marble deposits. The geothermal water sources are located in Tsalenjikha, Chkhorotsku, Zugdidi, Khobi, Martvili and Senaki Districts with the total daily flow of 35 thousand cubic metres. From these, Zugdidi-Tsaishi geothermal field has the highest capacity, with rated flow currently estimated as 14,300 m^3 of 80-100 ^{0}C water per day.

529. There are four major peat deposits in the region, Anaklia (Zugdidi District), Churia and Nabada (Khobi District), Otsantsaleshi (Martili District). Besides these, there are several smaller capacity peat sites as Chataukali (Zugdidi District), Chkhopi and Etseri (Martvili District), Tsakipuli (Khobi District). The total reserve is 48 million tones with total economical value of 333.2 million USD.

530. Various non-ferrous metals extraction sites operate in the region, which forecasted reserves are as follows: gold – 103.7 tones, lead – 300,000 t, zinc – 370,000 tones, copper – 376,000 t, cobalt – 6,000 t, silver – 8.4 t. The total estimated economical potential of this production is 2,985.86 million USD.

531. Facing stone materials are extracted in Martvili, Mestia and Chkorotsku Districts from the deposits of igneous rocks with total estimated reserves of 6,475 thousand cubic metres and potential economical production value of 317 million USD. The estimated volume of marble reserves in Mestia District is 2,992 thousand m3 with economical production value of 441 million USD. The limestone deposits usable in facing are located in Mestia, Martvili and Tsalenjikha Districts and have the total estimate capacity of 1,089 thousand m3 with economical value of 75 million USD. The sources of saw rock and debris materials are represented by limestone deposits located in Martvili, Senaki, Chkhorotsku and Tsalenjikha Districts and have the total estimate reserves of 25,033 thousand m3 with economical value of 248 million USD. The quarries of construction sand and gravel material located in Senaki, Abasha, Chkorotsku and Tsalenjikha Districts have the total estimate production capacity of 1,089,119,162 thousand m3 and economical value of 952 million USD. The lime is extracted at limestone deposits of Mestia, Senaki, Zugdidi and Tsalenjikha districts, which total estimated reservs account to 102,418 thousand m3 with economical value of 79 million USD. Brick earth barrows are located in Tsalenjikha, Chkhorotsku, Zugdidi, Senaki, Martvili, Khobi and Abasha districts and have the total estimated reserves of 13,267 thousand m3 with economical value of 249.8 million USD. The total estimate capacity of gypsum and anhydrite deposits located in Tsalenjikha District is 12,584 thousand tones with economical value of 319 million USD. Barite deposits are located in Mestia, Tsalenjikha, Martvili and Zugdidi districts, but no estimated capacities are available. Besides above, the region has the reserves of fresh water, healing water and minerals and gemstones. The total economical potential (value) of the on-balance regional natural resources - 3,439.4 million USD; forecasted resources – 2,996.9 million USD; The gross economical potential (value) - 6,436.3 million USD.

5. Social and Cultural Resources

a. Population

Munisipalities	2001	2002	2003	2004	2005	2006	2007	2008	2009
Samegrelo-Zemo SvaneTi	**460.6**	**466.1**	**462.8**	**459.5**	**460.4**	**471.0**	**469.8**	**467.7**	**468.0**
Poti	45.2	47.1	46.7	46.5	46.7	47.3	47.3	47.4	47.5
Abasha municipality	26.4	28.7	28.4	28.1	28.1	28.2	28.1	27.9	27.8
Zugdidi Municipality	186.4	167.8	166.7	165.7	166.2	172.2	172.1	171.4	171.6
Martvili Municipality	41.3	44.6	44.3	44.0	44.2	44.8	44.6	44.4	44.4
Mestia Municipality	10.7	14.3	14.2	14.0	14.1	14.1	14.2	14.3	14.4
Senaki Municipality	51.2	52.1	51.8	51.5	51.4	52.2	52.0	51.7	51.7
Chkhorotsky Municipality	26.2	30.1	29.9	29.6	29.6	30.2	30.0	29.8	29.8
Talenjikha Municipality	35.5	40.2	39.9	39.5	39.5	40.5	40.3	40.0	40.0
Khobi Municipality	37.7	41.2	40.9	40.6	40.6	41.5	41.2	40.8	40.8

Official data on regular inhabitants of Samegrelo-Zemo Svaneti during 2001-2009.

532. In the mestia Municipality 99% of population is ethnically Georgian.

6. Health Facilities

533. The network of 22 stationary healthcare facilities is operating in Samegrelo-Zemo Svaneti Region. Based on statistical data, annual load of these facilities is 14,380 patients. The healthcare sector employs 1095 doctors and 1554 medium-level medical personnel. From these, 11 employees hold the highest medical scientific degrees (1 doctor and 10 candidates of medical sciences). The municipal and central district hospitals are equipped by clinical, x-ray and functional diagnostic laboratories, as well as have the endocrinology and ultrasonic diagnostic offices and anaesthesia and intensive therapy departments. The cardiology centre "Guli" located in Zugdidi operates 2 reanimobiles. In 2008, Gejati ambulatory of city of Senaki was improved and fitted with the state-of-the-art medical equipment under the framework of Presidential Program. This facility served 984 patients during 10 months. In addition, the same Presidential Program provided modern equipment for Nosiri ambulatory, which served 1748 patients during 10 months.

534. The St. Luka Medical Centre of city of Zugdidi established on the basis of Republican Healthcare Complex shall be specified, which fully complies with the modern standards. During 10 month, this centre provided healthcare services to 4,500 stationary and 21,000 ambulatory patients.

The list of medical institutions in Mestia District.

#	Medical Institution	Contact information	Number of doctors	Number of nurses
1	"Mestia Clinic and Maternity Hospital" Ltd	10 Rustaveli Street, Mestia, Mobile: 899 57 28 50	15	16
2	"Mestia District Hospital" Ltd	6 Rustaveli Street, Mestia Mobile: 899 61 34 55	8	18
3	"Mestia Ambulance Service – 03" Ltd	2 Stali Street, Mestia, Mobile: 899 14 07 56	8	12
4	Dental clinic	16 Rustaveli Street, Mestia, Mobile: 899 910893	3	2
5	non-entrepreneurial legal person "Mestia Public Health Service"	6 Rustaveli Street, Mestia, Mobile: 895 956109	6	5
6	Ushguli Outpatient Clinic	Ushguli Village, Mestia,	1	1

		Mobile: 898 398174		
7	Ipari Outpatient Clinic	Ipari Village, Mestia, Mobile:895 134960	1	1
8	Tsvimri Outpatient Clinic	Tsvimri Village, Mestia Mobile: 893 4187 64	2	1
9	Mulakhi Outpatient Clinic	Mestia, Mulakhi Village Mobile: 893 418764	1	1
10	Latali Outpatient Clinic	Mestia, Latali Village Mobile 899 92 33 79	1	1
11	Tskhumari Outpatient Clinic	Mestia, Tskhumari Village, Mobile: 899 79 75 29	1	1
12	Becho Outpatient Clinic	Mestia, Becho Village, Mobile: 899 47 43 71	1	1
13	Etseri Outpatient Clinic	Mestia, Etseri Village Mobile: 899 39 85 99	1	1
14	Nakra Outpatient Clinic	Mestia, Nakra Village Mobile: 899 64 85 52	1	1
15	Chubra Outpatient Clinic	Mestia, Chubra Village Mobile: 899 25 13 58	1	1
16	Khaishi Outpatient Clinic	Mestia, Khaishi Village	1	1
17	Lakhamuli Outpatient Clinic	Mestia, Lakhamula Village: Mobile: 899 97 28 15	1	1

Figures 11. Mestia ambulance office **Figures 12. Mestia ambulance staff.**

a. Mestia Branch of Social Service Agency

535. In accordance with 1 January 2010 statistics, 3,025 pensioners are registered in Mestia District, including 34 war veterans and 406 various category disabled persons. From the 2,380 households recorded in the district, 620 are registered as indigent (below poverty level). Number of district residents provided with health insurance policies is 4,175.

7. Education Facilities

536. Based on information of the Ministry of Education and Science of Georgia, 282 secondary schools (including 25 one private ones) and 3 orphanages operate in Samegrelo-Zemo Svaneti Region.

537. In Mestia District there are 24 secondary schools with 2,117 pupils, school children's house, four sport schools, art school, music school, central and village libraries, village clubs and cultural centres.

538. From the villages located immediately along the road the full-fledged (grades 1-12) public schools are in Pari (Fig. 17), Etseri and Becho. The primary schools (grades 1-4) are in Qvemo Luha, Ladreri and Qartvani (Fig. 18). No public schools are in Nogari, Lakhani, Zemo Luha and Lankhvari, from where children go to schools located in the nearest villages

Figurei 13 Village Fari

Figure 14 Vollage Ladreri

539. From the 21 state and 108 private higher education institutions, which are certified at present by the Ministry of Education and Science of Georgia, the following two are located in Samegrelo-Zemo Svaneti Region:

(i) Shota Meskhia State University (opened in 2007)
(ii) Zugdidi Independent University.

8. Physical or Cultural Heritage

540. Khaishi-Mestia Motor Road practically entirely runs along Enguri River valley. Below are listed the various age and nature monuments/artefacts discovered incidentally or through archaeological excavations at the settlements located along this valley and its branches.

541. In 1969, during construction of Enguri Hydro Power Plant, the multi-layer archaeological monument was destroyed, which based analysis of recovered items belong to II-I Millenniums B.C.

542. Village of Khaishi – Khaishi Treasure, I c. B.C – I c. A.D.; discovered in 1948 during conduct of earthworks. The treasure included: silver bowls and drinking vessels, gold adornment, necklaces, buckles, pendants decorated with images of fabulous animals and figures of musicians playing on reed-pipe and 'chianuri' (string instrument).
In the same village, the 'baksania'-type metal casting furnace was destroyed due to blasting; the bronze ingots survived.

543. Khudoni fortress is located in the same village.

544. Chuberi Community – Early ancient period (VI-IV c.c. B.C.) burial ground has been studied, which was discovered during archaeological excavations carried out at the left terrace of Nenskra River (left tributari of R. Enguri), at Larilari Site. The cremation platforms graded by stones and compacted clay revealed. It was been identified that the deceased was burned

together with the enclosed personal possessions. Thousands of items were discovered: ceramic vessel, metal tools and armaments, bronze-made plastic images of the sheep, bull, horse, dog, wild goat and bird; beads made of glass, pasta, amber, agate, bronze and other material; glass pendants and amulets with bird images. Large quantity of bronze bracelets, buckles, bells and fibulas decorated with astral and animal-faced art images. Among the particularly distinguished artefacts discovered at this site were the horse tack elements including the strap clasps, metal bit and images of the horse head and neck painted on the ceramic vessels. Also, along with the local products, the items made in various Greek and Asian civilization centres were discovered including Phoenician and Egyptian polychromatic glass beads, and black/red varnished Greek ceramic drinking containers.

545. In addition, the metallurgical production remains were identified in the same community, at Skhibra Site with the smaller portion excavated (VII-VI c.c. B.C).
The medieval fortresses and cult structures were found within the village of Idliani of the same community.

546. **Village of Ipari** - the incidental archaeological artefacts comprising the bronze items were discovered.

547. **Village of Dizi** – the incidental archeological artefacts comprising the metal plough and Late Antic burial items.

548. **Etseri Community** – Early Antic period (VII-IV c.c. B.C.) settlement mound was discovered. The dwelling surrounded by stone masonry wall; cult worships (IV c., alters), entire complex of household structures. The walls of structures mainly are built by stone masonry using the clay mortar. The rich archaeological material was revealed, including the particularly important items as bronze hoes, iron ploughs and ancient grain crop species.

549. **In the same community** – smaller scale archaeological excavations were carried out at the remains of Lamaria Church.

550. **At village of Ledredri of the same community** – in 1932, during road construction works, the bronze daggers and crescent was discovered together with the ceramic vessels (X-VII c.c. B.C.), which are stored in Mestia Museum.

551. **In 1974**, during construction of Mestia-Zugdidi motor road, the medieval burial ground was disrupted **in village of Etservi**. Later the inventory of glazed ceramic bowls, glass containers for perfume and parts of the black-burnished silver belt were found among the local residents employed at construction works.

552. **In Tskhumari Temi** – the remains of medieval structures were completely destroyed at Tvirbishi Site during rock excavation for construction of the local kindergarten. Later smaller portion of discovered material (ceramics, hand-mills, pestles) were collected from local residents.

553. **Village of Qartvani of Becho Community** – the cultural archaeological layers were destroyed during grading the yard for construction of the private residential house. The part of discovered items, including the bronze daggers, disk-shaped clasps, and bullhead and sheep sculptures were delivered to Mestia Museum. Based on results of analysis of the discovered items, the specialists assume that this site should be a burial ground.

554. **Latali Community** – more than 30 various period archaeological monuments were recorded by Archaeological Expedition.

555. **Lenjeri Community** –incidental discovery – black varnished Greek lekythos (oil jar) aged VI-V c.c. B.C.

556. **Mestia Community** – known incidental discovery – Egyptian Scarab Beetle.
Numerous incidentally discovered artefacts were found and several archaeological sites were excavated in upstream villages of Enguri Valley including Ushguli, however at this time they are out of our consideration area.

557. It shall be emphasized that the list provided above includes only part of the monuments/artefacts which were possible to locate along the study road alignment using available references. Unfortunately, in the specialist references the exact locations of the monuments are specified in selfdom or almost are not provided at all.

558. The cultural and historical heritage samples of highland part of historical Colchis listed above have the function of original source material for highlighting not only the past of Colchis, but for studying the remote history of other Georgian tribes occupying the entire Caucasus highland, and identification of their role and importance in the Georgian history. These artefacts and monuments also contribute to improved knowledge about the history of trade, economical and cultural relationships with the neighbouring and remote countries.

559. Based on all above, we believe that it is necessary to undertake supervision of the reconstruction works along the entire road alignment by respective specialists to avoid recurrence of the previous adverse cases and exclude destruction of the cultural heritage of this important Georgian region.

560. Such consideration leads to necessity of applying the careful approach to the earthworks, adherence to the archaeological management procedures and engagement of employees of the Ministry of Culture and Archaeological Research Centre in case of archaeological discoveries.

a. Historical Sites

561. The scope of cultural heritage monuments of Mestia District comprises 45 churches with frescos in Mestia District, as well as other 107 churches, 311 Svanetian towers and more than 100 Svanetian Houses (Machubi).

562. Church of the Saviour (Matskhvari) in vil. of Chvabiani of Muzhali Community was built in X century. The structure has protruded apse. Its interior is equipped with five-arched iconostasis. The apse was painted in the same X century, during reign of Bagrat III. The painting is distinguished by its refined colouring. The precious sky-blue paint was used that is unique for Svanetian paintings. The church was repainted in XIII c.

563. St. Kvirike, the St. Ivlite church (Svanetian name – Lagurka) is located in village of Kala, single-nave church. In medieval centuries this church comprised the monastery complex. The church was painted in 1112 by royal painter Tevdore, who previously in 1096 painted the Archangel Church in Ipari. The entire treasure of Kala Community is secured in the church, including the medieval embossed and painted icons. The enamel-decorated icon of holy relics called Shaliani Icon by Svans.

564. Saint George church in village of Nakipari was built in X century using the yellowish calcareous tuff. It is the single-nave chapel, which eastern facade is decorated by painting and sculptured animal images (bull, chamois, deer, lion and bear). The interior was painted in 1130 by royal painter Tevdore. The painting is very impressive and is distinguished by interesting art techniques. The special attention is attracted by the vault painting representing the known version of supplication, and heraldic type images of the Saint Riders (Saint George and Saint Tevdore) painted on the north wall. The embossed icons of XI-XII-XIII centuries are secured in the church, as well as the Saint George icon made by Asan, gold-smith living in XI c. (ordered by Marushin). The church is functional.

565. Church of the Saviour (Matskhvari) is located in vil. of Latali, Mestia District. This X century church is of single-nave type and is built of calcareous tuff. Interior was painted by Mikhael Maglakelidze in 1140, in the 15th year of reign of Demetre I that is noted by Asomtavruli writting. The painting is characterised by emphasized decoration. The image of inauguration ceremony of Demetre I is painted on the north wall. The church is rich with medieval painted icons. Also, the church houses the byzantine pictoral cross of XII century adorned by enamels using the plique-a-jour technique. The church is functional.

566. Lagami Church of the Saviour (Matskhvari) is located in village of Lagami, older Mestia. This is two-storey single-nave church. The wall painting of the first and second floors are of X and XX centuries respectively. The interior and facade of the second floor are painted in XIV century.

567. The ancient dwelling complex of Margiani brotherhood is located in Lanchvali, historical section of Mestia. The complex was built in XIV c. and comprises 'Machubi' (dwelling house) with large hall, summer terrace-type structure 'Guband' and adjoining multi-storey tower built by large stone quadrants.

568. Svaneti History and Ethnography Museum. The museum was established in 1936 by ethnographer Egnate Gabliani. The exhibition halls and storage facilities of the museum house very important samples of the Christian culture. The cultural and material monuments kept in the museum are characterised with widespread chronology from the archaeological artefacts of III Milenium B.C. to the Common Era monuments.`

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Design phase

N	Project Related Impact	Yes/No	Comments
1	Route alternatives and impact: • Geo hazardous areas • Sensitive ecosystems • Land use	Yes	In terms of impact on land use and private households and crossing sensitive ecosystems the rehabilitation of the existing road corridor and utilization of new land is recommended. However, the existing road crosses some sections hazardous in terms of landslips and with the aim to mitigate risks the selection of optimal route could be better
2	Alternative places for inert material quarries, waste disposal areas, asphalt making, builders' camps, fuel filling and material storage territories	Yes	Air pollution with dust / emissions depends on the appropriate selection of working areas (away from residential areas). For landscape impact minimization less sensitive landscapes will be chosen
3	Soil erosion, instability and road wash out	Yes	Complete project is significant to reduce

	caused by slope erosion; river pollution with sediments		these negative impacts: project of temporary and permanent drainage systems, reinforcement structures, berms and earth fills, project on anti-erosive engineering constructions and restoration plan
4	Planning, selection and design of cross sections	Yes	Improvement of safety and local travel.
5	Compliance with international technical standards	Yes	Effectiveness of safety, exploitation and maintenance / repair
6	Noise and emissions related with automobile traffic	Yes	Significant impact of emissions and noise on those residential areas is not anticipated which are more or less away from the designed automobile road section
7	Artificial constructions, drainage systems and other road infrastructure	Yes	Appropriate design determines the sustainability and safety of infrastructure elements. The landslip-gravitational processes are anticipated on the mentioned section of the highway: landslips, rock slips, avalanches. Mudflow centers are less dangerous. The risk of the development of erosive processes also exists. Within these conditions appropriate design of drainage systems and other protective constructions of surface waters and slope waters is important
8	Damage to other infrastructural elements	Yes	Risk of damaging electricity lines and towers. The project should provide for the protection or moving of the existing towers

B. Construction Phase

N	Project Related Impact	Yes/No	Comments
1	Elimination or long term degradation of the natural landscape (relief, soil, vegetation, habitats and wildlife) within the right of way	Yes Insignificant	Along the RoW
2	Long term degradation of the natural landscape (relief, soil, vegetation, habitats and wildlife) at the access roads, pits, areas of allocation of solid waste, construction areas and equipment storage yards	Yes medium	In the waste disposal areas From incorrect exploitation of borrow pits.
3	Landslips and other hazardous gravitation processes, land subsidence, risk of stimulation of landslip and gravitation processes as a result of construction works	yes	Km 109, 114, 115-116; 120; 125 – 126; All geohazardous sites are located on the sections of road, which are not included in the proposed investment project. These sections are addressed by specific projects. Proposed investment project does not cross any major geohazard prone area.
4	Provocation of erosion by land works and disruption or filling (as a result of filling with sediments) of natural drainage channels connected with the road construction and under the road surface caused by concentrated flow from surface or underground drainage channels	Yes medium	Along the RoW
5	Increase of average weighed sediments in	Yes	Along RoW and bad of River rioni

	surface water objects (rivers, rivulets, lakes) as a result of erosion and earthfill washing connected with the construction. Deterioration of water quality and increase of sediment volume	medium	
6	Impact of the construction of the water ecosystems of rivers, rivulets and lakes, which shall be crossed by the highway. Indirect impact related to possible turbid processes in r. Enguri caused by sediments washed during land and concrete works. Increase of sediments due to intensified erosion	Yes Medium, indirect	Impact related to possible turbid processes
7	Pollution of soil and water with oil, lubricants, fuel and paint (construction corridor; equipment storage and asphalt factories)	Yes Medium,	Construction camps.
8	Impact connected with the debris and construction waste. 260000 m^3 debris will be created during the road rehabilitation	Yes important. Most important problem of the project	Along the RoW.
9	Waste within construction corridors and road; bad sanitary conditions in construction camps and areas (sewage, sanitary conditions, waste management)	Yes Medium,	Along the RoW
10	Air pollution by construction equipment and transport in residential areas, which are crossed by the highway. Among these especially notable are district centers and densely populated villages. Dust on construction areas and access roads	Yes Medium,	Nearby the villages along the RoW
11	Air pollution by asphalt factories	Yes Medium,	Dama Mestia and village Dgorkvali (Asphalt plants location areas)
12	Negative impact of car noise in residential areas, which are crossed by the highway. Among these especially notable are district centers and densely populated villages	Yes Medium,	Nearby the villages along the RoW
13	Poaching of construction workers	Low	River Enguri
14	Creation of favorable temporary natural habitats for disease carrying insect breeding (artificial puddles, etc), pooling of water in pits, etc. All these are favorable for mosquito breeding and carriage of diseases. Pollution with biological material during land works in the vicinity of mounds (among these, unregistered) (i.e. anthrax)	Yes Medium,	Along the RoW
15	Negative impact of noise dangerous to health and emissions by transport, creation of dust during construction	Yes Medium,	Nearby the villages along the RoW
16	Impact on archeological monuments	Yes	Along the RoW
17	Creation of dangerous conditions for vehicle at the areas where the construction involves functioning roads	Yes Medium,	Nearby the villages along the RoW
18	Impact on existing infrastructural elements: high voltage transmission lines	Medium or high	Along the road
19	Risk of casualties connected with cars and other transport, which could result in spill of toxic substance, exploding of explosive cargo, death or damage to people	Yes Medium,	Along the road Nearby the villages along the RoW

C. Potential Environmental Impact - Construction Stage

Activity	Impact	Impact Type							
		Direct	Indirect	Positive	Negative	Reversible	Irreversible	Temporary	Residual
Ground cleaning and leveling in right of way	Landscape and habitate degradation and errosion	+			+		+		+
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Pollution of soil and surface waters		+		+	+		+	
Construction of the new pavement, installation of paving	Landscape and habitate degradation and errosion								
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Pollution of soil and surface waters		+		+	+		+	
Borrow excavation	Landscape and habitate degradation and errosion	+			+		+		+
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Pollution of soil and surface waters	+			+	+		+	
Trsnsporting sand and gravel from the borrows. Supply of building materials.	Landscape and habitate degradation and errosion								
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	

	Ground pollution and/or waste generation		+		+	+		+	
	Pollution of soil and surface waters		+		+	+		+	
Demolition of the old paving during rehabilitation of the existing pavement	Landscape and habitate degradation and errosion								
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Pollution of soil and surface waters		+		+	+		+	
Disposal of the extra ground and waste	Landscape and habitate degradation and errosion	+			+	+		+	
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Pollution of soil and surface waters		+		+	+		+	

D. Exploitation Phase

N	**(Impact Related to the Physical Presence and exploitation of Highway)**	**Yes/No** **Significance**	**Sections**
20	Long-term degradation of the natural landscapes (relief, soil, vegetation, environment and wildlife), modification of landscape in the right of way	Yes Insignificant Rehabilitation of the existing road	Entire length
21	Long-term degradation of the natural landscape (relief, soil, vegetation, environment and wildlife), modification or elimination of landscape at the access roads, pits, strata embankments, construction areas and equipment yards	Yes Insignificant Maybe significant	Pit areas Embankment areas
22	Landslips, landslides and dangerous gravitational processes after the completion of construction: processes could be triggered by road construction related change of landscape or other landslip causes, which are connected with the project (deforestation, vegetation removal from slopes, change of hydrographic configuration, changes to terrain and soil density, etc)	Yes	Km 109, 114 115-116; 120; 125 – 126; All geohazardous sites are located on the sections of road, which are not included in the proposed investment project. These sections are addressed by specific projects. Proposed investment project does not cross any major geohazard prone area.

			For details – geohazard map,
23	Activation of erosive processes in the highway corridor and adjacent territories: processes could be triggered by road construction related change of landscape or other landslip causes, which are connected with the project (deforestation, vegetation removal from slopes, change of hydrographic configuration, changes to terrain and soil density, etc) Erosion under the road surface due to concentrated directing of water through open or closed drainage channels Temporary filling of drainage ways with sediments	Yes Moderate	Entire length
24	Landscape scarring with dams, unaesthetic engineering constructions, ground excavation and degradation of vegetation. Remaining earthfills and unmaintained pits. Damaged landscape (not restored construction areas, landscape degraded due to landslips and erosion caused by construction)	Yes Moderate	Entire length of corridor
25	Alteration of hydrological regime of those rivers and streams, which cross the highway due to bridges, gabions, bank retaining and other hydrotechnical constructions. Impact of this alteration on adjacent areas and infrastructure, arable land and ecosystems	No	No
26	Alteration of surface and ground drainage systems (due to earth works, excavation of deep trenches and changes of terrain)	Yes Positive	Restoration of drainage systems in disrepair
27	Increase of sediments in streams, rivulets and rivers due to erosion activated by road construction. Deterioration o water quality and increase of sediments	Yes Insignificant	R. Enguri
28	Soil and water pollution with oil, lubricants, fuel and paint along the highway (due to intensification of auto traffic)	Yes Insignificant	Entire length R. Enguri
29	Ground and surface water pollution with herbicides against the vegetation or chemicals against dust (i.e. Calcium Chloride)	No	No
30	Air pollution during maintenance repair by construction equipment	Yes Insignificant	Entire length
31	Increase of air pollution due to intensification of auto traffic (dust, emission of harmful substances)	Yes Moderate	Entire length; Villages: Etseri, Matskhvarashi, Latali, Kashveti and large village Mestia
32	Increase of car noise due to intensification of auto traffic (especially in residential areas, which are crossed by the highway, in the zone of district centers and densely populated villages)	Yes Moderate	Villages located in the areas adjacent to the highway
33	Increased amount of waste along the highway	Yes Moderate	Entire length
34	Creation of new routes of human and animal diseases (infection vectors)	Yes Moderate	Entire length
35	Creation of new routes of diseases, parasites, weeds and other harmful organisms	Yes Moderate	Entire length
36	Threat to population health due to air pollution (emissions, dust) and noise connected with the intensified traffic	Yes Moderate	Villages located in the areas adjacent to the highway
37	Dislocation and forced displacement of the individuals living in the right of way (in towns and rich farming regions it could involve large numbers)	No	No
38	Moving of routes from houses to farms, etc, which increases the travel time	No	No
39	Hampering of the non-motor vehicle due to reduction or	No	No

	impediments within the right of way		
40	Induced development, uncontrolled construction of commercial, industrial, residential infrastructure and adjacent areas along the road	No	No
41	Planned development and other illicit invasion on the land of local population, which causes serious social and economic explosion	No	No
N	**Impact of Emergency Situations of Exploitation Phase**	**Yes/No Significance**	**Sections**
42	Risk of casualties connected with cars and other transport, which could result in spilling of toxic substances	Yes Insignificant	Villages: Etseri, Matskhvarashi, Latali, Kashveti and large village Mestia

Activity/Factor	Impact	Direct	Indirect	Positive	Negative	Reversible	Irreversible	Temporary	Mitigable	Residual
Physical existence of linear installation	Shallow groundwater and drainage patterns	+			+		+		+	
	Aquatic area									
	Emissions									
	Noise, vibration									
	Ground pollution and/or waste generation									
	Ground and surface water pollution									
Transport Movement	Destruction of natural landscape, habitats, erosion									
	Aquatic area									
	Emissions	+			+				+	+
	Noise, vibration	+			+				+	+
	Ground pollution and/or waste generation		+		+	+		+		
	Ground and surface water pollution		+		+	+		+		
Repairing/Restoration activities	Destruction of natural landscape, habitats, erosion	+			+	+		+	+	
	Aquatic area	+			+	+		+	+	
	Emissions	+			+	+		+	+	
	Noise, vibration	+			+	+		+	+	
	Ground pollution and/or waste generation	+			+	+		+	+	
	Ground and surface water pollution	+			+	+		+	+	
Traffice Incidents	Destruction of natural landscape, habitats, erosion								+	
	Aquatic area	+			+	+		+	+	
	Emissions	+			+	+		+	+	
	Noise, vibration	+			+	+		+	+	
	Ground pollution and/or waste generation	+			+	+		+	+	
	Ground and surface water pollution	+			+	+		+	+	

E. Physical Resources

1. Noise and Air Quality

a. Impacts

569. Noise and emissions of harmful substances are typical impacts of construction. However, in the case of this project, it is clear that there will not be any significant impact on the environment due to noise or air emissions. This is determined by two factors: a) the noise and emission levels associated with construction and operation activities are not severe (see estimations provided below); b) Almost all sections of the road included in the proposed investment project are located at a substantial distance from residential and public areas and sensitive ecological receptors and, therefore, the emission/noise related disturbance will be minimal for local population, as well as wildlife.

570. **Emissions during construction.** It should be noted that on the one hand vehicle emissions are temporary and do not have irreversable impact on environment. On the other hand, vehicle emissions practically do not diffuse to 200m distance from the site, whereas the major part of villages located along the road are as a rule remote from the road and detached from it by raised elements of the extremely partitioned territory. The road is in direct vicinity of residential houses only in several villages like: Etseri, Matskhvara, Latali, Kashveti da Village Mestia.

571. **Emissions during road operation** . Volume of noxious emissions (gr/sec) diffused in the environment along the whole project route (60km) and its sections (1km and 10m) during road oepartion is given in the following table, the more detailed explanation of the table is included in Annex 2. It is notable that intensity of diffusion, as well as traffic intensity is on average 20 times less than the same indicators for the E-60 highway, for instance its Aghaiani-Igoeti section. Emission related environmental impact is negligible not only due to low intensity, but also for the reason that the air quality background state is far better in Svaneti than in big cities or central highways. It should also be considered that the density of settlements along the project road is rather low and major part of villages located along the road are as a rule remote from the road and detached from it by mountainous relief. The road is in direct vicinity of residential houses only in several villages like: Etseri, Matskhvara, Latali, Kashveti and Village Mestia.

#	Type	Noxious Emissions (gr/sec) on Aghaianai-Igoeti Section of the Highway							
		,	NO_X	C_XH_Y	C(soot)	SO_2	Formaldehyde	Lead	Benzpyrene
1	2	3	4	5	6	7	8	9	10
	12 km section					**2009**			
1	passenger cars. (25,8)hr	0,817	0,1548	0.0903	-	0.0028	0.000258	0.000817	7.3×10^{-8}
2	microbuses (5,3)	0.01735	0.03565	0.0178	0.00067	0.00323	0.00069	-	1.5×10^{-8}
3	buses (0.45) hr	0.0066	0.012	0.004875	0.000225	0.00109	0.0002325	-	$0,5\ x10^{-8}$
4	trucks (2,4) hr	0.03525	0.0617	0.024	0.0012	0.005	0.00084	-	$0,8\times10^{-7}$
	total for 12 km	0.8762	0.26415	0.136975	0.002095	0.01212	0.0020205	0.000817	$17.3\ x\ 10^{-8}$
	10m	0.00073	0.000220	0.000114	0.0000017	0.000010	0.00000168	$6,8x10^{-7}$	$1.44\ x\ 10^{-10}$
	1km	0.073	0.0220	0.0114	0.00017	0.0010	0.000168	$6,8x10^{-5}$	$1.44\ x\ 10^{-8}$
	60km	4.38	1.32	0.684	0.0102	0.06	0.01008	$4.1\ x10^{-3}$	8.6×10^{-7}
	12 km section					**2015**			
5	passenger cars . (56,3)	1.78	0.3378	0.1971	-	0.0061	0.000563	0.00178	1.6×10^{-7}
6	microbuses (3.7)	0.01355	0.02465	0.01	0.0004625	0.002235	0.000478	-	1.05×10^{-8}
7	buses (0,9)	0.1085	0.1973	0.08	0.0037	0.145	0.0038	-	8.3×10^{-8}
8	trucks (2,1)	0.0293	0.053905	0.021	0.00105	0.004375	0.000735	-	2.25×10^{-8}
	total for 12 km section	1.93135	0.613655	0.3081	0.0052125	0.15771	0.005576	0.00178	27.6×10^{-8}
	10m	0.00161	0.00051	0.000257	$4.34x10^{-6}$	0.000131	$4.646x10^{-6}$	$1.48x10^{-6}$	$2.3x10^{-10}$
	1km	0.161	0.051	0.0257	0.000434	0.0131	0.0004646	0.0001483	$2.3x10^{-8}$
	60km	9.65675	3.068275	16.881875	0.0260625	0.78855	0.02788	0.0089	$138x10^{-8}$

572. **Noise during construction**. Approximate estimate of noise caused by construction activities reveals that the noise impact does not spread over a 320 m radius. It means that the populated areas will not be affected by noise at all or certain districts of the villages will be temporarily affected for a short period of time (to negligible extent) during works' performance in their vicinity. Ecologically sensitive areas will not be affected by noise. In the range of 300m around the site temporary and negligible increase of noise level is acceptable. Though, in such cases certain mitigation measures can be taken, like control and technical maintenance of the engines of machinery and equipment to avoid no-load operation of engines on site. The only recommended restriction concerns restriction of works during night time in the vicinity of villages. As for other sections, works can be performed in the night time without any restrictions.

573. **Noise during road operation**. Impact of noise caused by traffic is not observed at 80km distance from the highway. Such impact is not expected neither by 2015, when the traffic insensity will double as compared to current situation. The impact of traffic volume increase will be partially compensated at the expense of improvement of road characteristics (geometrical and road paving) and traffic conditions. Additional mitigation measure: 1) Limited traffic speed; b) Control and supervision of engine maintenance.

b. Mitigation Measures

574. However, emissions of heavy machinery involved in the construction should be managed by a proper engine maintenance practice and use of good quality fuel. The work of engines in an idle mode should be excluded.

575. A relatively high impact is related to the dust emissions, which hardly can be quantified. However, it is obvious that the earth works and transportation of gravel and other inert materials from borrow-pits will impose nuisance related with dust. This is a temporary impact, and should be mitigated by periodical watering of the work sites.
The residential and public areas will not be disturbed significantly by the noise nuisance. Mitigation of this impact is possible by employing the engine maintenance practice and avoidance of engine work in an idle mode. The only limitation that could be recommended is:

(i) to prohibit the night-time (10 pm and 6 am) works .
(ii) to limit the works performed near the residential or public houses to the absolutely necessary site-related works and to carry out all auxiliary noisy works (like crushing conglomerates, milling demolished asphalt etc.) at sufficient distance from residential houses.
(iii) All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or the local people.
(iv) All vehicles will be checked and repaired in case of need to eliminate increased level of noise due to damaged parts.

576. Regular maintenance of diesel engines will be undertaken to ensure that emissions are minimized, for example by cleaning fuel injectors. Routine maintenance will be carried out to a high standard to ensure that vehicles are safe and that emissions and noise are minimized. All the plants used on site will be regularly maintained so as to be in good working order at all times to minimize potentially polluting exhaust emissions.

577. Vehicle refueling shall be undertaken so as to avoid fugitive emissions of volatile organic compounds through the use of fuel nozzles and pumps and enclosed tanks (no open containers will be used to store the fuel).

578. If it is deemed necessary in dry conditions or where significant quantities of dust are being or are likely to be produced, mitigation measures will be arranged with the Construction Manager. Mitigation measures will include:

(i) Damping down using water browsers with spray bars or other technical means; Minimum 1 browsers should be required for that purpose. However, the construction contractor should not be limited by this figure, and if required additional browsers should be engaged.
(ii) Sheeting of construction materials and storage piles; and
(iii) Use reductions in vehicle speed where required. Materials will be transported to the site in off peak hours.

579. Materials transported to the site will be covered/ wetted down to reduce dust. The construction site will be watered as appropriate. Personal protective equipment will be provided to workers as necessary. All vehicles will be checked and repaired in case of need to eliminate increased emission due to the damaged parts;

2. Geohazardous Processes

a. Impacts

580. In general, normal functioning of the motor road Zugdidi-Jvari-Mestia-Lasdili is especially complicated by landslides formed in tectonically unstable slate strata; their deformation depth lies within dozens of meters and their development-activation takes place through integration of complex factors, where earthquake effect has one of significant roles. Lanslide prone areas are located at the sections Km 109, 114, 115-116; 120; and 125 – 126 of the road. The landslides developed at 109 km and 114 km ("Malaia Tvibra" landslide) are most complex and of high risk. Complete stabilization of the landslips through engineering constructions is impossible.

581. All the mentioned geohazardous sites are located on the sections of road, which are not included in the proposed investment project. These sections are addressed by specific projects.

582. Along the automobile road in the distribution area of Jurassic clay-slates and carbonate flysch mudflow transformation is common, which results in rock-muddy debris periodically threatening the normal functioning of the transport.

583. Proposed investment project does not cross any major geohazard prone area.

b. Mitigation Measures

584. To facilitate safe operation of the road the removal of the actively dynamic landslip body at KM 109, cutting the road into the slope, its shaping into steps and organized removal of surface waters are needed; arrangement of gabion in the lower part of the road is desirable.

585. Mala Tvibra landslide section is located on the right slope of r. Enguri gorge on the 114th km of the automobile road, on the territory of village Fari. Proceeding from the activity of the landslip processes long-term capital anti-landslip measures to facilitate the normal functioning of the road are useless. Some preventive measures should be implemented, namely:

(i) Removal of actively dynamic landslip formations at the upper slope of the road and the slope should be given the stable inclination;
(ii) Systemic removal of surface and ground waters outside the landslip body and not causing additional watering of the lower slopes;

(iii) To prevent road surface deformation arrange gabion below.

586. To reduce the landslips developed as a result of precipitations (i.e. village Becho, 120 km) regulation of surface waters is needed.

587. Periodic cleaning- straightening and deepening of the mudflow ravine beds is needed. Implementation of other capital anti-mudflow measures is difficult and the result is less reliable. The road sections to be rehabilitated within the proposed investment project, do not cross major geohazard areas and do not require specific preventive/protective measures. However, common measures for protection against rockfall and slope stabilization will be applied to prevent slope/cut failure during construction and further during road operation. In particular, construction of several gabions and revetement walls and surface water drainage is envisaged, as described in chapter C – Project description.

F. Soil and Water Pollution and Waste Management Issues

1. Spoil and Inert Construction Waste

a. Impact

588. At the stage of rehabilitation works on Khaishi-Mestia section of the Zugdidi-Jvari-Mestia-Lasdili motor road the main environmental problem is the disposal of spoil and debris. As a result of drilling-explosion and earth works the total amount of debris is 260 000 m^3. Debris is formed in River Enguri floodplain and if left there, it shall eventually be washed to Enguri Hydro-Power Station reservoir.

b. Mitigation Measures

589. The prevention of the anticipated harmful results is necessary through planning of appropriate measures.

(i) Debris should be removed from r. Enguri floodplain for about 3-5 km;
(ii) Prior to carrying debris to the allocation area, in the section where the above process is somehow impeded or requires time debris should be collected in the temporary area of allocation. The area of temporary allocation should be selected and arranged to maximally minimize the washing of the debris by river flow to lower tail waters;
(iii) The selection of the temporary allocation areas is recommended in the meander sections of r. Enguri, where river flow has less velocity and bed trajectory reduced the possibility of washing;
(iv) It is recommended not to chaotically put debris in the temporary allocation areas, but arrangement in the outer perimeter by large fraction of boulders. The diameter of large boulders should be selected to form effective barrier of protection from washing of smaller stones. The system of appropriate gabions could be used

590. Construction contractor should develop specific plan of temporary and permanent allocation of debris, where the following should be noted: areas of debris allocations; engineering project of allocation (plan, section, etc.); transportation plan; temporary and permanent allocation plan dholes be agreed with the local authorities and regional service of the protection of the environment and natural resources.

2. Other non-hazardous wastes

591. In general, to non-hazardous constructional wastes belong:

(i) wood (cut trees and bushes in small amount)
(ii) metal objects (including metal scrap and cables) – accumulation of very small amounts of metal wastes is possible

592. As for everyday solid wastes, then the quantity of such wastes is minor and depends on number of staff members participating in the working processes. Number of employees at the enterprise amounts to 30 people in one shift and the works are conducted in one-shift order. The average annual everyday solid wastes may amount to 70-80 kg per employee. Collection of solid wastes on the road construction site, location in containers for wastes and further disposal is implemented from time to time through communal services of cleaning, serving the nearby site villages.

3. Hazardous wastes

a. Impact

593. Small quantities of hazardous wastes will be generated as a result of vehicle operations and the maintenance activities, including:

(i) bitumen;
(ii) liquid fuels;
(iii) lubricants, hydraulic oils;
(iv) chemicals, such as anti-freeze;
(v) contaminated soil;
(vi) spillage control materials used to absorb oil and chemical spillages;
(vii) machine/engine filter cartridges;
(viii) oily rags, spent filters, contaminated soil, etc)

b. Mitigation Measures

594. 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 MoE 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.

595. Contractors will be required to ensure the proper handling of all hazardous materials, including liquid fuels, lubricants, hydraulic oils, chemicals, such as anti-freeze, contaminated soil, materials used to absorb oil and chemical spillages; machine/engine filter cartridges; oily rags, used filters, contaminated soil. Storage containers for these materials should not be located within 50m of any watercourse in this case the River Enguri. All containers should be placed in a bund of at least 110% of the tank's maximum capacity. If more than one container is stored within the bund, the system must be capable of storing 110% of the biggest container's capacity or 25% of their total capacity, whichever is greater.

596. The bund should be impermeable (e.g. concrete-lined), without drainage points or other breaches. Accumulated rainwater in bunds should be pumped out of the bund to either drains or

onto the ground if uncontaminated. In case of fuel spillage the spilled fuel should be recollected and the contaminated bund shall be treated using the absorbents: sawdust, sand or straw.

4. Soil Pollution

a. Impact

597. There are a number of materials need in a project of this type, which can pollute both soil and water if spilled or improperly disposed of. These include:

(i) Diesel fuel, lubrication oils and hydraulic fluids, antifreeze, etc. from construction vehicles and machinery;
(ii) Miscellaneous pollutants (e.g. asphalt, cement and concrete);
(iii) Construction wastes (packaging, stones and gravel, cement and concrete residue, wood, etc.);
(iv) Extremely small amount of hazardous wastes (e.g. waste oils, oily rags, spent filters, contaminated soil, etc) constituting about 0.1% of total amount of the wastes.

b. Mitigation Measures

598. Specific mitigation measures should be implemented on the construction site to prevent the soil pollution:

599. Contractors should ensure the proper handling of lubricants, fuel and solvents. All tanks should be placed in a bund of at least 110% of the tank's maximum capacity. If more than one tank is stored within the bund, the system must be capable of storing 110% of the biggest container's capacity or 25% of their total capacity, whichever is greater.
All fuel / hydrocarbon dispensing nozzles are to be of a drip control design and securely locked when not in use.

600. Vehicles should not be left without the supervision during refueling process. All refueling operations on the working sites should use absorbent pads and/or straw to minimize spills, which shall be put in place prior to the commencement of refueling operations

5. Water Pollution

a. Impact

601. Water pollution may result from a variety of sources, including the following:

(i) Spillages of fuel, oil or other hazardous substances, especially during refueling
(ii) Silt suspended in runoff waters from the construction site
(iii) Washing of vehicles or equipment or disturbance of watercourse banks and bed when crossing the watercourse by a heavy machinery
(iv) Exposure of contaminated land and groundwater

602. Spillages, etc may travel quickly downhill to a watercourse or water body which in this case is located immediately alongside the site (River Enguri). Once in a watercourse, it can be difficult to contain the pollution which can then impact over a wide area downstream. It is therefore vital that a prompt action is taken in the event of any potential water pollution incident. Once the working width has been stripped of topsoil, the subsoil becomes exposed. When

implementing the earthworks in a wet weather this may result in uncontrolled release of suspended solids from the work area.

603. Topsoil stripping on the work sites and trenching may result in increased erosion runoff and contamination of surface water.

b. Mitigation Measures

604. Specific mitigation measures should be implemented on the construction site in order to prevent water pollution:

605. Contractors should ensure the proper storage and handling of lubricants, fuel and solvents by following the storage and pollution prevention measures proposed above.

606. No fuel storage or refueling of vehicles or equipment should be allowed within 50m of river Enguri, or near drainage channels. Vehicles should not be left without the supervision during refueling process. All refueling operations on the working sites should use absorbent pads and/or straw to minimize spills, which shall be put in place prior to the commencement of refueling operations.

607. The risk of Ground water and surface water pollution should be reduced or eliminated by the measures outlined above, and by prompt action in the event of a spill, to contain and clean up the material and remove the polluted ground. Soiled ground and absorbents should be removed, stored and treated as a hazardous waste as described above. In case of a significant spill an authorized and responsible person should be informed, works shall be stopped till the pollution has been removed. Refueling shall always be carried out with the correct equipment (i.e. nozzles of the appropriate size), and only by suitably trained and experienced Refueling Operators. Fuel supply equipment should be regularly checked to prevent leakage due to inappropriate condition of refueling equipment. Equipment and storages should be isolated and guarded to prevent pollution due to cases of stealing or vandalism. All mobile plants, including but not limited to cranes, compressors, generators, bulldozers, excavators etc. and storage tanks should be maintained and operated in such a way that all leaks and spills of materials should be minimized. Daily plant checks (Vehicle Maintenance Procedure) will be undertaken to ensure that there are no leaks or other problems. Vehicle maintenance, cleaning, degreasing etc should be undertaken in designated areas of hard-standing, not over the unstable ground (embankments etc.). Water tanks with sprinklers are envisaged for watering roads and machinery maintenance. Maintenance points will not be located within 50m of river Rioni, or near drainage channels. The storage of potentially polluting materials, refueling and maintenance of mobile plant within 50m of all watercourses/water bodies, dry riverbeds should be prohibited.

608. Erosion control measures should be applied during the construction activities to prevent runoff of into the River Enguri. The contractor should plan all excavations, topsoil and subsoil storage so as to reduce to a minimum any runoff. Contractors will be required to organize and cover material storage areas and to isolate wash down areas from the river by selecting areas that are not free draining into any watercourse.

609. Where any area of the spread is at risk from silt pollution washing off into a watercourse of water body, effective measures should be put in place to ensure that such pollution does not occur. Contractors should be required to implement such measures as:

(i) Use of silt fences

(ii) Use of straw bales to deflect and filter water
(iii) Use of a system of bunds and grips to prevent water from entering watercourse, etc.
(iv) Use of holding/settling lagoons to store water running off the spread. It is intended to use natural settling rather than flocculants to facilitate sedimentation following which clean water can be disposed.

610. Asphalt or wet cement and/or concrete will not be allowed to enter any watercourse, pond or ditch.

6. Protection of the Soil and Erosion Prevention

a. Impact

611. Top soil could be affected at the sites of road widening (slope cuts, infrastructure) and new alignments (new footprint). The major works are conducted within the existing footprint.

612. The topsoil could be lost during excavations and earthworks (in case if topsoil is not stripped and segregated from subsoil) and as a result of improper storage (mixing with subsoil stockpiles; washing by rainfall run-off).
Soil erosion processes on slopes and fresh cuts triggered by road construction activities lead to topsoil loss, ground instability and increased sediment load on watercources due to soil washout by rainfall run-off.

b. Mitigation

613. The topsoil shall not be handled by construction contractor when the following conditions are observed:
(i) The topsoil is frozen;
(ii) The site is experiencing persistent rainfall;
(iii) The topsoil is saturated;

614. Topsoil will be stored in stockpiles, no more than 2m high with side slopes at a maximum angle of 45^0. The following shall also be taken into consideration:
(i) Dedicated storage locations will be used that prevent the stockpiles being compacted by vehicle movements or contaminated by other materials;
(ii) Topsoil will be segregated from subsoil stockpiles;
(iii) No material will be stored where there is a potential for flooding;
(iv) No storage at less than 25m from river/streams, subject to the site specific topography.

615. In the event that the stockpiles experience significant erosion the Contractor will be required to implement corrective action, such as installing erosion matting over the stockpiles if further surface compaction and/or topsoil seeding fails. The Contractor shall protect the stockpiles from flooding and run-off by placing berms or equivalent around the outside where necessary.

616. Topsoil stockpiles shall be monitored and should any adverse conditions are identified corrective actions to be taken shall include:

(i) Anaerobic conditions - turning the stockpile or creating ventilation holes through the stockpile;
(ii) Erosion - temporary protective silt fencing shall be erected

c. Subsoil Storage

617. For storing the subsoil in stockpiles, no more than 3m high with side slopes at a maximum angle of 60^0, the following shall be taken into consideration:
(i) Dedicated storage locations where the stockpiles shall not be compacted by vehicle movements
(ii) or contaminated by other materials; and
(iii) Segregation from topsoil stockpiles.

618. In the event that the subsoil stockpiles experience a significant erosion, Contractor shall take a corrective action such as installing erosion matting over the stockpiles

G. Ecological Resources

1. Flora

619. The project envisages rehabilitation of the existing road and is applied only within the boundaries of the actual right of way. The whole area within that strip has already been changed and is of the negligible ecological value. Neither landscape nor flora of the Project section can be regarded as sensitive. No additional assess roads will be utilized as far as the motorway itself provides accessibility of vehicles and machinery on the working site.
The indirect affect may occur only due to and through the refuse heap, more precisely, as its volume increases. Correct selection of the place for disposal of useless material is crucial for avoiding vegetation damage and general degradation of the landscape.

2. Fauna

620. The reconstruction and increased capacity of the road may cause some affects over biodiversity of fauna. Namely:
(i) Reconstruction and intense operation of the road will dramatically increase its factor as of the local area rupturing artificial structure. Special passing sections should be provided for several species of mammals, reptiles and amphibian, otherwise the road will be insuperable obstacle for them.
(ii) Road rehabilitation activities will increase noise and vibration and vegetation will be covered with dust affecting the nutrition base of several vertebrates and invertebrates and their reproduction (Iyablokov, Ostroumov, 1985);
(iii) All birds nesting close to the road will suffer from increased disturbance;
(iv) In case of spill of hazardous materials into the eater or on the banks of water flows fish, amphibious birds nesting close to water streams and otter populations will be damaged as well as all wildlife inhabiting the spilling and leaking areas and its surrounding territories. Water and soil pollution may last for many years automatically causing dramatic decrease of number of wildlife and even full extinction of endangers species (Iyablokov, Ostroumov, 1985);
(v) In case of fires and cutting down the forest at sensitive sections along the road all rare species of birds, reptiles and cheiroptera well be deprived of their usual forest and forest edge habitats.

3. Protection of ecological receptors

621. On the basis of researches conducted at the stage of environmental impact assessment we do not expect the considerable impact on flora and fauna. In spite of the mentioned it is essential the definite rules to be kept, preliminary defined research to be conducted and protecting arrangements in compliance to the mentioned researches to be corrected. In particular, before construction commencement it is essential the exact demarcation of the corridor to be implemented, trees that are to be felled to be recorded and cadastral description to be made by participation of competent bodies; avoidance of the Red Book trees, compensation calculation and payment due to the fixed rules. The road section of the project covers the following forest sections:

(i) The areas on the left side of km 83 - km 90 section (between Nakontorebi and Nenaori sites);
(ii) From the left bank of Nakra River to km 98 (before entering village of Nodashi);
(iii) Smaller area at km 100 (Manshura River valley);
(iv) Smaller area at km 104 (Ladlina River valley);
(v) The area at the left roadside of km 120 – km 126 section (from vil. Dolasvipi and further prior entering vil. Martskhvarishi);
(vi) Smaller area at the left roadside of km 130 – km 133 section (between R. Tvikhulderi and vil. Soli, at Guruldi Site).

622. It needs to be noted as well that the forests are mainly located on the slopes and will be felled on those small sections only where the existing road is widened by entering the slope, or on the construction site of artificial premises.

623. Before the rehabilitation process of traffic roads, the sites in need of reconstruction should be studied, in particular, those near the sensitive place, like bridges and fixed-site establishments, to detect nests of chiroptera, owl like birds, birds of prey, water birds, also the trace of green finch, otter and other large or medium-sized predatory mammals.

624. Nests of bird species protected by the law should be recorded and getting close to them should be banned from April to July.

625. Habitats of chiroptera species protected by the law should be recorded.

626. Measures should be taken to reduce the amount of dust produced during the construction.

627. Measures should be taken to reduce the amount of vibration and noise.

628. Accumulation of daily and construction waste should be prevented.

629. Spill of oil products into the water and soil should be prevented.

630. Open holes and trenches should be fenced to prevent animals from falling into them. Motley-colored tapes can be used for large animals, while in case of small animals; fencing can be constructed with the help of flat material like tin or polyethylene. Ditches and holes can be covered boards and branches (on one side), that will enable little animals to crawl out of the holes. The holes and ditches should be checked before they are filled up.

Instead of the shelters of birds and mammals placed on the chopped trees, artificial shelters (in 100-300 m) should be arranged.

631. Special measures should be taken to soften the influence on fresh water and flora. During the spawning season stirring up the water in the river should be avoided. Besides, the cement used for the construction should be prevented from throwing onto the water that might follow the flow of the river.

632. Poaching by workers, especially by using electricity and poisons (like calcium i.e. carbide) should be strictly prohibited.

Fig 15. Forested slopes

H. Socio-Cultural Resources

1. Cultural Heritage

a. Impacts on Archaeological Sites

633. Land clearance works, grading and excavations are associated with the risks of damaging underground archaeological remnants. Most expected archaeological sites are listed in the annex 3. However, not listed sites could be as sensitive as already known archaeological sites. The known sites have been identified just during major construction works, particularly

during construction of the existing highway. The other sites have not been studied systematically. During construction of the roads in Soviet times some archaeological artifacts have been destroyed. Therefore, special care should be taken not only at the new construction sites, but also at the sites where the existing motor road will be upgraded and widened

b. Mitigation Measures

634. Despite the fact that the construction sites are not located near any known subterranean monuments or areas of an archeological interest, destruction of archeological layers during the construction process is possible. To avoid this risk, preliminary preventive studies and archeological 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 and Sport 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 earth-works is obliged to submit 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. According to the established practice, the archaeological studies are conducted under the detailed design contract at the stage of obtaining the Construction Permit.
At the construction stage archaeological monitoring should be ensured by the constructing contractor under the supervision of the Ministry of Culture, Monument Protection and Sport of Georgia. The budget necessary for the archeological supervision and other agreed works should be fixed under the construction works appraisal.

I. Community Disturbance and Health and Safety Issues

1. Blasting Works

a. Impacts

635. During road reconstruction and rehabilitation works, according construction plan it is necessary to use blasting activities which maybe related to safety risks for personnel and residents of nearest villages (cause seismic impact, flying of the rocks etc.), as well as disturbances associated with noise and dust along the site.

b. Mitigation Measures

636. The holes are undermined and exploded. Blasting shall be done in intervals. Intervals between blasting are preserved in order to avoid seismic impact on power lines located along the site as well as to avoid fragments of rock damaging the lines.

637. The order of blasting works shall be preserved as follows in order to avoid flying rocks: the block shall be exploded - at the first stage blast-hole charges are exploded in order to loosen the hillside soil on the side of the road. The soil shall be loosened to such a condition that it will not happen on the road. The rest of the blast-hole charges shall be exploded three times with insignificant intervals between them and the soil loosened at the first stage working as a protecting screen in the process of the following explosions to stop flying rocks whilst massive explosions.

638. Miner-rock climbers shall be equipped with ropes and other tools (crowbar and jack hammers).

639. They climb the natural platform using the bypass road. Safety area may be constructed on that platform. The worker shall be tied up with Capron rope. The second end of the rope shall be fixed on the tree or on some other solid object. Other two workers hold the worker and loosen the rope slowly as he gets down the mountain and regulate the tension of the rope. The area of sliding of boulders and debris shall be fenced with concrete blocks. The workers shall safeguard the road from both sides nobody to enter the dangerous section. The road shall be closed and furnished with corresponding road signs and temporary fencing. The workers shall wear protective clothing and gloves as well as hard hats.

640. The above-mentioned works are altitude works requiring strict adherence to safety procedures applied in corresponding cases. The group of representatives of energy supply shall be present on the site in case power lines are damaged to repair them (in such a case the expenses are no included on the design and they shall be covered from contingencies).

641. Blasting works generally shall be done by specialized authorities and team and only when the corresponding Works Productions Plan is available, in accordance with the Project of Production and Organization of Blasting works.

642. Safety requirements set forth in Overall Safety Requirements shall be preserved. Blasting works shall be altogether done by specialized agency, teams. The works shall only be done upon the delivery of Works Production Plan. Optimal quantity of explosives shall be determined and defined on site by means of advanced blasting (test explosion), taking into account properties and geological structure of soil. Blasting works shall be performed in the direction opposite to the protected object.

643. Charges in the holes shall achieve the depth of 0.7 m. The rest of the space is used for placing soft soil (do not use gravel and crushed stones for this purpose). Charges shall be initiated by power, which is safer and is more effective.

644. Adhere strictly to safety procedures whilst conducting blasting works. Blasting of soil shall be done in accordance with valid standards, particularly “Overall safety procedures whilst conducting blasting works”.

645. Blasting works, which belong to severely dangerous types of works, shall be approached with great care. Highly qualified and specialized member of staff can be nominated to direct blasting works.

646. Determining the limits of the site and fencing shall be done in advance. Observation (security) Posts shall be located on the site so that all the roads adjoining the site can be permanently observed. Chief of blasting team shall position Observation (security) Posts.

647. Boring is available during twenty-four hours, whilst blasting only in the daytime. Blasting works are prohibited in unfavorable weather conditions such as lightning, rain, fog. Evacuation of people from the dangerous site shall take place after the charges are ready to blast.

648. The Guards shall be located so that to protect the site. Smoking and fire are prohibited within the radius of 100 m from the site.

2. Construction Related Disturbances

a. Impacts

649. The construction process will produce large number of movement by heavy trucks on the roads served the site, delivery construction materials and excavation waste for use or disposal. This can cause a number of impacts, including:
Heavy trucks are required to deliver required amount of inert materials to the needed sites within the construction site. Different types of impacts are anticipated in that regard:

(i) Noise & Vibration;
(ii) Traffic congestion (nuisance);
(iii) Air pollution (dust; emissions);
(iv) Mud on roads;
(v) Refueling, maintenance and vehicle cleaning and related risks of soil and water contamination.

650. The construction sites carry certain safety risks for the population and, therefore, compliance with safety rules is important. Local traffic can be affected by transport activities related to the project. The mentioned impact is temporary, insignificant and manageable. A long-term impact on local traffic should be beneficial.

b. Mitigation Measures

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

(i) Require adherence to engine maintenance schedules and standards to reduce air pollution.
(ii) Use of defined, well planned haulage routes and reductions in vehicle speed where required;
(iii) Periodically water down temporary roads on site;
(iv) Cover trucks carrying cement gravel or other loose materials;
(v) Wet or cover trucks carrying stone/ sand/ gravel;
(vi) Haul materials to and from the site in off peak traffic hours.
(vii) The construction site should be watered as appropriate ensuring that watering is not enough to produce surface runoff. Personal protective equipment shall be provided to workers as necessary. All vehicles shall be checked and repaired in case of need to eliminate increased emission due to damaged parts.

652. **Traffic Obstruction/Jams.** Movement of transportation means involved in the Project Implementation Phase may have minor affects on local traffic.

J. Construction Camp

653. All construction camps are directly attached to the construction sites and any additional affects over the landscape caused by the camps are less probable. One construction camp is envisaged for every lot assigned for accommodation of 30 employees in average. According to the Project 2-3 storage yards will be arranged along the road with several trailers acquired for equipment storage instead of all inclusive construction camps. There is neither capacity nor need for the latter. Workers will be provided with the lodging and sanitation and first aid facilities located in near-by villages (list of villages is provided). No savage or water treatment facilities will be arranged in camps. Nor will the workforce stay on site overnight. The trailers will be used for storage of the equipment and as a security guard's nighttime post. Free space of the yard will be used as parking and storing lot and machinery fueling and easy maintenance area. (The areas allocated for construction camp are listed on Pg. 47 Par.4.1.7.). Camp activities may cause several affects on the ambient environment that are as follows:

(i) Pollution/contamination during fueling and fuel and lubricants storage;
(ii) Improper waist management.

654. Concerning the possible accumulation of solid non-hazardous waist on the camp territory, its anticipated amounts will be minimal and basically depends on number of workforce on site. Crew of 30 men will be working in a shift. During a day works will be carried out in one shift only. As estimated the amount of solid non-hazardous waist accumulated by one worker comes up to 70-80 kg. annually.

K. Impacts on Quarry Sites Cause by Construction Activities

655. In general, any expected impact on the environment cased by borrowing of inert masses should be regarded as indirect impact. No new curries are expected to be opened during the project activities. Inert material, borrowed from only existing and officially registered quarries with valid environmental permits will be used. Apparently the carries located in Enguri riverbed next to Ipari village and somewhere in the middle of Ipari and Jorkveli villages will be utilized coupled with the Mestiachala gravel quarry and apporx. 30-35 M^3 of inert masses will be borrowed in total. Respectively no additional negative impacts are expected over the river floodplain or the riverbed shaping processes, provided that the quarry operation companies are within the limits set for the in the respective Permits.

L. Possible Emergency Situations during Construction Activities and Their Expected Environmental Impacts;

656. The emergencies that may occur during the road rehabilitation activities are as follows:
(i) Oil spill from any reserve tanks, machinery and vehicles;
(ii) Fire and spread of fire.

657. The essential recourses that may be affected by the emergencies are the residential areas located on the territories adjusting the road and transport infrastructure.

M. Construction Related Impacts at the Asphalt Plant Sites

658. The asphalt will be provided to constructing contractor by the suppliers and, therefore, the asphalt plant related impacts are not direct impact of the project. However, the impacts of

the asphalt plants (particularly emissions, waste disposal and pollution) should be considered as indirect impact of the project due to the increased production of asphalt by the existing plants.

659. Direct impacts of the asphalt plants (landscape degradation; emissions and dust; noise etc.) should be considered in case if the constructing company will decide to use its own mobile asphalt plants. In that case relevant EIA should be prepared and environmental Impact Permit should be obtained for installation and operation of the plant.

N. Mitigation Measures of Exploitation Phase

660. Erosion and ground stability control and landscape management. Road department of Georgia should facilitate control over erosive processes and ground stability as well as landscape restoration monitoring upon the completion of construction and introducing timely corrections. Corrections comprise but are not limited to rehabilitation-maintenance of drainage systems and implementation of anti-erosion measures (berms, restoration of relief and vegetation, etc), whereas necessary.

661. Road waste and pollution with fuel. Road department of Georgia should coordinate and organize the work of appropriate divisions (gas stations; waste management service, etc) and introduction of suitable tools.

662. Pollution of air with emissions, noise and pollution connected with rehabilitation work. Road department of Georgia should facilitate the implementation of those rules during rehabilitation work, which are described in the below management plan for construction works.

663. Prevention and mitigation of health risks and damage connected with spill of toxic substances due to emergency situations. Readiness for emergency situations. Road department of Georgia should participate and encourage the service of reaction to emergencies of the ministry of the internal affairs of Georgia in the development and introduction of the legislative acts necessary for the reaction action plans to similar emergency situations and their implementation as well as development of regulating legislation on transporting of hazardous material. System of measures should comprise the minimum of the following components:

(i) Development and introduction of safety measures and reaction plans in terms of damage prevention and mitigation as a result of spill of toxic substances;
(ii) Planning of special routes for hazardous substance transportation;
(iii) Introduction of strict control on the transporting of hazardous substances to reduce the danger;
(iv) Prohibition of transporting of toxic waste within sensitive areas.

664. The above measures should be planned according to Georgian legislation – law of Georgia “on Hazardous Chemical Substances” (1998).

665. **Prevention of spreading of human, animal and plant diseases.** The organization responsible for the control on the possible spread of human, animal and plant diseases during passenger and cargo transporting are the following: customs service, public legal entity “Inspection of Sanitary Supervision” and “National Service of Food Product Safety, Veterinary Service and Plant Protection” of the ministry of agriculture.

VI. ANALYSIS OF ALTERNATIVES

666. Non-implementation alternative was not discussed as socio-economic development of Svaneti region, namely, the utilization of its tourist potential, is impossible without the road rehabilitation.

667. The only realistic alternative could be proposed for the existing road section of 105 km-125 km. In substitution to the existing road section the alternative of moving the road to the left river bank was reviewed (figure 1). At the earlier stage the following became clear as a result of comparing of the alternatives.
The mentioned section (105 km-125 km) of the existing road is characterized by medium to high landslip threat:

(i) 109 km landslip – medium threat
(ii) 114 km landslip section (Mala Tvibra) – medium threat
(iii) 120 km village Becho – low threat

668. The mitigation of the landslip processes on the mentioned sections is possible through engineering measures.

669. On the alternative route only two landslip areas of medium threat occur.

670. However, some of the sections of the alternative route are characterized with mudflow and avalanche areas of the highest risk:

(i) 0.0 km – section of the highest mudflow and avalanche threat;
(ii) 3.5 km - section of the highest mudflow and avalanche threat;
(iii) 6.5 km - section of the highest mudflow and avalanche threat;
(iv) 8.5-9.0 km - section of the highest mudflow and avalanche threat.

671. Engineering control of the high energy mudflow and avalanche processes is possible at the above sections. The possibility of the development of hazardous gravitation events is high and results – catastrophic. Hence, the further discussion of the route alternative was found useless.

VII. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

A. Legislation and regulations of Georgia

672. In April 2000 Georgia ratified the Aarhus Convention. This UNECE convention facilitates and regulates information availability, involvement of the public in the decision making and law availability issues for the field of environmental protection. It secures implementation of the principle that the involvement of all interested parties is necessary in order to achieve a steady development. The convention provides that the environmental protection shall be within the area of governmental accountability, transparency and responsibility. It is based on the premise that involvement of the public provides for the better projects creation, better development and governance.

673. The Georgian legislation on EIA and Environmental Permits requires consultations with the public only for those projects for which it is required that the Environmental Impact Assessment be developed.

672. Article 6 of the law of Environmental Impact Permit (2008) sets out detailed requirements and procedures for conducting public consultations and the timeframes for information disclosure and discussion, namely:

673. A developer is obliged to carry out public discussion of the EIA before it is submitted to an administrative body responsible for issuing a permit (in case of activity requiring a construction permit before initiating stage 2 procedure for construction permit issuance).
The project proponent/developer shall publish information on the planned activity before conducting a public review. The information shall be published in the central mass media, as well as in the newspapers in the administrative territorial office (if any) of the region, where the activity is planned.

674. The announcement shall contain the following information:

(i) The goal, title and place of the planned activity;
(ii) The location of the agency where interested and affected people will be able to familiarize themselves with the documents associated with the activity (including reports o environmental impact);
(iii) The deadline for submittal of suggestions;
(iv) The venue and time of the public review/meeting.

675. The project proponent shall:

(i) Provide a hard copy of IEE and its electronic version to the administrative agency that issues permission, in a week after the publication;
(ii) Accept and consider written notes and suggestions provided by citizens up to 45 days after the date of publishing the assessment;
(iii) Conduct a public review meeting of the planned activity no later than in 60 days after publication of the announcement;
(iv) Invite corresponding local self – administration and governmental agency representatives; the Ministry of the Environmental Protection, and the Ministry of Economical Development and other involved administrative agencies to the public review;

676. Reviews shall be open to the public and any citizen will be able to attend it. The public review shall be conducted in the region administrative center, where the activity is planned.

677. According to Article 7 of the law, during 5 days after conducting the public disclosure meeting, the minutes of the meeting should be prepared to reflect all the questions and comments raised and explanations provided by the project proponents in response. Appropriate corrections should be incorporated into the main text of the EIA, if required. If the comments and proposals of stakeholders are not accepted a letter of explanation should be sent to the authors. The minutes of the meeting, as well as response letters, explanations and corrections should be submitted as supplementary materials to the EIA to MoE or the administrative body responsible for issuing the Permit. The mentioned documents should be considered as an essential part of the EIA.

B. ADB Requirements

678. Information Disclosure. In line with ADB's Public Communications Policy, ADB is committed to working with the borrower/client to ensure that relevant information (whether positive or negative) about social and environmental safeguard issues is made available in a

timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation. ADB will post the following safeguard documents on its website:

(i) For environment category A projects, draft environmental impact assessment reports at least 120 days before Board consideration;
(ii) Draft environmental assessment and review framework, draft resettlement frameworks and/or plans, and draft Indigenous Peoples planning frameworks and/or plans before project appraisal;
(iii) Final or updated environmental impact assessments and/or initial environmental examinations, resettlement plans, and Indigenous Peoples plans upon receipt;
(iv) Environmental, involuntary resettlement, and Indigenous Peoples monitoring reports submitted by borrowers/clients during project implementation upon receipt.

679. Consultation and Participation. ADB is committed to working with borrowers/clients to put meaningful consultation processes into practice. For policy application, meaningful consultation is a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of 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. ADB will require borrowers/clients to engage with communities, groups, or people affected by proposed projects, and with civil society through information disclosure, consultation, and informed participation in a manner commensurate with the risks to and impacts on affected communities. For projects with significant adverse environmental, involuntary resettlement, or Indigenous Peoples impacts, ADB project teams willparticipate in consultation activities to understand the concerns of affected people and ensure that such concerns are addressed in project design and safeguard plans.

680. In addition, ADB recognizes that Indigenous Peoples may be particularly vulnerable in certain project circumstances. Therefore, consent of affected Indigenous Peoples communities, through meaningful consultation, will be ascertained for the following project activities: (i) commercial development of the cultural resources and knowledge of Indigenous Peoples; (ii) physical relocation from traditional or customary lands; and (iii) commercial development of natural resources within customary lands under use that would impact the livelihoods or cultural, ceremonial, or spiritual uses that define the identity and community of Indigenous Peoples. For the purposes of policy application, consent of affected Indigenous Peoples communities refers to a collective expression by the affected Indigenous Peoples communities, through individuals and/or their recognized representatives, of broad community support for such project activities. Broad community support may exist even if some individuals or groups object to the project activities. The borrower/client will ascertain whether the affected Indigenous Peoples communities provide their broad support to the project activities, and where such broad community support exists, the IPP will clearly document the consultation process. ADB will review the borrower's/client's documentation of the engagement process, and in addition, through its own investigation, will assure itself that broad community support for the project activities has been demonstrated by the affected Indigenous Peoples communities. ADB will not finance the project if such broad community support does not exist.

C. Public Consultation Scheme

681. In order to comply with the Georgian legislation and the ADB requirements and to ensure meaningful consultations, the following actions was ralesed:

D. Disclosure of documents

682. The electronic versions of the draft EIA was placed on the Mestia Municipality, MDF and orhuse centre web-sites.

683. Hard copies of Project environmental documentation (draft IEE and Executive Summary) was placed in:

(i) Mestia Municipality office;
(ii) MDF head office;
(iii) MoE Department of Licenses and Permits

E. Public Discussions

684. The Ministry of Regional Development and Infrastructure of Georgia

Road Department of Georgia

685. The minutes of the public discussion of the environmental impact assessment report of the reconstruction and rehabilitation works of the 75 km-139 km section of Zugdidi-Jvari-Mestia-Lasdili automobile road of state significance

686. The public discussion of the environmental impact assessment report of the reconstruction and rehabilitation works of the 75 km-139 km section of Zugdidi-Jvari-Mestia-Lasdili automobile road of state significance was conducted in the administration building of large village Mestia municipality on 4th March, 2010. The aim of the public discussion was the delivery of information to the local population within the direct impact area of the planned works about the above works and terms. The issues of the temporary discomfort to the population during the work process and planned mitigation measures to reduce undesirable events connected with the works were also discussed. During the management plan discussion the attendant public had the opportunity to inquire and critically remark on the plans for the consideration during the final planning.

Name, Surname	Organization Name
David Siradze	Employee of the road department
Otar Khatiashvili	Employee of the road department
Luiza Bubashvili	Employee of the road department

687. The public discussion was attended by the authorized representatives of the village territorial bodies of Mestia district and representatives of the population.
The environmental impact assessment report of the construction and rehabilitation works of the road of state significance was explained to the attendants by road department employee Otar Khatiashvili and environmental specialist Luiza Bubashvili.

688. The meeting was opened by Otar Khatiashvili, who informed the attendants of the state road construction within the municipality territory. The great significance of state road rehabilitation was discussed in terms of economic development of Georgia.

689. The environmental management plans were presented by Luiza Bubashvili. Project related works, their possible environmental impact and influence on human health were discussed along with mitigation measures, which facilitate minimization of any harmful impact in the phase of road construction and exploitation to acceptable level.

690. Technical issues of the project and related questions were addressed by Otar Khatiashvili.

691. The questions and comments of the participants were answered by the road department employees. Questions and answers are given in Table N13.

Deputy Chairman
G. Tsereteli

Employees of the road department of Georgia:
Davit Siradze
Otar Khatiashvili
Luiza Bubashvili.

692. Public consultation of the environmental impact assessment of the rehabilitation projects of the road of state significance

Question/comment author	Question/comment	Notes
Nora Jafaridze	What works shall be implemented in the residential areas, where road is narrowed?	In the residential areas, where existing road is narrowed by bearing walls or gabions, the road shall be widened up to project volume.
Gurgen Gvirgvliani	Does the project provide for the restoration of water pipes, if they are damaged during road rehabilitation?	If the pipes are damaged by rehabilitation work, their restoration shall be conducted within the project scope.
Murad Ushkhvani	Where will be the territory of construction waste allocation be located?	The area of construction waste allocation shall be agreed with local authorities.

693. The answers on the comments from the ministry of the protection of the environment and natural resources is given in the below table.

N	Questions and comments	Comment author	Comments of EIA Consultant
1.	The types and volume of explosive works, especially – in the proximity of residential areas should be more specific in EIA report	The ministry of the protection of the environment and natural resources	Drilling and explosive works will be conducted on the following sections: 101 km-110 km section of Zugdidi-Jvari-Mestia-Lasdili automobile road – rehabilitation works need preliminary disintegration of part of the rocky ground through drilling and explosions (31^a) in the total amount of 3805 m^3. 111 km-115 km section of Zugdidi-Jvari-Mestia-Lasdili automobile road – rehabilitation works need preliminary disintegration of part of the rocky ground through drilling and explosions (31^a) in the total amount of 10100 m^3. 114 km-115 km and 115 km-116 km sections of Zugdidi-Jvari-Mestia-Lasdili automobile road – rehabilitation works need preliminary disintegration of part of the rocky ground through drilling and explosions (31^a) in the total amount of 2200 m^3.

2.	Builders' camps and expected emissions should be described in more detail in EIA report	The ministry of the protection of the environment and natural resources	A camp is designed per lot, it will serve about 30 builders. At present the arrangement of equipment storage yards with 2 or 3 trailers and not full scale camps is planned for builder accommodation. There is no place or need to construct large building camp. The accommodation of builders will be facilitated in the nearby villages (see below list) as well as sanitary-hygienic facilities. Arrangement of sanitary-hygienic facilities is not planned in the camps. The workers will not live in trailers, which are determined for the storage of part of equipment and night shift of 1 safety employee. The yard will be used to store equipment and part of cars, fuelling the equipment and performance of easy maintenance. The equipped yards will probably be located at the villages: Dizi, Nodashi or lakhamula, Etseri, Latali and Mestia – presumably, workers will be accommodated and equipment yards arranged in these villages. The exact location will selected by construction contractors. The location shall be selected using the following criteria: - transformed urban or rural landscapes not sensitive in ecological terms; - fuelling equipment should be arranged 50 m or more away from surface water objects; - the camps should not be located closed than 350 m to the residential areas. The distance should be sufficient to reduce the noise impact to acceptable level and not very far, because the workers will be accommodated in the nearby villages during construction. The project does not provide for the dissipation stationary sources and consequently, there is no need for the preparation of normative documentation (i.e. MAI and MAD).
3.	EIA report should describe non-organic dust emissions in detail	The ministry of the protection of the environment and natural resources	**The emissions of non-organic dust is important for the construction phase, while during the exploitation the emission of harmful substances as a result of fuel consumption is significant (which is discussed in EIA). According to the request, additional attention will be focused on the issue of non-organic dust during the construction work.** At the same time we should note that the preparation of the report on the dissemination of harmful substances during the construction of roads is not internationally practiced (i.e. see EIA guidelines prepared by the World Bank for the road department of Georgia in 2007-2009). For the construction works the qualitative assessment of the construction equipment emissions (and not quantitative) and planning of protection measures (which do not depend on the precise amount). The assessment of the equipment emission is discussed in detail in EIA. The project does not provide for the dissipation

			stationary sources and consequently, there is no need for the preparation of normative documentation (i.e. MAI and MAD).
4.	Monthly values of direct and total radiation for horizontal and vertical surfaces of various orientations should be indicated in EIA report, for which residential areas and according to what they are given (p. 47, Appendix p. 164)	The ministry of the protection of the environment and natural resources	Climate description is given on the basis of Mestia hydro-meteorological station. The comment is taken into account and hence we indicate the sources of data, which is listed in Appendix 9. The following sources are mainly used for climate data: 1. Information Bulletin (2005): On the Ecological Conditions of Underground Hydro-Sphere and Study and Prognosis of Hazardous Geological Processes. "Sakgeologia", Tbilisi, p. 410 2. Reference Book of Scientific-Applied Climate of Georgia; part one, individual climate characteristics, Tbilisi 2004m, p. 127 3. Sh. Javakhisvhili (1977), Climatography of Georgia, Tbilisi State University, p. 204 Climate data is reviewed in EIA in the volume sufficient to assess the project impact on the environment.
5.	EIA should identify which source is used for the climate data on wind, amount of clear and cloudy as well as misty days	The ministry of the protection of the environment and natural resources	On p. 47 of volume I and p. 164 of II volume (Appendices) of EIA the information could be found that climate characterization is given according to Mestia hydro-meteorological station data.
6.	Absolute minimal temperature is incorrectly indicated in EIA report. It is unclear to which period does -3 (presumably degrees) minimum temperature belong to (p. 47, Appendix p. 164)	The ministry of the protection of the environment and natural resources	As regards the absolute minimal temperature the indicated figure -3-5° is just a misspelling and should be -35°. P. 47 of volume I and p. 164 of volume II are changed accordingly. Average minimal temperature is indicated for winter period, value (-0,3°) is based upon the average of long term observations. The climate data was mainly obtained through the following sources: 1. Information Bulletin (2005): On the Ecological Conditions of Underground Hydro-Sphere and Study and Prognosis of Hazardous Geological Processes. "Sakgeologia", Tbilisi, p. 410 2. Reference Book of Scientific-Applied Climate of Georgia; part one, individual climate characteristics, Tbilisi 2004m, p. 127 3. Sh. Javakhisvhili (1977), Climatography of Georgia, Tbilisi State University, p. 204 Climate data is reviewed in EIA in the volume sufficient to assess the project impact on the environment.
7.	Such necessary hydrological characteristics, such as annual maximum discharge of various recurrences for r. Enguri and its tributaries should be given in EIA report	The ministry of the protection of the environment and natural	Maximum discharge of various recurrences for r. Enguri is given in Appendix 1. The comment is taken into account and hydrological characteristics are added to the corrected EIA report (volume II, Appendix I, p. 190).

		resources	The fact that the project does not imply building of new bridges should be noted. The repair of the existing bridges is limited to strictly rehabilitation work (restoration of cover, reinforcement of accesses, etc).
8.	The presented EIA report is general and needs more details in the following: • specific measures of management of waste formed during the construction; • categories of the waste by types and amount; • issues of waste characterization and management (allocation, processing, transportation, storage, distribution and securing) with due regard for risk-factors of environmental impact	The ministry of the protection of the environment and natural resources	Both in terms of quantitative and allocation problems of the waste during construction the only significant type of waste is formed from debris of rock stratum and ground debris increased by small amount of asphalt dissipated by cutter. Quantitative and allocation issues are described in EIA (total amount of debris is 260000 m^s). As regards the formation of solid household refuse, the amount is insignificant and depends on the number of staff in the building process. The number of workers in one shift is 30. There is one shift. The average annual amount of household waste per worker could be 70-80 kg. The collection of the waste on road construction section, allocation in waste containers and further transportation shall be conducted periodically through the utilities services which serve the villages located along the road. Insignificant amount of other types of waste (household or harmful refuse, such as oil or pieces polluted by fuel and filters) are not connected with the rehabilitation project and hence the project does not require precise quantitative analysis. Planning of adequate procedures of waste management is enough, which is reviewed in EIA (p. 73).
9.	The representatives of the wild life of Georgia included in Georgian Red List and presumably distributed in the right of way are listed in EIA report. Possible negative impact on each species should be studied and if necessary appropriate mitigation measures introduced. With due regard to the results of these studies the plans of environmental monitoring, mitigation measures, reaction to emergencies, compensation measures, which should be reflected in EIA presented for ecological expertise	The ministry of the protection of the environment and natural resources	It should be taken into account that project does not imply new road construction, but reconstruction of the existing road. Impact on new habitat or damage to intact landscapes is not expected. The project is not connected with habitat fragmentation or degradation risks and disruption of animal migration routes. The level of ecological studies, which is needed for the EIA format, is completed and adequate mitigation measures named. Mitigation measures comprise pre-construction survey, which implies reconnaissance of the construction corridor and if bird nests and small animal living areas are discovered, preventive measures should be implemented during the mobilization phase (forcing of movement to new living area via soft methods and clearing of the corridor). The above measures are listed despite the fact that the actual possibility of the necessity to implement such measures is really low – rehabilitation works are conducted within the existing road and widening is planned through cutting into rocky slopes.
10.	The plants included in Red List of Georgia could occur along the adjacent areas to automobile road and they could be eliminated. Surveys should be conducted prior to the commencement of the construction and species of plants included in Georgian Red List identified along with number of individuals to be cut.	The ministry of the protection of the environment and natural resources	It should be taken into account that project does not imply new road construction, but reconstruction of the existing road. The road widening on the narrow sections is planned through cutting into rocky slopes. Any significant impact on new habitats or damage to intact landscapes is not expected. The level of ecological studies, which is needed for the EIA format, is completed and adequate mitigation measures named.

	Further activities should be conducted in accordance with the laws of Georgia on Red List and Red Book		Wood cutting is not required in intact landscape by the project. Despite the above (if cutting of individual trees is necessary), the procedure to be implemented prior to commencement of the construction and involving cadastre inventory of the trees to be cut and agreement of the cutting plan with the forestry department of the ministry of protection of the environment and natural resources is given. Mitigation measures comprise pre-construction survey, which implies reconnaissance of the construction corridor during the mobilization phase. If the individuals of protected plants are discovered on the areas which could be under the impact of the construction (i.e. allocation areas of builders' camps, which will be eventually selected by the contractor).
11.	Working project of river crossing by the automobile road should be agreed upon with the national environmental agency of the ministry of the protection of the environment and natural resources prior to presenting for ecological expertise	The ministry of the protection of the environment and natural resources	The project does not involve construction of any bridges. The rehabilitation of the 7 bridges is limited to the restoration of the road surface and other simple rehabilitation works.
12.	The EIA report should be supplemented with the coordinates of the mentioned road section or digital version in Shp file format	The ministry of the protection of the environment and natural resources	The EIA report is supplemented with the plan and topographic map. The technical project comprises appropriate topographic measuring (in Autocad files). There is no provision in Georgia legislation making submission of Shp files mandatory.

VIII. GRIEVANCE REDRESS MECHANISM

694. PIU (MDF in this particular case) has overall responsibility for project implementation and environmental compliance. The administrative bodies responsible for environmental protection are the Ministry of Environmental Protection and Natural Resources and the City Hall. The affected population and stakeholders may send their grievances, related to the project induced environmental impacts and nuisance to PIU or directly to the administrative bodies responsible for the environmental protection.

695. The MoE and city hall are obliged to respond to the grievances, which have been received from the population or other interested parties in accordance with the requirements of the Administrative Code of Georgia.

696. However, the PIU will facilitate the response through implementing the following grievance redress mechanism. During the public consultation process, the PIU will inform the stakeholders and the public that PIU is responsible for environmental compliance and grievance redress. PIU will provide information on the public consultation meetings and post on the MDF web-site the contact details of the persons responsible for grievance collection and response.

697. Upon receiving the grievance (in written or oral form) the PIU will carry out the following actions:

(i) send its representatives to check the claims and monitor the situation
(ii) involve MoE and City Hall when and where appropriate
(iii) receive expert's conclusion (from MDF personnel, independent experts or MoE/City Hall experts)
(iv) submit an instruction on corrective measures to the construction company and the operator during 10 days after receiving the grievance inform the affected person or persons about the experts'
(v) decision and corrective measures applied;
(vi) If the affected person is not satisfied by the decision, they may present further information in support of new case. The subsequent decision of the PIU/MOE and Municipality is considered finally.

698. In case the affected stakeholder or person is not satisfied with the response, the grievance may be the directed to the court.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Framework for EMP Implementation

699. Construction Contractor shall be obligated by his contract to follow EMP and good construction practice. In order to meet this obligation, the Contractor shall have at least one environmental specialist in the team, who is able to fully understand the requirements of the EMP and professionally apply the envisaged mitigation measures to the contractor's daily operations. The construction contractor will also be required to prepare and implement his own Construction Phase EMP explaining in detail the action he will take to provide the mitigation set out in this IEE that is his responsibility.

700. The technical supervisor of works commissioned by MDF shall be responsible for establishing a strong field presence in the Project area and keep a close eye on the performance of works. Besides ensuring consistency with the design and ensuring quality of

works, the supervisor is required to track implementation of the EMP by the contractor, reveal any deviations from the prescribed actions, as well as identify any unexpected environmental issues should they emerge at any stage of works.
MDF provides a general oversight on the environmental compliance of works through ensuring quality performance of the technical supervisor and of the contractor. MDF also liaises with ADB, ensures availability of all environmental information, and facilitates environmental supervision of the Project by ADB.

B. Reporting on EMP Implementation

701. The Contractor, will be required by the construction consultant to prepare monthly progress reports on the EMP implementation. Such reports shall be prepared by the Contractors environmental specialist and will contain information on the main types of activities carried out during the reporting period, status of any clearances/permits/licenses which are required for carrying out such activities, mitigation measures applied, and any environmental issues that have emerged in relations with suppliers, local authorities, affected communities, etc. Contractor's monthly progress reports shall be submitted to the technical supervisor and MDF.

702. The technical supervisor shall prepare monthly reports on the progress of EMP implementation and environmental performance of the contractor. These reports shall be based on the contractor's reports and will carry analysis of their contents. The technical supervisor shall assess how accurate is the factual information provided in the contractor's reports, fill in any gaps identified therein, and evaluate the adequacy of mitigation measures applied by the contractor. The technical supervisor shall highlight any cases of incompliance with EMPs, inform on any acute issues brought up by the contractor or revealed by supervisor himself, and propose corrective actions. Once approved by MDF the Technical Supervisor will instruct the contractor to implement the corrective action.

703. MDF shall ensure that monthly reports from the contractor and from the technical supervisor are made available for the environmental specialists of the Fund promptly after they are received by the MDF administration. The Fund, through its environmental specialists, shall report to ADB on the status of environmental compliance of construction works each quarter. Such reports shall contain information on all violations identified and the actions taken to correct them. MDF shall inform the ADB on any major environmental issue at any time, independently from the schedule of regular reporting.

C. Monitoring

704. The monitoring plan for the project is summarized in p.10.1 Monitoring measures include construction site supervision, verification of permits, monitoring of compliance of the contractor performance and specific monitoring of environmental impacts like: noise, dust, soil and water pollution and air emissions etc.

705. The technical supervisor of works commissioned by MDF is responsible to establish strong field presence in the Project area and keep a close eye on the course of works. Along with ensuring consistency with the design and ensuring quality of works, the supervisor is mandated to track implementation of EMP by the contractor, reveal any deviations from the prescribed actions, as well as identify any unexpected environmental issues should they emerge at any stage of works.

D. Budget for implementation of EMP

706. Most of the mitigation requires action by the contractor, which will be taken as part of the normal construction activities, the costs of which are estimated elsewhere. There are in fact very few other mitigation actions that need to be budgeted separately. Those that do require separate budgeting provision are:

707. The costs of environmental activities associated with the construction will be included in the contract for construction.

708. Construction contractor is obligated to follow EMP and good construction practice. In order to meet this obligation, a contractor shall have at least one environmental specialist on the team, who is able to fully understand recommendations of EMP and professionally apply prescribed mitigation measures to the contractor's daily operations.

709. The Archaeological studies should be conducted by contractor via engaging appropriate organization. Estimated costs for these studies equal 3 000 GEL. These expenses should be considered in the Construction contract.

710. Costs of spoil and rock disposal approximately is 600 000 – 800 000 GEL.

711. Some not significant expenses are foreseen with respect to the following public consultation on the EIA and EMP and will be borne by the Contractor company.

E. Remedies for EMP Violation

712. MDF as PIU and administration of the Region, as a client of construction works, shall be responsible for enforcing compliance of the contractor with the terms of the contract, including adherence to the EMP. For minor infringements, an incident which causes temporary but reversible damage, the contractor will be given 48 hours to remedy the problem and to restore the environment. If restoration is done satisfactorily during this period, no further actions will be taken. If it is not done during this period, another contractor shall be tasked to do the restoration, and the cost shall be deducted from the failed contractor's next payment.

F. EMP Matrixe

Environmental impact at the Construction Phase					
Impacts	**Sites**	**Mitigation Measures**	**Costs**	**Responsibility for Implementation**	**Responsibility for Monitoring and Enforcement**
Erosion from road cuts and fills and sedimentation of natural drainage ways. **Nature of impact**: long-term. Change of relief, drainage patterns, land clearance, may cause gradual but stabile intensification of erosion	Construction site RoW	Installation of long-term drainage systems and anti-erosion structures. • reinstatement of relief, soil and vegetation cover • Installation of long-term drainage system and permanent monitoring. • Installation of sedimentation basins, seeding or planting of erodible surfaces as soon as possible • Increase the number of drain outlets. • Place drain outlets so as to avoid cascade effect. • Line receiving surface with stones, concrete. • Long-term monitoring and maintenance	Insignificant	Construction Contractor	Construction Contractor MDF.
Erosion stimulated from fresh road cuts and fills and temporary sedimentation of natural drainage ways. **Nature of impact: immediate**; Fresh road cuts may immediately trigger intensive erosion during construction and drastic increase of sedimentation	Construction site RoW	**Mitigation strategy**: prevention through implementing temporary anti-erosion measures – temporary drainage, biomatting or geo-textile cover, berms etc. • Limitation of earth moving to dry periods. • Protection of most susceptible soil surfaces with mulch. • Protection of drainage channels with berms, straw or fabric barriers. • Installation of sedimentation basins	Insignificant	Constructing contractor	Constructing contractor MDF.
Erosion of lands below the road bed receiving concentrated outflow	Construction site	• Increase the number of drain outlets. • Place drain outlets to avoid	Insignificant	Constructing contractor	Constructing contractor MDF.

from covered or open drains		cascade effect. • Line receiving surface with stones, concrete.			
Topsoil losses due to improper storage and handling	Construction site	**Topsoil Protection** The topsoil will not be handled by Contractor when the following conditions are observed: • The topsoil is frozen; • The site is experiencing persistent rainfall; • The topsoil is saturated; or • Handling will damage the structure of the topsoil. • Keep topsoil storage standards	Insignificant	Constructing contractor	Constructing contractor MDF.
Increased suspended sediment in streams affected by erosion at construction sites and fresh road cuts, fills and waste dumps. Declined water quality and increased sedimentation **Character of impact**: immediate; Fresh road cuts may immediately trigger intensive erosion during construction and drastic increase of sedimentation	Construction site	**Mitigation strategy**: prevention through implementing temporary anti-erosion measures – temporary drainage, temporary sediment catchments etc. • Protect susceptible surfaces with r fabric, • Establishment of retention ponds to reduce sediment loads before water enters streams	Insignificant	Constructing contractor	Constructing contractor MDF.
Soil and water contamination during construction by oil, grease, fuel and paint	Construction site	• Collect and recycle lubricants. Store the lubricants and fuel residue in special room. Use impermeable tray for placing lubricant containers. • Avoid accidental spills through good practice. • Avoid refueling near watercourses; Ensure proper	Insignificant	Constructing contractor	Constructing contractor MDF.

		maintenance of equipment and fueling of the vehicles and machinery. • Check vehicles (leaking of fuel etc.) • Organize and cover material storage areas; • Isolate concrete, earthwork and other works from water courses by using sealed formwork; • Isolate wash down areas of cement and gravel trucks and other equipment from water courses by selecting areas for washing that are not free draining directly or indirectly into water courses;			
Poor sanitation and solid waste disposal in construction camp and work sites (sewerage, sanitation, waste management) .	Construction site	Provide adequately located and maintained waste disposal facilities (containers). Contract municipal waste operators for disposing the household waste, garbage and small amounts of nonhazardous construction waste etc. .	Insignificant	Constructing contractor	Constructing contractor MDF.
Construction wastes. Disposal of excess soil and rock. Certain part of the cut material (soil and rocks) should be disposed of Demolition of old pavement	Construction site Asphalt and rocks demolition area; Landfill	Assess and, if required, develop a spoil and rock disposal plan Provide for disposal facilities agreed with Regional Services of MoE Transport any further material to the nearest spoil disposal sites agreed with the regional services of MoE and/or municipal services. The main purpose is not to damage valuable landscapes or soil deposits and other ecological sensitivities. For the rock disposal licensed landfill can be used. All waste from the construction site will be disposed of in accordance with the local environmental regulations and on the sites approved by the	Significant 700 000 Lari	Constructing contractor	Constructing contractor MDF. MoE

		environmental authority. The demolished asphalt and rocks should be reused.			
Noise pollution from vehicle operation during construction in the populated areas traversed by the highway, Local noise.	Construction site	Install and maintain mufflers on equipment. Routine maintenance shall be done to a high standard to ensure that vehicles are safe and that emissions and noise are minimized. All the plants used on site will be regularly maintained so as to be in good working order at all times to minimize noise. Prohibit night works near the settlements	Insignificant	Constructing contractor	Constructing contractor MDF.
Air pollution from vehicle operations during construction in the populated areas traversed by the highway, Local dust	Construction site Access roads	• Require adherence to engine maintenance schedules and standards (or use alternative fuels) to reduce air pollution. • Periodically water down or lightly oil temporary roads. • Enhance public transportation and traffic management capability. Cover trucks carrying cement and/or gravel; Wet or cover trucks carrying stone/ sand/ gravel; Haul materials in off peak traffic hours.	Insignificant	Constructing contractor	Constructing contractor MDF.
Infrastructure. The main infrastructure element that could be affected are the power transmission lines, water supply systems and irrigation pipes and channels..	Construction site	**Protection of infrastructure.** Replace the affected infrastructure elements Permanent monitoring during construction. Full reinstatement in case of damage	Including in project budget	Constructing contractor	Constructing contractor MDF.
Construction Camp Site The potential impacts related to the	Construction site	• Proper waste management. • Pollution prevention strategies: proper	Insignificant	Constructing contractor	Constructing contractor MDF.

construction and operation of the camp can be summarized as follows: • Clearance of vegetation cover during camp construction • Potential damage of topsoil • Contamination related to fuel storage and fuelling operations • Sewerage related contamination • Waste management		organization of fueling, waste management; • Proper storage of topsoil			
Creation of temporary breeding habitats for mosquito vectors of disease e.g. sunny, stagnant pools of water. Creation of stagnant water bodies in borrow pits, quarries, etc. suited to mosquito breeding and other disease vectors.	Construction site	Remove all created pools till spring-time. Reinstate relief and landscape.	Insignificant	Constructing contractor	Constructing contractor MDF.
Health hazards by noise, air emissions and dust raised and blown by vehicles during construction activities.	Construction site; Access roads	Dust control by application of watering. Use as minimum as 2 browsers; Noise control, installation of mufflers on equipment, daytime works;	Insignificant	Constructing contractor	Constructing contractor MDF.
Impacts on archaeological sites and remnants	Construction site	Permanent monitoring during land clearance and excavation activities. Stoppage and suspension of construction activities in case of archaeological findings. Completion of required archaeological works before restarting construction activities. Conservation of remnants	Insignificant	Constructing contractor	CAS represents Constructing contractor MDF.

biological recontamination during earthworks near pest-holes of soil infections (e.g. anthrax);	Construction site	Permanent monitoring during land clearance and excavation activities. Stoppage and suspension of construction activities in case of burial site findings. Notification to the local division of Veterinary Department. Veterinary clearance before start up.	Insignificant	Constructing contractor	Veterinary Department of the NSFSVPP Constructing contractor MDF.
Hazardous driving conditions where construction interferes with pre-existingroads	Construction site	Include in the design for proper markings and safety signs on roads, including lights. Instruct the drivers	Insignificant	Constructing contractor	Constructing contractor MDF.

I.7 Environmental Monitoring Plan (Matrix)

Construction Phase

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost**	**Responsible Institution**
Whole construction period.	Dust and Air pollution (solid particles, suspended solids, flying heavy metal particles)	Construction site; Access roads; Cut asphalt and rocks crushing area. Blasting Works	Supervision	*Unannounced inspections; following complaints*	*Assure compliance with HSE requirements.*	*Minimal Included in supervision contracts*	Constructing Contractor MDF
Whole construction period.	*Vibration and Noise*	*Construction site;* Access roads Blasting Works Cut asphalt and rocks crushing area.	*Supervision*	*Unannounced inspections; following complaints*	*Assure compliance with HSE requirements.*	*Minimal Included in supervision contracts*	*Constructing Contractor* *MDF*
Whole construction	*Topsoil and subsoil*	*Construction site,*	Observation	Once per week	Assure compliance	Minimal Included in supervision	Constructing Contractor; MDF

period.	*management*	Rite of way				contracts	
Whole construction period.	Traffic safety/ Vehicle/ pedestrian access Visibility/ appropriate signs	Construction site, Access roads Rite of way	Observation	Once per week	Assure compliance	Minimal Included in supervision contracts	Constructing Contractor; MDF
Whole construction period.	Material and waste storage, handling, use Water and soil quality (suspended solids, oils, etc)	Construction site; Rite of way Material and waste storage sites;	Observation	During material delivery and periodically during construction (average 1/week), especially during precipitation (rain/ snow/ etc).	Assure pollution abatement; Assure compliance with, construction standards, environmental norms and EMP provisions;	Minimal Included in supervision contracts	Constructing Contractor; MDF;
Whole construction period.	Waste Management (Transportation and disposal)	Construction sites; Access Roads; Waste disposal areas.	Observation	Once per week	Assure pollution abatement; Assure compliance with, construction standards, environmental norms and EMP provisions	Minimal Included in supervision contracts	Constructing Contractor; MDF
Whole construction period.	Equipment maintenance and fuelling	Refueling and equipment maintenance facilities;	Observation	average 1/week,	Assure pollution abatement	Minimal Included in supervision contracts	Constructing Contractor; MDF
Whole construction period.	Impacts on archaeological sites and remnants	Construction site	Observation	Permanent/daily	Assure cultural heritage protection	Minimal	CAS represents. Constructing Contractor; MDF
Whole construction period.	biological recontamination during earthworks near pest-holes of soil infections (e.g. anthrax);	earthwork site	Observation	Permanent/daily	Assure health protection	Minimal Included in supervision contracts	Construction Field officer; Veterinary Department of the NSFSVPP
Whole construction period.	Protection of infrastructure elements	Construction site; Crossings of current infrastructure;	Observation	During construction activities at the site	Assure infrastructure protection and replasement	Minimal Included in supervision contracts	Constructing Contractor MDF

During Construction period	Reforestation. Eco-compensation Program	Recreation site	Observation	During Construction period	Assure offset of cut forests	Minimal Included in supervision contracts	Constructing Contractor; MDF
During Construction period	Disposal of construction wastes (Inert Waste)	work sites, used areas, Landfill	Observation	During Construction period	Ensure pollution prevention and landscape protection;	Minimal Included in supervision contracts	Constructing Contractor; MDF
Whole construction period.	Personal Protective equipment. HSE issues	Construction site Access roads	Inspection	Unannounced inspections during works	Assure compliance with HSE requirements	Minimal Included in supervision contracts	Constructing Contractor; MDF

X. CONCLUSION AND RECOMMENDATION

713. The presented IEE document clearly shows that there would be positive as well as negative impacts on environment during construction and regular operation phases. The document describes mitigation measures for all negative impacts on environment together with related expenses that includes implementation of the mitigation measures as well as monitoring costs:

(i) One of the most positive results of the project implementation is the restored and widened Zugdidi-Jvari-Mestia-Lasdili road. The rehabilitation works will become significant factor for Zemo Svaneti region in local socio-economic and development of tourism;

(ii) Negative impact during the construction phase will be formed due to increase of the level of noise, dust and vibration, although it is noteworthy that the same impact is typical to any construction project and hence a wide array of mitigation measures have been elaborated and checked for effectiveness;

(iii) The level of noise, dust and vibration resulting from the movement of equipment will be significantly decreased upon the completion of the construction;

(iv) Large amount, approximately 260 000 m^3 inert waste will be formed due to rock cutting for road widening process during the project implementation. The inert waste should be used (distributed to the population, arrangement of reinforcement of the sensitive areas in agreement with government organizations as well as trench filling, etc). The allocation of inert material is the last way of waste management;

(v) The normal functioning of the road is especially complicated by landslips developed in the tectonically unstable slate strata with deformation depths within several dozens of meters and their formation-activation occurs through integration of various factors. Complete stabilization of these landslips via engineering construction is impossible. A range of effective measures recommended during the characterization of these landslips are the most reasonable to retain their dynamic balance.

(vi) Despite some negative impact, which require permanent monitoring and precise implementation of mitigation measures, the benefit from the project greatly exceeds the negative impact.

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