Initial Environmental Examination

Initial Environmental Examination 3
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GEO: Sustainable Urban Transport Investment Program, Tranche 2 (Mtskheta Bridge Project)

Prepared by Municipal Development Fund of the Ministry of Regional Development and Infrastructure for the Asian Development Bank.

Mtskheta Bridge Detailed Design Project

INITIAL ENVIRONMENTAL EXAMINATION

Draft Final Report

Municipal Development Fund of Georgia

Ministry of Regional Development and Infrastructure

Prepared for Transproject
By Foundation WEG

Tbilisi

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ADB	Asian Development Bank
CAS	Center of Archaeological Search of the Ministry of Culture and Sports
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
GIS	Geographical Information Systems
GP	Good Practices
GPS	Global Positioning System
HSE	Health, Safety and Environment
IFI	International Financial Institution
IEE	Initial Environmental Examination
LARP	Land Acquisition and Resettlement Plan
MAC	Maximum Admissible Concentrations
MoA	Ministry of Agriculture
MDF	Municipal Development Fund of Georgia
MoE	Ministry of Environmental Protection and Natural Resources
MLHSP	Ministry of Labor, Health and Social Protection
MoI	Ministry of Interior
MoCMP	Ministry of Culture and Monument Protection
MUFSRA	Management Unit for Food Safety and Risk Analyze of the Ministry of the Agriculture
PIU	Project Implementation Unit
PPE	Personal protective equipment
RDMRDI	Road Department of the Ministry of Regional Development and Infrastructure
RAP	Resettlement Action Plan
RoW	Right of Way
SPS	ADB Safeguard Policy Statement 2009
WB	World Bank

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EXECUTIVE SUMMARY

Background

1. This IEE has been prepared by the Municipal Development Fund of the Ministry of Regional Development and Infrastructure (MDF), the Executing Agency (EA). Its objective is to addresses Environmental impact issues for the Mtskheta Bridge Project so as to fit the ADB's Safeguards Policy Statement of 2009 (SPS). With MDF as the Implementing Agency (IA) the Project is included in Tranche 2 of the Sustainable Urban Transport Investment Program. The IEE is based on detailed design it is final and fits ADB's Safeguards Policy Statement of (SPS) requirements.

2. Mtskheta is the administrative center of Mtskheta-Tianeti region, district Mtskheta. The city and its suburbs represent the oldest settlement in Georgia. Due to its historical significance and numerous ancient monuments, Mtskheta (certain districts) became a UNESCO World Heritage site. Tourism represents a significant income source and source of employment of the population in the region.

3. Currently, Mtskheta is linked to Tbilisi by the by means of 2 secondary roads and bridge, which do not meet safety standards and requirements as regards increased traffic flow and modern loads. Construction of new bridge across the river Aragvi will be the shortest link with the motorway Tbilisi-Senaki-Leselidze and will significantly reduce the distance from Tbilisi to Mtskheta. The travel will become more comfortable and safe and will support increased tourist flow in Mtskheta.

Scope of Report

4. The IEE demonstrates and describes the need for this Project. The IEE details the Project concept design, proposed method of delivery and proposed location of the Project. This IEE considers the technical constraints of the Project and by doing so presents the potential positive and negative social and environmental impacts that may result from its implementation.
This IEE presents the following:

- Introduction;
- Legal requirements;
- Project Description
- Description of existing environment:
- Socioeconomic condition
- An assessment of potential impacts as a result of the Project and proposed mitigation
- Considered Project alternatives;
- Environmental management plan;
- Environmental Monitoring Program
- Public consultation;
- Grievance Redress Mechanism
- Conclusions and recommendations

Project Description

5. The design object is planned to construct over the river Aragvi, at the confluence of the rivers Mtkvari and Aragvi, at 200-250 m up the estuary, against the current and is distanced by about 20 km from Tbilisi.

6. Design envisages construction of two-lane road providing for the parameters of four-lane motorway (expected modernization of the road into 4-lane motorway in the future).

7. Arched bridge over the river Aragvi envisaged in the design is of individual design. Bridge diagram is (21.5+3x33.0+21.5) m, L=151.6 m, dimensions (17.0+2x1.5) m. In conjunction with the bridge, construction of overpasses on the motorway is envisaged in the design.

8. Bridge will be constructed in two stages to avoid any contamination of river from concrete. The first stage is carried out from one side of the river. A raised platform of local soil fill material is created and from this platform the foundation is constructed. Piles are drilled from the platform after installing a casing. Soil material is removed from the bottom of the casing always ensuring that the casing is at least 1 m below the level of excavated soil. A reinforced framework is then installed and filled with concrete. The casing is gradually raised higher ensuring that the bottom end of the casing is always at least 2.5m below the newly poured concrete level. On top of the constructed foundation a pier is installed and the superstructure construction works are carried out.

Government Policies and Legislation, ADB SPS

9. The chapter 2 presents detail description of the environmental legal framework and administrative structure in Georgia including environmental regulations, measures required and indicates the institutions at the local and national levels responsible for issuing permits, licenses, and enforcing compliance with environmental standards. ADB safeguard requirements; screening and categorization of projects. This Section also provides public consultation procedures; procedure for official submission of EIA/IEE, Rules for construction projects by Government Ministries etc. In addition, information on relevant agencies such as, MDF, Road Department, Ministry of Environmental protection, and Ministry of Economy and Sustainable Development are assembled as well.

Summary of Findings

10. This IEE study has identified that there is the potential for both positive and negative environmental and social impacts to occur as a result of the Project. The IEE has determined that comprehensive and effective management and mitigation measures are feasible to be implemented through all delivery phases of the Project. Such measures could feasibly mitigate potentially negative impacts and enhance the identified potential positive benefits. Key potential negative impacts identified in this IEE if unmitigated include:

- Noise, emission and dust from project construction activities may affect local people or nearby fauna
- Impacts to soil and surface water receptors are possible from the accidental spillage, leakage or improper management of hazardous substances such as fuels or oils;
- Construction waste and wastes generated by the accommodation of personnel living and working on site could pollute nearby environments if improperly managed;
- Potential damage of archaeological remains during the construction works

11. The identified potential negative impacts are likely to be able to be minimized and managed effectively with the implementation of the measures detailed in the Environmental Management Plan.

12. Potentially positive impacts that could result from the Project include, safe driving conditions for tourists and local population and higher carrying capacity of the road that will better fit increased transport flows. The design road is also very much important for supporting tourism development in Mtskheta district.

13. The preliminary public consultation with the affected community showed that the community is supportive of the proposed Project and perceived benefits of the Project by increasing business and local employment opportunities.

14. The detailed Resettlement Action Plan has been prepared. Beside the 15,020 sq.m of unused public land, this project will affect 7 private households with 35 household members. Its impact is related to the permanent take of 7 private unused private agricultural land plots with total area of 7,249sq.m sq.m. The project will not entail loss of crops or assets attached to the land (trees, structures etc.), or loss of incomes. The affected land is not cultivated or used.

15. According to the ADB SPS 2009, this sub-project is thus classified as of category B and needs only the preparation of a Short Resettlement Plan (SRP).

16. Results of this IEE suggest that the proposed Project is likely to be able to proceed without resulting in any negative significant impacts to physical, biological, or socio-economic environments occurring, if appropriate management measures are implemented. As such, the Project will have overall beneficial impact as well as some minor negative impacts that will be carefully monitored and adequately mitigated. Therefore, the completion of this IEE fully meets the MoE and ADB requirements and submitted to MoE to obtain Environmental Impact Permit.

1. INTRODUCTION

1.1. BACKGROUND INFORMATION

1. Mtskheta is the administrative center of Mtskheta-Tianeti region, district Mtskheta. Mtskheta and its suburbs represent the oldest settlement in Georgia. Historically, Mtskheta was the capital of Kartli in the eighties of the III century BC and afterwards it became the capital of Georgia, since when up to the fifth century AD it plays a significant part both in Georgia and the Caucasus. Over a period of 800 years Mtskheta remained political and religious center of Iberian Kingdom.

2. Mtskheta and its suburbs are full of numerous ancient monuments and archeological remnants. There are at least 200 historical monuments in Mtskheta. Mtskheta with its unique beauty, natural and cultural landscape and historical and cultural heritage has great tourist potential. Due to its historical significance and numerous ancient monuments, Mtskheta (3 local areas with monuments) became a UNESCO World Heritage site.

3. Mtskheta attracts tourists with its historical-architectural, archeological sights, museums, churches and monasteries. Tourism represents a significant income source and source of employment of the population in the region. Provision of services significantly changes living conditions of the population and enables sustainable development.

4. Currently, Mtskheta is linked to Tbilisi and the mainline E-60 highway by means of 2 secondary roads and bridge, which do not meet safety standards and requirements as regards increased traffic flow and modern loads. This existing road infrastructure cannot support increased tourist flows.

5. Government of Georgia has approached ADB with request to finance construction of a new bridge connecting the highway with Mtskheta. The Project is included in Tranche 2 of the Sustainable Urban Transport Investment Program. Municipal Development Fund of Georgia is the Executing Agency.

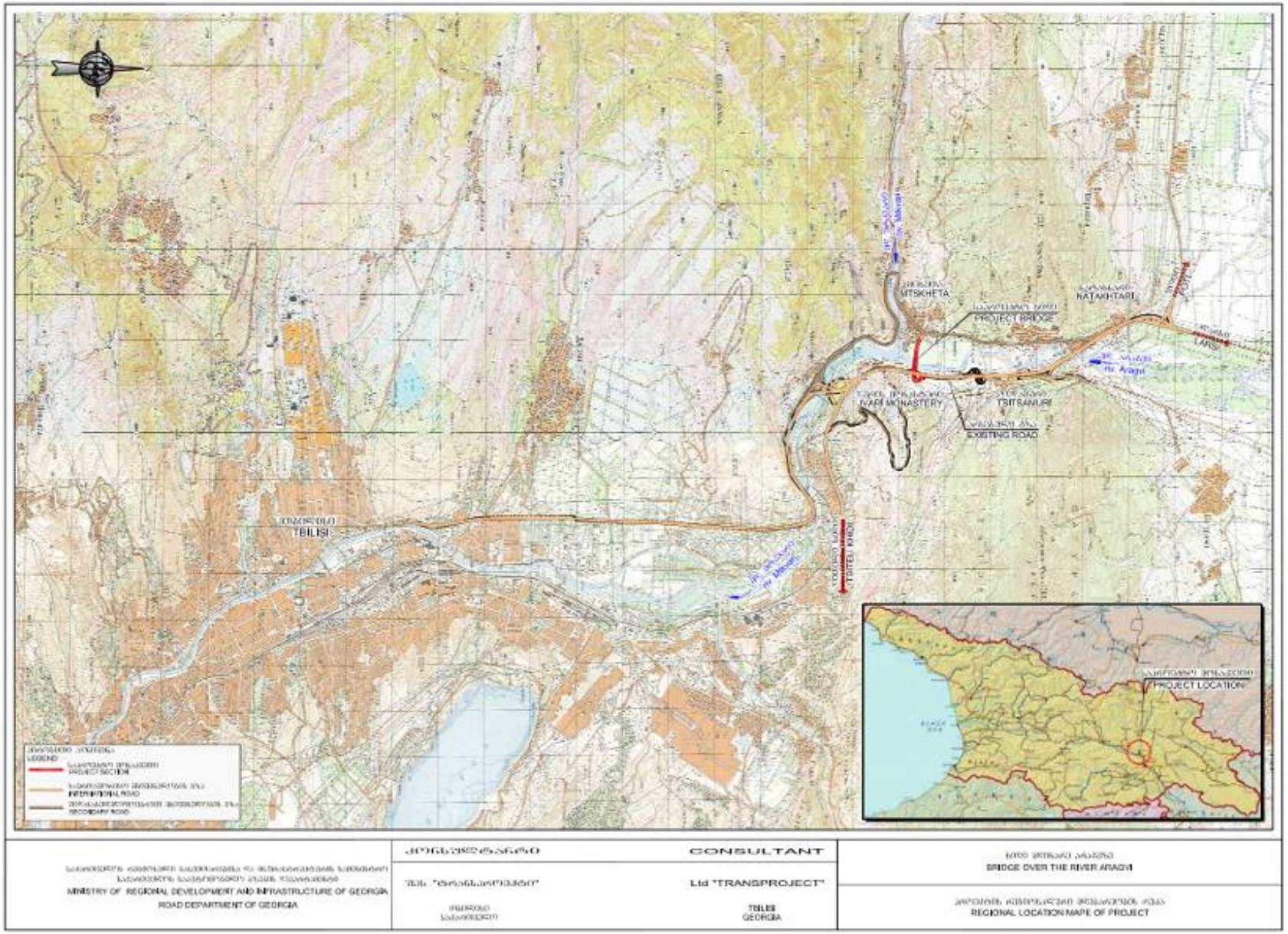


Fig.1.1 Scheme of Integration of r.Aragvi Bridge in the Road Network

1.2 RATIONAL FOR THE PROJECT

6. Actually, Mtskheta is linked to Tbilisi and the motorway by means of secondary road Zahesi-Mtskheta-Kavtiskhevi-Gori, Zahesi-Mtskheta road section, Narekvavi-Mtskheta-Railway Station road.

7. Secondary road Zahesi-Mtskheta-Kavtiskhevi-Gori starts at the km 20 of international road Tbilisi-Senaki-Leselidze.

8. Junction of the motorway with the road Zahesi-Mtskheta-Kavtiskhevi-Gori and layout of motorway in the vicinity of Jvari Monastery is shown on the photo.

9. Zahesi-Mtskheta section of the secondary road Zahesi-Mtskheta-Kavtiskhevi-Gori is located on the right bank of the river Mtkvari. Width of road bed ranges within 7.0 m - 9.0 m. Width of shoulders is 0.5m - 1.5 m. The road is characterized by frequent sharp bends in plan and small radii.

10. The road doesn't meet safety requirements, there are frequent accidents on the road ending in death toll, also resulting in economic losses.

11. The road Narekvavi-Mtskheta-Railway Station starts at km 5 of the road Zahesi-Mtskheta-Kavtiskhevi-Gori. The road crosses the river Mtkvari by steel reinforced concrete bridge and afterwards total section is located within the limits of Mtskheta.

12. Dimensions of steel reinforced concrete bridge across the river Mtkvari at the entrance to Mtskheta are 6.2+2*1.0 L=101.0 m with a continuous span scheme 26.6+40+16.6 m. Superstructure is composed of two bridge trusses of variable heights. The trusses are interconnected by longitudinal and transverse links. Piers and abutments are solid. The bridge doesn't meet requirements as regards increased traffic flow and modern loads.
(See photos of the bridge)

13. Construction of new bridge across the river Aragvi will be the shortest link with the motorway Tbilisi-Senaki-Leselidze and will significantly reduce the distance from Tbilisi to Mtskheta. The travel will become more comfortable and safe.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Introduction

14. In the chapter 2.1 detailed description of Georgian environmental legislation is provided. It describes existing in Georgia environmental regulations relevant to the project, provides guidance on the measures required for ensuring consistency with environmental assessment and makes reference to institutions at the local and national levels responsible for issuing permits, licenses, and enforcing compliance of environmental standards. In chapter 2.2 screening requirements according to the ADB **SPS** 2009 and WB's environmental and social safeguards are described. Screening determination regarding the present project is provided in chapter 2.3

2.1 ADMINISTRATIVE STRUCTURE AND ENVIRONMENTAL PERMITING PROCEDURES IN GEORIA

2.1.1 Administrative Structure

15. Recent changes in the administrative structure, adopted by the Decrees No 132 and 133 of the Government of Georgia dated 16.03.2011, resulted in redistribution of responsibilities between the Ministry of Environmental Protection and Natural Resources (MoEPNR) and the Ministry of Energy and are reflected in current titles of the mentioned ministries. The MoEPNR is renamed as the Ministry of Environmental Protection (MoE) and the Ministry of Energy is now titled as the Ministry of Energy and Natural Resources.

Ministry of Environment Protection (MoE) and Ministry of Energy and Natural Resources.

16. The MoE is still considered as a leading ministry responsible developing the environmental policy of the government. The MoE consists of several functional departments, which are responsible for different aspects of environmental protection, and other supporting departments, like administrative department, Legal Department, PR Department etc.

17. Functional departments and their responsibilities:

Department of Permits	Carrying out Ecological Expertise and issuing Environmental permits Post EIA monitoring of compliance with the conditions of Environmental Permit
Department of Environmental Policy and International Relations	Development of the State Policy and State Environmental Programs
Department of Integrated Management of Environment	Ambient air and water protection strategy Consent on the Reports of "Inventory of Stationary Sources of Emissions" and "Norms of Maximally Admissible Emissions" Consent on the Report on "Norms of Maximally Admissible Discharges" Consent on the technical regulations for Water Intake from the Surface Water Objects Waste Management Hazardous Substance Management Climate change control Environmental Standards and Norms
Biodiversity Protection Department	Biodiversity protection policy and programs

Legal Department	Development of Environmental Legislation
Agency of Protected Areas	Protected areas development policy and programs
Environmental Agency	Hydrometeorology Pollution Monitoring Geohazard monitoring Monitoring of geo-ecological conditions of river basins, water reservoirs, Black Sea territorial waters, continental

18. The Ministry of Energy and Natural Resources has at present overall responsibility for managing natural resources and radiation safety.

The Department of Natural Resources is managing following environmental issues:

- Issuance of licenses on exploration of natural resources. This includes also licenses for quarries and borrow pits supplying the road projects with the inert construction materials

Nuclear and Radiation Safety Department is responsible for

- Development of Nuclear and Radiation Safety Policy
- Radiation Safety Control

Environmental Inspection of the MoENR is responsible for:

- Inspection of compliance with the natural resource use regulations
- Inspection of compliance with the conditions of Environmental Impact Permit

19. In relation with the road projects, first of all it should be mentioned that Ministry of Environmental Protection is still in charge of issuing Environmental Impact Permits. At the same time, as it could be seen from the above schemes, both agencies – MoE and MoENR are sharing responsibilities for the post EIA monitoring, although the efficient monitoring system still needs to be developed. MoENR is responsible for issuing licenses for quarries and borrow pits.

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

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

22. For projects requiring 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 the issuance of the Permit is subject to the consent of the MoE in a 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 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 administrative proceedings initiated for the purpose of permit issuance, in accordance with Georgia’s Law on Licenses and Permits.

23. 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) is carried out by the project implementing agency and its consultants (in this case RDMRDI and its consultants). Scoping and screening do not represent mandatory procedures according to Georgian legislature although review of scoping/screening outcomes and agreement of the Ministry of Environment Protection is considered a desired practice.

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

25. Ministry of Economic and Sustainable Development. The projects related to construction or reconstruction of the highways of international significance and attached road infrastructure are classified as the projects of Special Importance. MoESD is responsible for carrying out the review of technical documentation (including conclusion of an independent experts) and issuing Permits on Construction for such projects, as well as for supervision over constructing activities and for arranging Acceptance Commission after completion of construction.

26. 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

27. MoESD is issuing licenses for operations of quarries, needed for highway construction activities.

Other Responsible Governmental Institutions:

28. The Ministry of Culture and Protection of Monuments. The ministry is responsible on supervision of the construction activities in order to protect archaeological heritage. In case if construction is to be carried out in a historic sites or zones of cultural heritage, consent of the Ministry of Culture, Monument Protection and Sport is also required for issuing construction permit.

29. The "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of the Agriculture (NSFSVPP). NSFSVPP is responsible for implementation of complex sanitary protection measures in case of identification of burial sites during earthworks. Information about suspicious burial sites should be delivered to the "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of the Agriculture by the Constructing Contactor (field environmental officer) and MDF field officer.

2.1.2 LEGAL FRAMEWORK

2.1.2.1 Legislation Related to Environmental Permitting

30. At present, the environmental permitting procedure in Georgia is set out in three laws:

31. The project proponent, in implementing projects, will comply with (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**. In more details the EIA process and required content of the EIA document is described in the **Regulation on EIA issued by the MoE dated March 16, 2009.**

32. The Law on Licenses and Permits was adopted by 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).

33. The Laws on Environmental Impact Permit and on Ecological Examination have been published on 14.12.2007 and entered in force on 01.01.2008. These new laws integrate all the amendments introduced in legislation of Georgia during recent years.

34. The Law of Georgia on Environmental Impact Permit.
The Law of Georgia on Environmental Impact Permit determines the complete list of the activities and projects subject to the 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.

35. 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.

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

37. In case if the activity included into the list given in clause 4 p.1 does not require Construction Permit, based on the Conclusion on the Ecological Examination the MoE 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.

38. The aforementioned laws do not provide details of screening procedure and do not define responsibilities of parties. According to the practice, the screening of project proposals and the preliminary assessment of their environmental impact and proposed mitigation measures (scoping) are being carried out by the project proponent in consultation with the MoE.

39. Public Consultation Procedures.
The 6th clause of the law of Georgia on the Environmental Impact Permit provides detailed requirements and procedures for conducting public consultations and established timeframes for information disclosure and discussion, namely:
According to article 6 , 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).

40. A developer is obliged to disclose (publish) the draft EIA document and publish information regarding details fo the planned public discussion. Information is subject to publication in the central periodical as well as in the printing organ existing within the administrative territory of the same district (if such exists) where an activity is planned. Information (advertisement) shall contain the following information:
The objectives, title and location of the planned activity;
The location where interested individuals may obtain the activity related documents (including the EIA report);
Deadline for the submission of their opinions;
The place and time of public discussion.

41. A developer is entitled:

To submit a hard copy and an electronic version of the Environmental Impact Assessment to administrative body issuing a permit within a week from the date of the publication;
To receive and consider within 50 days from the date of publication from citizens written comments and suggestions;
Hold a public discussion on a planned activity not earlier than 50days and not later than 60 days from the publication of an advertisement;
To ensure invitation to public discussion of the representatives of respective local administration and governmental agencies representatives; the Ministry and the Ministry of Economic and Sustainable Development and other interested administrative bodies.

42. 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 district where an activity is planned.

43. 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. 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 to the MoE 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.

Procedure of Official Submission of EIA to MoE

44. Article 8 of the Law specifies the documents to submit to receive a permit:
(1) An operator, 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'.
(2) An operator is obliged, in addition to the information specified by the 'Law of Georgia on Licenses and Permits', to submit the following documents:

(a) An EIA report drawn up under the standards specified by the legislation of Georgia (in 5 hard copies and 1 soft copy)
(b) A situation plan of the planned activity (with the indication of distances)
(c) 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))
(d) A brief description of the activity (as a technical summary)
(e) A statement about the confidential part of the submitted statement.

(3) An operator 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.

45. Issuance of the Permit on Environmental Impact
The article 9 of the law describes the procedures of issuing the Environmental Impact Permit. The same issue is addressed in the laws of Georgia on "Licenses and Permits" (2005) and "on Ecological Examination' (2008).
1. According to the law on "Licenses and Permits," the MoE takes decision on issuing Permit within the 20 days after submission of request on permit by the project proponent.
2. MoE , 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.

Regulation on EIA as of March 16, 2009.

46. The requirements related to EIA studies and the EIA report are set forth in the Regulation on EIA issued by MoE in March 2009.
The content of the EIA document is specified in the clause 5 of the Regulation as follows:
Article 5. Content of the environmental impact assessment
The Environmental impact assessment report should include the following information:

(a) Analysis of the existing state of the environment;

(b) Identifying the sources, kinds and objects of impact caused by the activity;

(c) Forecast of the changes of quantitative and qualitative characteristics of the environment;

(d) Determining the probability of emergency situations due to the activity and evaluating the expected results;

(e) Evaluation of the environmental, social and economic results of the planned activity;

(f) Specifying the reduction measures for the negative impact on the environment and human health and specifying the compensation measures as necessary;

(g) Identifying the residual (cumulative) impact and measures for its control and monitoring;

(h) Undertaking environmental and economic evaluation of the projects;

(i) Analysis of the alternative variants of the project implementation, selection and forming new variants;

(j) Identifying the ways and means to restore the initial environmental condition in case of terminating entrepreneurship or other activity;

(k) Informing the society and studying the public opinion;

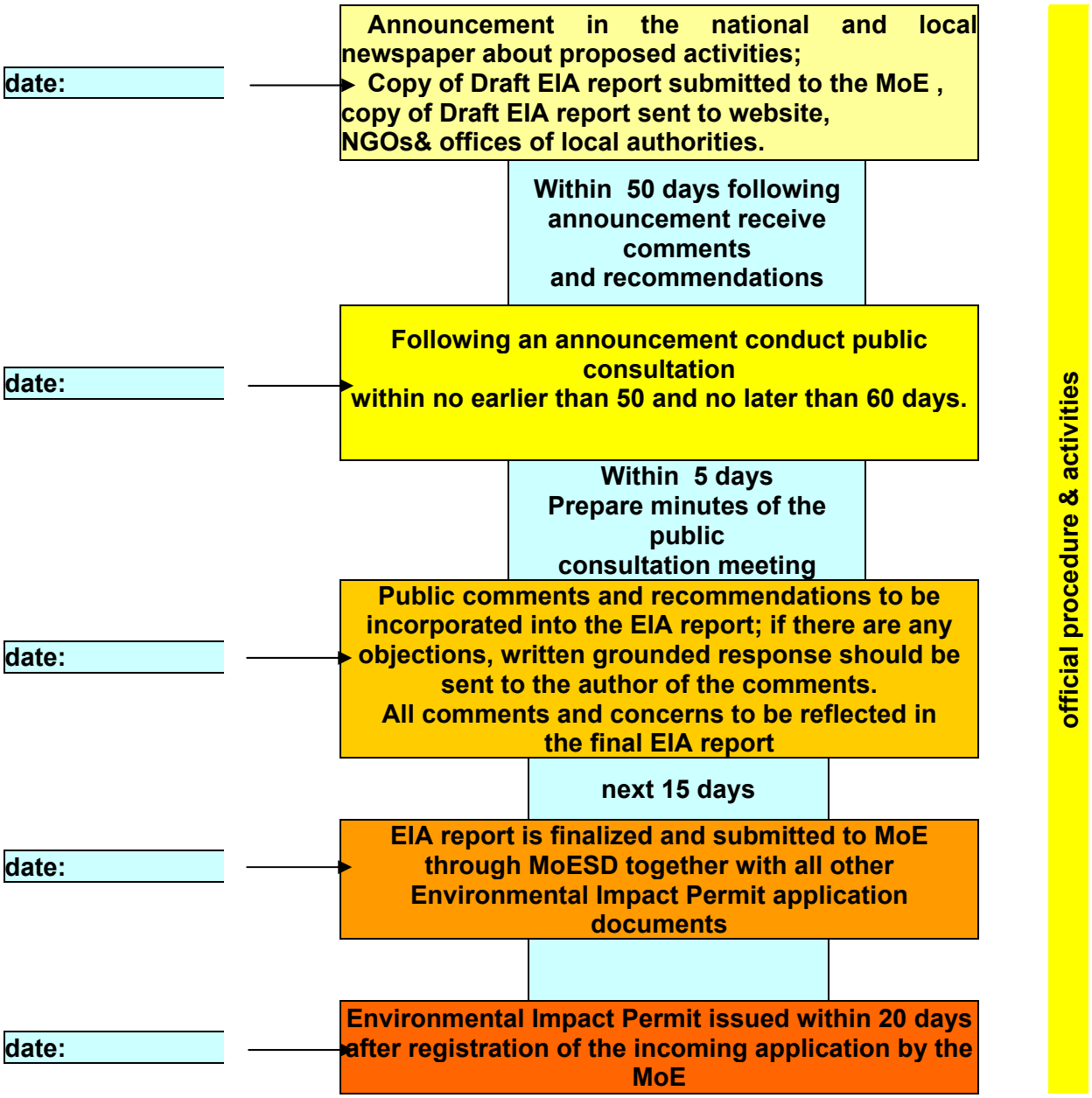
(l) Plan for the post-project situational analysis;

(m) Identifying the kinds and quantities of the expected emissions;

(n) Forecast of the expected environmental state gained through the environmental impact factors;

Decree also requires development of the Monitoring Plan during the implementation of the project and at the end of the activity.

Disclosure and Environmental Impact Permit Procedure



2.2 IEE AND ENVIRONMENTAL SCREENING UNDER ADB SPS 2009

47. The donor IFI (Bank) undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA. Screening principles and procedures, as well as other conceptual and procedural details of IEE process, are described in **ADB SPS 2009**. The Bank classifies the proposed project into one of three categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. The Bank establishes following three categories:

48. Category A is assigned to a proposed project if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. Full scale IEE and relatively longer period for public discussions (120 days) is required in this case. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares

them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the Borrower is responsible for preparing a IEE report.

49. Category B is assigned to a proposed project if its potential adverse environmental impacts on human environment are less adverse than those of Category A projects (e.g. insignificant impact on sensitive area or medium grade impact on less sensitive area). Like Category A EA, category B EA examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document). For the WB the EA for B category projects could be provided in a form of Environmental Management Plans (EMP) or Environmental Review (ER), which includes EMP. For ADB projects EA for B category projects is nominated as Initial Environmental Impact Assessment.

50. Category C is assigned to a proposed project if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

2.3 SCREENING DETERMINATION FOR THE PROJECT

51. According to Georgian legislation the activities related to construction or reconstruction of the roads of National and International Importance and related infrastructure requires Environmental Impact Permit. Therefore, construction of new bridge on r.Aragvi near Mtskheta needs obtaining of Environmental Impact Permit and preparation of the relevant IEE.

52. In accordance with the ADB and WB regulations the project of construction of new bridge in Mtskheta is attributed to the B category. Preparation of the Initial Environmental Assessment including the EMP is required for implementation of the project.

53. In order to comply with both – the Georgian and the WB regulations – it is required to prepare IIEE in a format compliant with Georgian IEE requirements, including EMP, and conduct public disclosure of the mentioned documents in compliance with the ADB/WB regulations and Georgian legal requirements.

3. PROJECT DESCRIPTION

3.1 DESIGN REQUIREMENTS AND STANDARDS

54. This project involves Concrete Arch bridge with total length of 159 m, which is about 16 % of the total alignment. This bridges is consist of 5-spans continuous. The Mtskheta Bridge is a river crossing bridge across the Aragvi river. The Bridge is a symmetric arch bridge with a concrete deck for the aesthetic requirements. Design parameters were adopted based on Georgian State Standard SST 72: 2009 “Public roads. Geometric and structural requirements” approved by the National Agency for standards, technical regulations and meteorology on 9 February 2009.

55. Design envisages construction of two-lane road providing for the parameters of four-lane motorway (expected modernization of the road into 4-lane motorway in the future).
Main parameters adopted in the design for two-lane traffic:

- Design speed - 80 km/hr;
- Width of road bed – 20.0 m;
- Number of traffic lanes – 4;
- Width of carriageway – 14.0 m;
- Width of traffic lane – 3.5 m;
- Width of paved shoulders – 0.5 m;
- Width of shoulders – 2.5 m;
- Type of pavement – asphalt concrete;

56. Design loads on bridges and overpasses – according to TEM and SNiP standards.

3.2 DESIGN PARAMETERS

3.2.1 Road Plan

57. Project road starts in Mtskheta, on the right bank of the river Aragvi at the confluence of the existing roads, where construction of roundabout at grade is envisaged, then crosses the river Aragvi and at km 22 joins the international road Tbilisi-Senaki-Leselidze with grade-separated intersection.

58. The project road joins the existing two-lane road with one-way traffic at the beginning.

59. One horizontal curve R=5000 m is applied on the route, whilst minimum radius of horizontal curve on interchanged is R=60.0 m.

60. Project data and actual situation are applied on the Road Plan.

3.2.2 Road pavement structure

61. Road pavement structure is designed considering technical and economic parameters and based on the following data:

- Traffic flow;
- Reliability factor;
- Service life.

62. Design service life of pavement structure is at least 20 years. Pavement structure is of asphalt concrete.

63. Width of carriageway with paved shoulders is 16.0 m; width of paved shoulders 0.5 m.
Cross-fall of carriageway is 2.0%, whilst that of the shoulder is 4%.

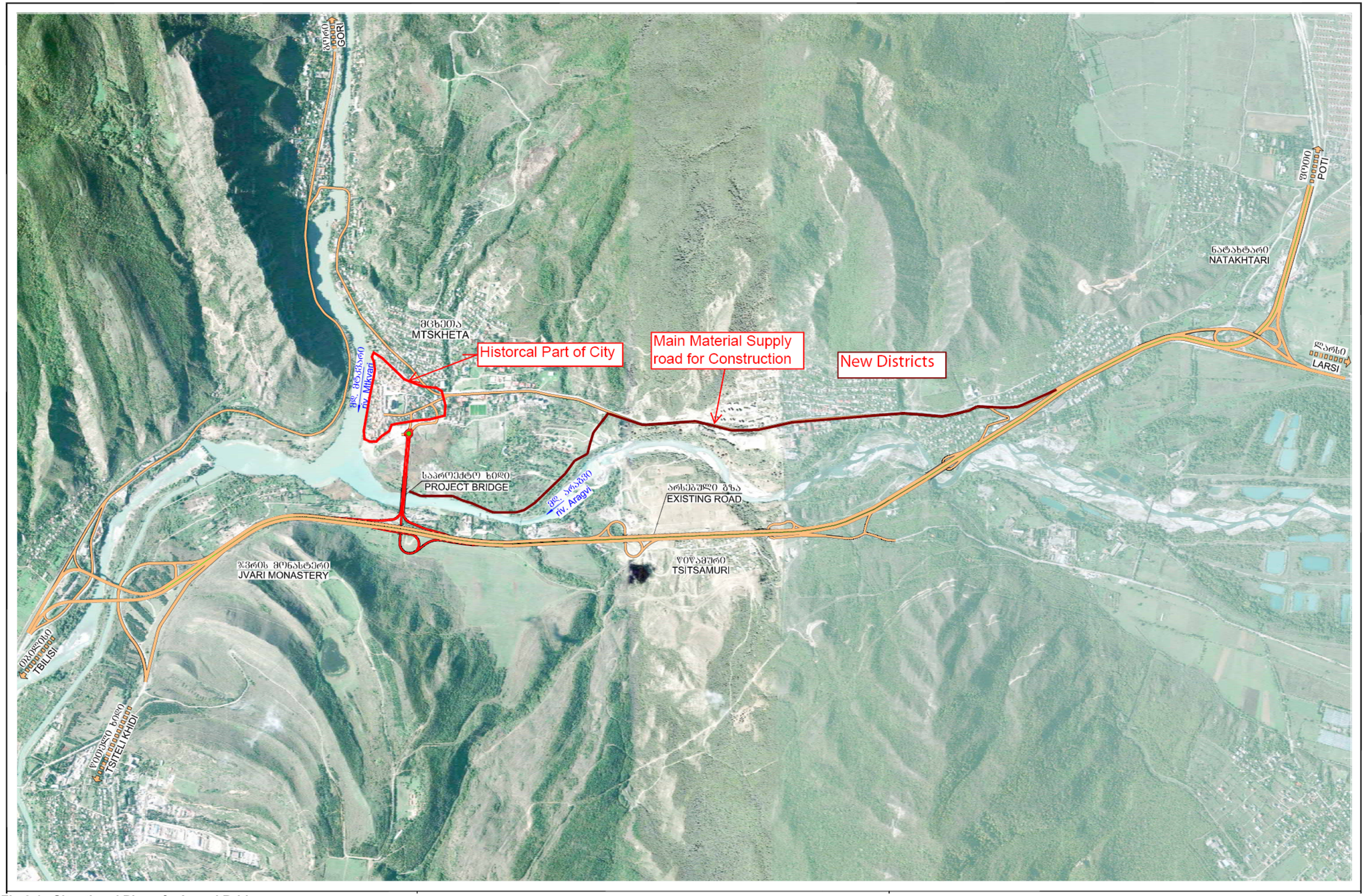


Fig.3.1 Situational Plan of r.Aragvi Bridge

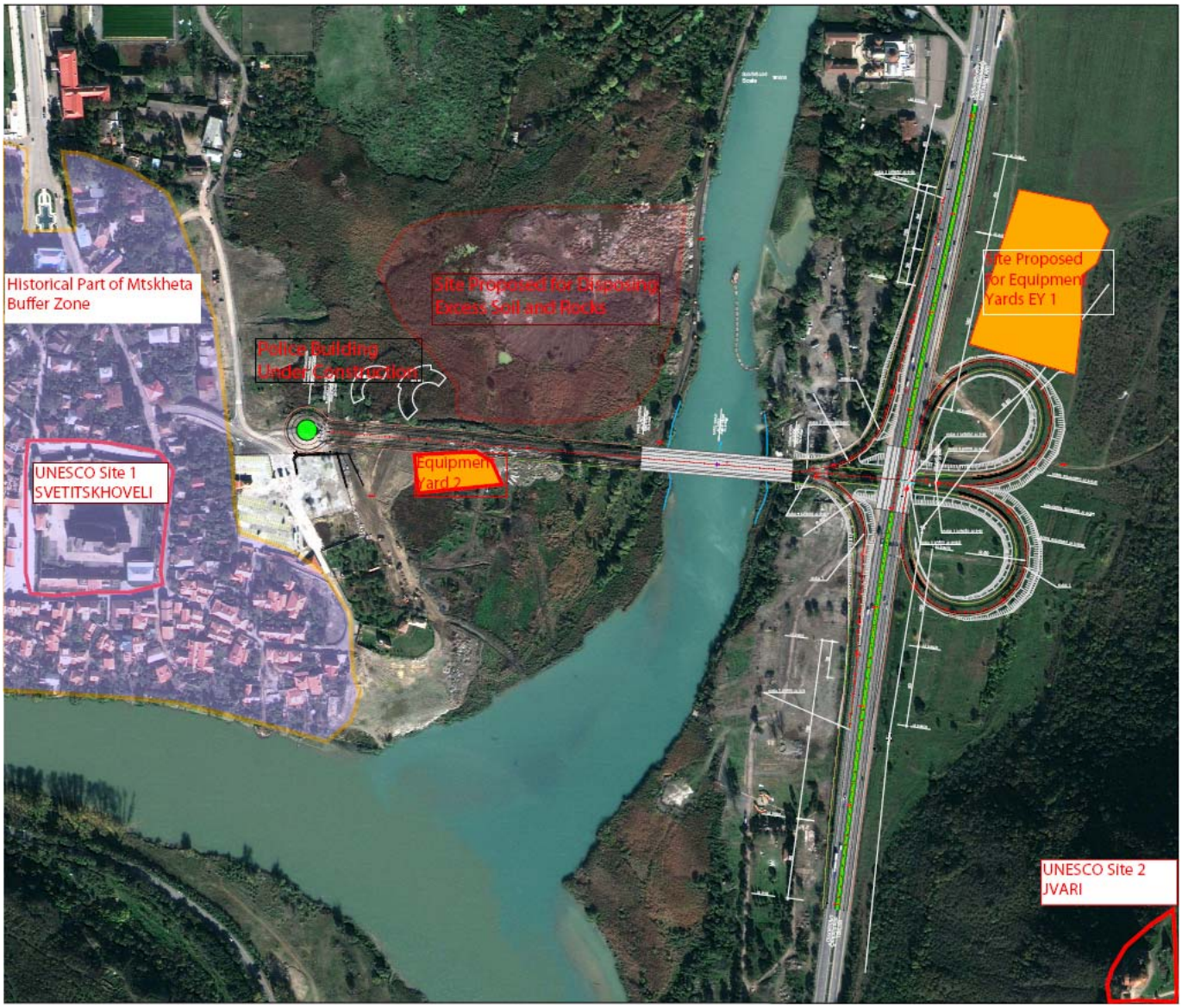


Fig.3.2 Layout Plan of the of r.Aragvi Bridge and Interchange System

64. Pavement structure adopted in the design:

- Wearing course - fine-grained dense asphalt-concrete hot mix, thickness 4 cm;
- Binder course - coarse-grained porous asphalt-concrete hot mix, thickness 6 cm;
- Upper layer of base course - coarse-grained porous asphalt-concrete hot mix, thickness 7 cm;
- Lower layer of base course – crushed aggregates 0-40 mm, thickness 25 cm;
- Sub-base - sand and gravel mix, thickness 30 cm;
- Shoulders - sand and gravel mix.

Pavement structure adopted on the interchange is similar to the that on the main road. Construction of wearing course is envisaged on the total area of that section of Tbilisi-Senaki-Leselidze road, where the interchange intersects the road.

3.2.3 Junctions and intersections

65. Construction of grade-separated interchange is stipulated on the international road Tbilisi-Senaki-Leselidze as well as the construction of roundabout at the beginning of the route at the confluence of the roads.

66. It is envisaged in each of the given Alternatives that considering the fact that the project bridge is located near to the motorway Tbilisi-Senaki-Leselidze and due to high water level in the river Aragvi, junction of the bridge with the motorway shall be carried out by means of four overpasses (two for each direction) with roundabouts on the interchange.

3.3. ENGINEERING STRUCTURES

3.3.1 Bridge over the river Aragvi

67. Arched bridge over the river Aragvi envisaged in the design is of individual design. Aesthetic value of the bridge was considered as important design factor for this historical and tourist site.

68. Bridge length is L=159 m. There are three reinforced concrete arches 0.9x3.0 m in the cross-section of the bridge. The arches are fixed on piers by reinforced concrete joining belt. Two adjacent arches on the pier heads are interconnected by reinforced concrete beams L=17.6 m of individual design.

69. Bearing parts (movable and fixed) are constructed on the heads of reinforced concrete body of piers. Pier body through raft foundation is rested on reinforced concrete bored piles d=1.2m L=18.5 m, number – 14 units.

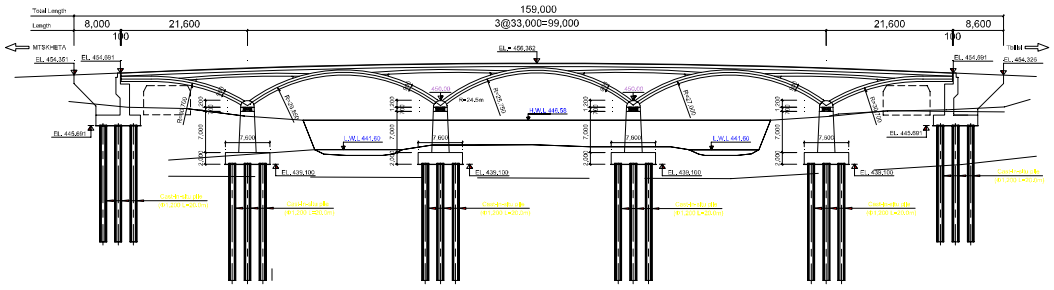
70. Solid reinforced concrete abutments are not filled with soil and are rested on reinforced concrete bored piles d=1.2m L=18.5 m – 11 units through raft foundation.

Fig. 3.3 Aesthetic view of the designed Mtskheta bridge on r. Aragvi

71. Span arrangement of superstructure for the bridges was determined depending mainly on required clearance under the bridge, availability of the materials, economy and constructability, and selection of bridge type was made taking into account topographic and geological conditions of the site.

- Considering factors including aesthetics, economy, availability of local construction materials and construction methods, the following types of the Mtskheta Bridge is recommendation..
- The bridge type(main girder) adopts pre-stressing concrete construction to minimize the cost and to ensure good quality of superstructure.

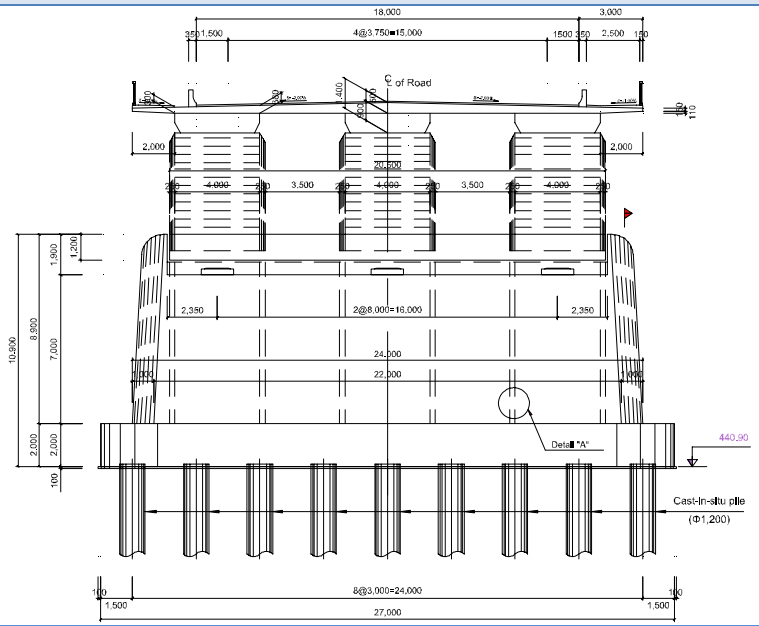
Table 3.1. Longitudinal Profile of the Mtskheta Bridge

Item	Concrete Arch Bridge (5-Span)	
Advan-tage	• Excellent aesthethics to long span • Clear driver's view at bank road	• Highly symbolized Arch –Rib Plan • Decreased cost by same arch lines
Planned Scheme	 L = 8,0 + 21,7 + 3@33,0 + 21,7 + 8,6 = 159,0m	

72. For the Mtskheta Bridge, the application of the cast-in-situ concrete girder is suitable, Main girder type to make out based on as follows;

- On the other hand, in case of cast-in-situ concrete deck, although the construction period increases, it may be beneficial in the economic aspect owing to the reduced construction cost of the girder.
- Optimum concrete girder type for the Mtskheta Bridge is as follows;

Table 3.2 Typical Cross Section

Item	Type of the Main Girder
Cross Section	

Advantage	• Improved quality owing to the use of the concrete girder which can be cast-in-situ. • Less deflection caused by live load in comparison with steel composite cross section. • No need of to carry steel and reduced maintenance cost in comparison with steel composite cross section. • Easy maintenance management on a regular basis because concrete cracks are visible to the naked eye.
Construction	• Excellent constructability by applying a simple construction method known as FSM, one of the cast-in-situ methods.

73. The superstructure of bridges was designed in accordance with HL-93 loading and the others were designed based on AASHTO LRFD Bridge Design Specifications (2007).

3.3.2 Overpasses on the interchange

74. Construction of overpasses on the motorway is envisaged in the design. The overpasses represent one-span pre-fabricated beam structures, scheme (1x13.66÷18 m). Length of each overpass is L-26.3 m, dimensions are (1.0+11.5+13.25+1.0)m. Superstructure beams are pre-stressed and of reinforced concrete of variable length 13.66÷18 m, h=0.75 m. Number of beams in the cross-section is 38.

75. Superstructure beams are connected with reinforced concrete slab h=0.2 m.
Abutments are solid, of reinforced concrete and not filled with soil. Abutments through raft foundation are rested on reinforced concrete bored piles d=0.9 m L=12.0 m.

76. Construction of reinforced concrete retaining walls on bored piles d=0.9 m is envisaged at the abutments to support the fill at the approaches to overpasses.

3.3.3 Culverts

77. Design of culverts is carried after bridge axis and interchange are determined.
Design envisages:
- construction of culverts cross-section 1.0x1.5 – 3 units, total length 64.0 m;

Including:
- 2 culverts on the interchange;
- 1 culvert on the existing road.

78. Extension of the existing reinforced concrete box-culvert (underpass) cross-section 6x4.5 m and construction of reinforced concrete drain collectors, cross-section 1.0x1.5 m are envisaged in the design.

3.4 CONSTRUCTION WORKS

3.4.1 Introduction

79. Construction-rehabilitation works shall be performed accordance with typical technological diagrams as well as design specifications and in conformity with active standards, norms, recommendations and instructions.

80. Traffic control procedures and fencing of the construction site shall be done in accordance with relevant instructions throughout the whole performance period. Layout of corresponding works shall be agreed with the local representative of the Police.

81. All materials, semi products and prefabricated structures required for construction-rehabilitation works should correspond to the design requirements and to the requirements of corresponding standards. Only licensed suppliers will be contracted.

3.4.2 Preparatory works

82. Preparatory works shall be carried out prior to the construction.
Preparatory works include:

- Fixing, re-conditioning and staking of route - 3.5 km;
- Cutting and uprooting of shrubs – 0.84 hectare;
- Relocation of optical fibre cable within the limits the right-of-way - 750 m;
- Relocation of pipe d-1200 mm – 600 m;
- Relocation of pipe d-500 mm – 950 m.

83. Compensation for estates, buildings and plants located within the limits of right-of-way is envisaged in the design.

84. Installation of road signs, pavement marking, installation of guide posts and steel guardrails shall be done under the present project to ensure traffic regulations and safety.

3.4.3 Construction of Road Bed and Earthworks

85. Road bed is designed according to norms, standards and typical design decisions valid in Georgia.

86. Cutting of top soil shall be done prior to the construction of road bed. Volume of earthworks is calculated in accordance with the design cross-sections and is as follows for the main road:

- Volume of top soil that shall be removed - 2700 m^3;
- Cutting of loose soil under the road bed and filling with gravel soil (PK 0+40-PK 3+54) - 23400 m^3;
- Volume of fill - 47320 m^3;
- Volume of cut – 99740 m^3.

87. Volumes of earthworks according to kilometers and types of processing are specified in the Table of Distribution of Earthworks According to Kilometers.

88. Works ensuring removal of water from the road bed shall be done prior to the construction of road bed, which requires construction of ditches according to the layout defined on the plan.

89. Filling and compacting of top soil on fill slopes, seeding of grass shall be done under the present design.

3.4.4 Construction of Bridge

90. Bridge will be constructed in two stages to avoid any contamination of river from concrete. The first stage is carried out from one side of the river. A raised platform of local soil fill material is created and from this platform the foundation is constructed. Piles are drilled from the platform after installing a casing. Cast-in-place method is applied for arranging piles. Drilling mrthod is dry. No bentonite is used during the drilling process. (see for more details 3.4.5)

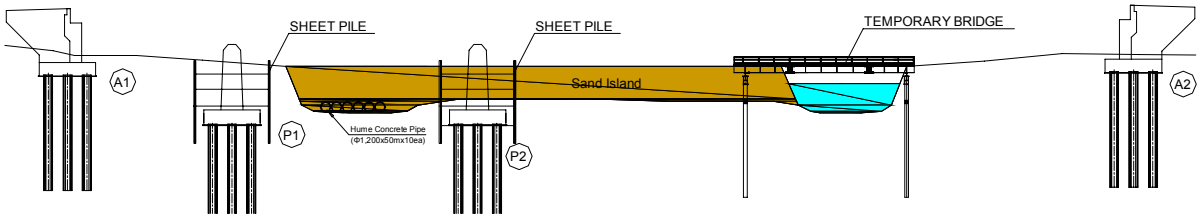
91. The use of this technology ensures that there can be no contamination to the river from concreting works. Following completion of the work, the same arrangement is duplicated on the other side of the river; a second temporary platform is created and the other half of the bridge is constructed using the same arrangements.

Construction Method for the Arch Bridge

92. In the Detailed Design, the most favourable construction method is determined by analyzing the followings from all angles : the Aragvi Rirver depth, geological condition, environment of the construction site, structural stability, traffic control, economic efficiency, and etc.

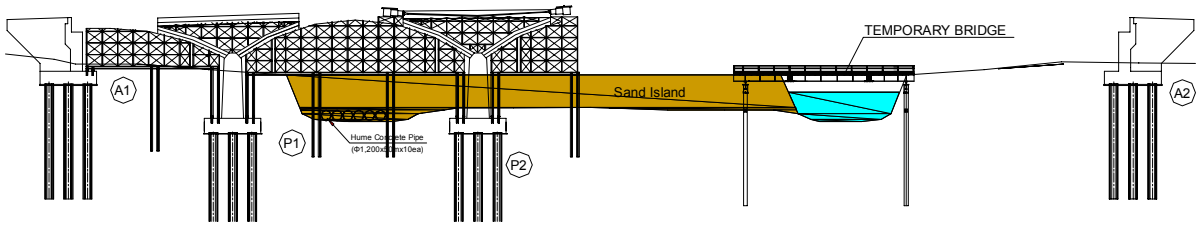
- The typical construction method of the concrete arch bridge is FSM (Full Staging Method).

1st : Construction of Abutment & Foundation, Sand Island



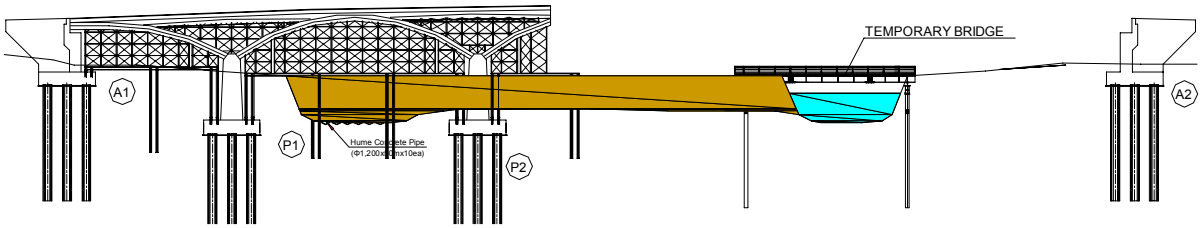
- To Construct of Sand Island and Sheet Piles, temporary bridge
- To Construct of Pile Foundations
- To Construct of Abutments and Piers

2rd : Construction of Arch Rib & Girder



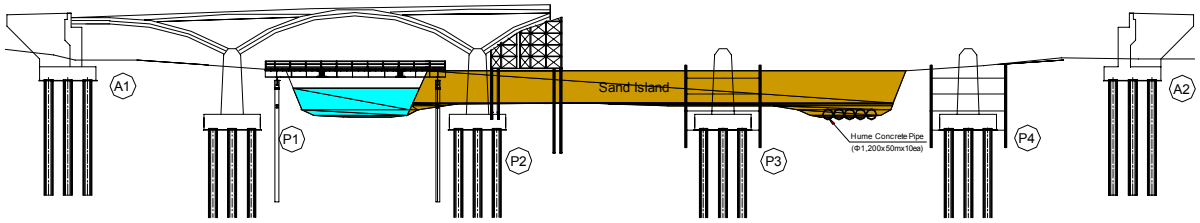
- Removal of Sheet piles
- To construct of system shores
- To Install of Cast-in-situ Arch Ribs and Cast-in-situ Girders
- To Transfer of Prestress in Girder

3rd : Construction of Arch Rib Crown & Girder



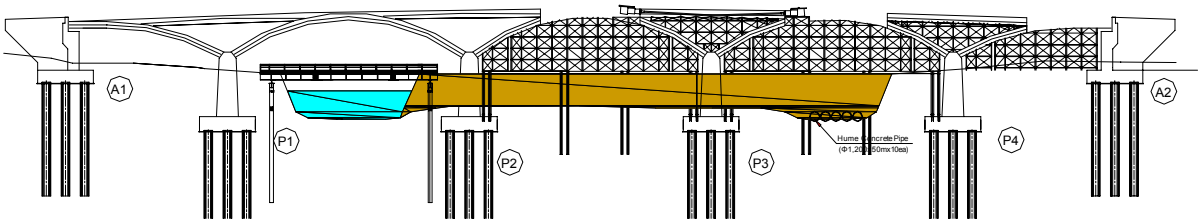
- To Construct of Arch Crown
- To construct of Slab and Asphalt Pavement

4rd : Reinstall temporary bridge & Sand Island



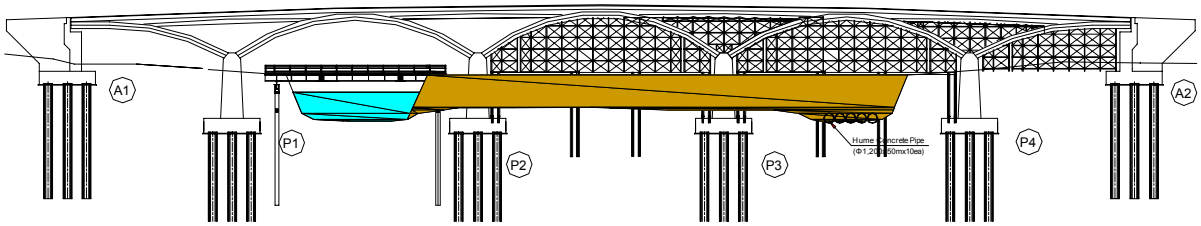
- To reuse of Sand Isl and and Sheet Pi l es, t empor ary bri dge

5rd : Construction of Arch Rib & Girder



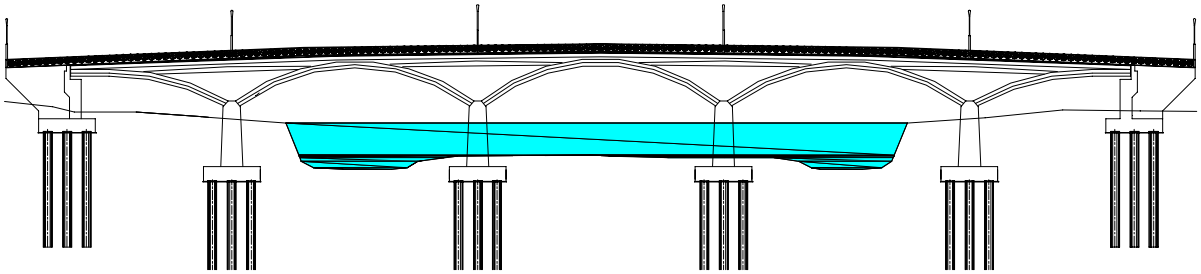
- To const r uct of syst em shor es
- To I nst al l of Cast-i n-si t u Arch Ri bs and Cast-i n-si t u Gi r ders
- To Transf er of Pr est r ess i n Gi r der

6rd : Construction of Arch Rib Crown & Girder



- To Const r uct of Arch Cr own
- To const r uct of Sl ab and Asphal t Pavement

7rd : Construction Finished



- Removal of Tempor ar y Br i dges and shor es
- To i nst al l of St r eet l amps and Par apet s

Fig. 3.4 Construction Sequence of Scaffolding Method

93. The construction method of pile foundation can be categorized into two-major parts such as Cast-in-Place and Ready-made.

Table 3.3 Classification of Foundation Type

Method	Cast-in-place	Bored
Schematic		
Description	• Minor noise, vibration • Easy to assure the bearing layer • Low corrosiveness • Comparatively high construction cost • Easy to keep the vertical straight	• Not affected by ground conditions • No possibility of collapse of bore-hole • Comparatively high construction cost • Need authentic quality control
Applicable Condition	• Almost all ground conditions	• Gravel, boulder layer
Review	• Cast-in-place is the most suitable method for deep foundation and high workability with a lot of experience in the region. D1200mm pile is selected as a standard material for the deep/pile foundations based on the local experiences.	

3.4.5 Drilling Operations

94. Cast-in-place is the method applied for piling. Dry drilling without bentonite is practiced. D1200mm pile is selected as a standard material for the deep/pile foundations based on the local experiences. In case of soft ground and risk of collapse of the drilled borehole, the metal casing of the same diameter is installed in the borehole (length os 1 section of casing 5.5m). The sections of casing are than connected by means of scre-bolts. Soil material is removed from the bottom of the casing always ensuring that the casing is at least 1 m below the level of excavated soil. A reinforced framework is then installed and filled with concrete. The casing is gradually raised higher ensuring that the bottom end of the casing is always at least 2.5m below the newly poured concrete level. On top of the constructed foundation a pier is installed and the superstructure construction works are carried out. The drilling facilities are shown on fig. 3.4.

3.4.6 Road signs

95. Installation of standard III-type size road signs is envisaged in the design ensuring traffic safety. Installation of road signs shall be done according to the requirements of GOST 10807-78, GOST 17918-80, ISO/ES, ASTM standards.

Fig. 3.5 Drilling Equipment Widely Used for Pile Arrangement in Georgia

3.5 SPOIL AND CONSTRUCTION WASTE

96. Part of spoil material generate in cuts will be used for filling embankments. However, substantial amounts of material will require disposal. Balance of fill and cut is given below:

- Volume of fill - 47320 m^3;
- Volume of cut – 99740 m^3.

About 50000 m^3 of spoil needs to be disposed.

97. In more details the waste generation issues are discussed in the chapter 5.4. Most part of spoil (excessive soil and rocks will be used for filling bogged area near the project site, intended by Municipality for urban development. The rest of the spoil will be disposed at the municipal Ksani landfill (see fig. 3.7) and will be later used as filling material to cover the landfill.

3. 6 QUARRIES

98. As it could be seen from the earthworks balance, embankment construction (47,320 m^3 of fill) will mainly utilize materials from road cut (99,740 $m^{3)}$. Materials supply from the quarries is related to the pavement construction needs.

99. Licensed quarries and borrow pits located in r.Aragvi floodplains are proposed to be used. Construction Contractor will take decision on material supply sources. One quarry and crusher plant is located in the immediate proximity to the bridge site. This plant is carrying out limited

quarrying activities, but besides that receives raw materials from the other quarries. However, this is the source of gravel and other materials that could be used by constructing contractor. The other closest quarries are located at a distance of 0.5 - 1.3 km from the project site (facing Mtskheta Residential Zone, so called “New District”; see the fig.).

100. For transportation of materials from the mentioned quarries the E-60 highway and the access roads shown on fig. 3.1 could be used.

No	Resources	License No	Extractor	Term of License	Total extraction m^3
1	Sand-gravel	101062	ENSIS LTD.	5	100000
2	Sand-gravel	101062	ENSIS LTD.	5	100000
3	Sand-gravel	100776	KATETO LTD.	5	90000
4	Sand-gravel	100764	KATETO LTD.	5	50000
5	Sand-gravel	100704	ARMAZI INVESTMENT LTD.	5	45300
6	Sand-gravel	100505	Physical Entity Jumber Abramishvili	5	20000
7	Sand-gravel	100367	Individual Enterprise Giorgi Alaverdashvili	5	40000
8	Sand-gravel	100335	JSC DELTA HOLDING	5	45300
9	Sand-gravel	1000617	FORTUNA 2011 LTD.	5	12300
10	Sand-gravel	1000616	NEW POWER LTD.	5	18000
11	Sand-gravel	1000395	KATETO LTD.	5	45300
12	Sand-gravel	1000313	physical Entity Davit Bochorishvili	5	21300
13	Sand-gravel	1000223	Physical Entity Akaki Chamiashvili	5	23100
14	Sand-gravel	1000176	KATETO LTD.	5	18300
15	Sand-gravel	1000176	KATETO LTD.	5	18300
16	Sand-gravel	579	Physical Entity Teimuraz Purtseliani	10	100000
17	Sand-gravel	314	Physical Entity Zaur Katsadze	20	70000
18	Sand-gravel	202	KATETO LTD.	5	60000
19	Sand-gravel	35	DELTA LTD.	10	910000
20	Sand-gravel	15	DELTA LTD.	20	900000

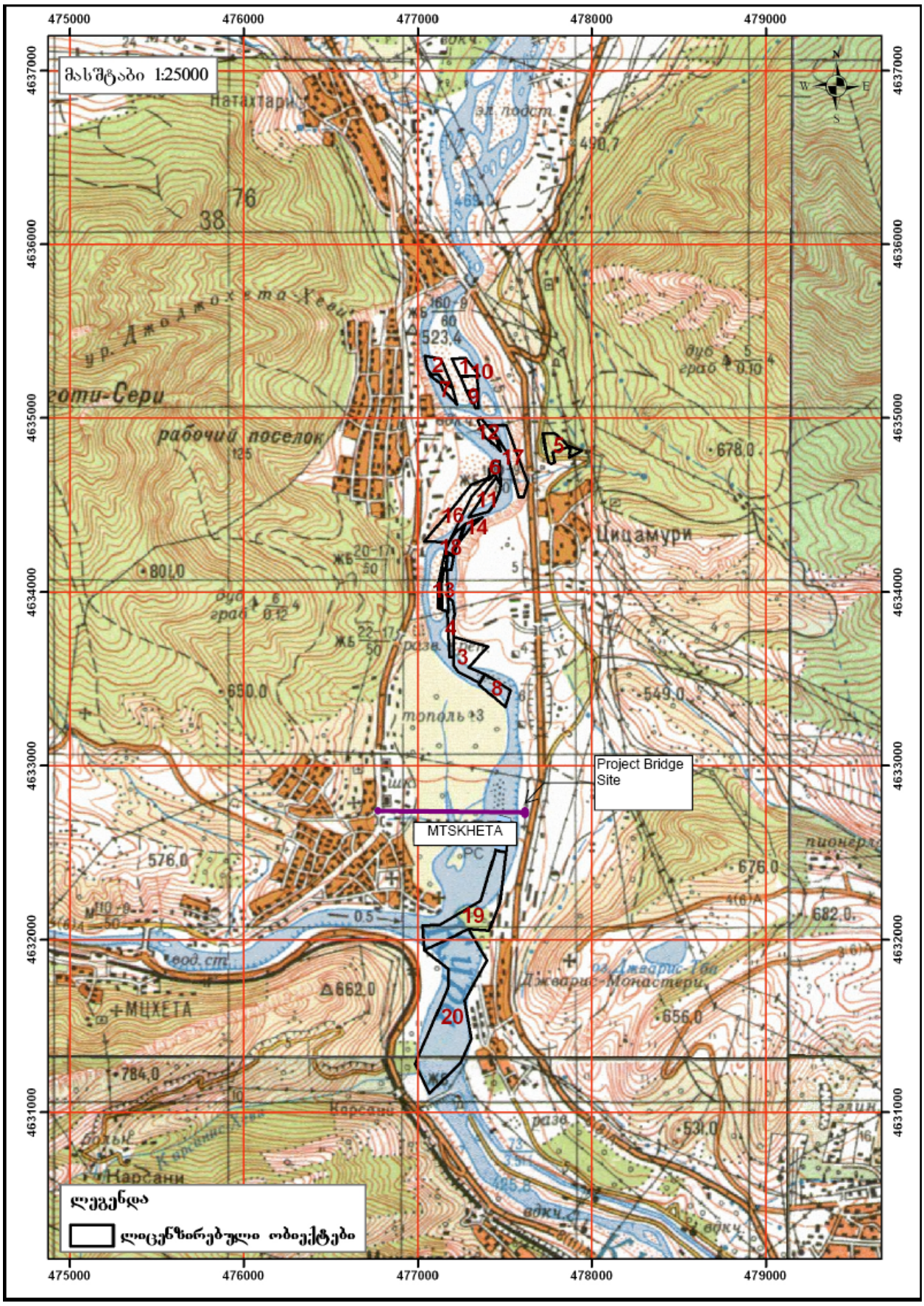


Fig. 3.6 Quarries located near the project site

3.7 ASPHALT MIXING PLANTS

101. The constructing contractor has a choice either to use licensed suppliers already operating in the area or to install its own asphalt plant. Taking into account the small scale of the project, first option seems preferable, however, construction contractor has to take decision. In case if the constructing contractor decides to use its own asphalt plant, prior to installation the company is obliged to prepare the relevant IEE and to get Environmental Impact Permit on installation and operation of the asphalt plant. In case if the contractor utilizes supplied asphalt, he is obliged to control license of supplier and ensure required quality of the asphalt. As we have mentioned, installation of the own asphalt plant is extremely unlikely decision for such small scale project. The Contractor can use materials provided from the nearest suppliers: e.g. Asphalt plants located in Dzegvi (Tsekuri Ltd; GZA-2003 Ltd) and in Zahesi (Zahesi Asphalt Plant). Dzegvi asphalt plants are located at a distance of 7km from the project site and Zahesi plant – at a distance of 2 km (see p.3.7).

3.8 CONSTRUCTION EQUIPMENT YARDS

102. One construction camp to serve approximately 40 workers will be required for the project. In fact, this is supposed to be the equipment yards with 2 or 3 trailers but not complete construction camps. The accommodation for the workers will be provided in Mtskheta or in the nearest villages. The workers will not live in the trailers, which are supposed to be used as office, storage site and building for the guard personnel. The yard will be used for storage of equipment and machinery, fueling, simple maintenance works. The equipment yards could be located at the left bank of r. Aragvi at the territories adjacent to the existing underpass under the highway. The exact location will be selected by the constructing contractor. The location should be selected to comply with the following criteria:

- transformed urban or rural landscape not sensitive from ecological standpoint
- the fueling facilities could be located at a distance of 50m and more from the surface water objects
- the camps should not be located closer than 350m to the residential settlements. The distance should be sufficient for reducing the noise impact to acceptable level and not too large, so far as it is supposed that the accommodation and sanitary-hygienic facilities are available for the workers in the villages.

3.9 MATERIAL TRANSPORTATION

103. Transportation routes forconstruction materials are demonstrated on fig. 3.7. The closest sources of asphalt are located in Zahesi (2km) and Dzegvi (7km), where existing asphalt plants are operating. E-60 highway, Zahesi-Mtskheta-Kavtiskhevi-Gori and Mtskheta-Dzegvi roads will be used for transportation of asphalt and other construction materials. The road from Dzegvi Plants will cross only v. Dzegvi, while road from Zahesi do not cross any settlements until reaching Mtskheta. In Mtskheta all the mentioned transportation routes join Narekvavi-Mtskheta-Railway Station road, which crosses new districts of Mtskheta and comes to the project site located on the right bank of r.Aragvi, without crossing historical part of the city. These transportation routes do not pass near the UNESCO heritage sites.

104. Quarries are located in close vicinity to the project site and only short section of the E-60 highway and Narekvavi-Mtskheta-Railway Station roads are used for transportation of sand and gravel to the project sites.

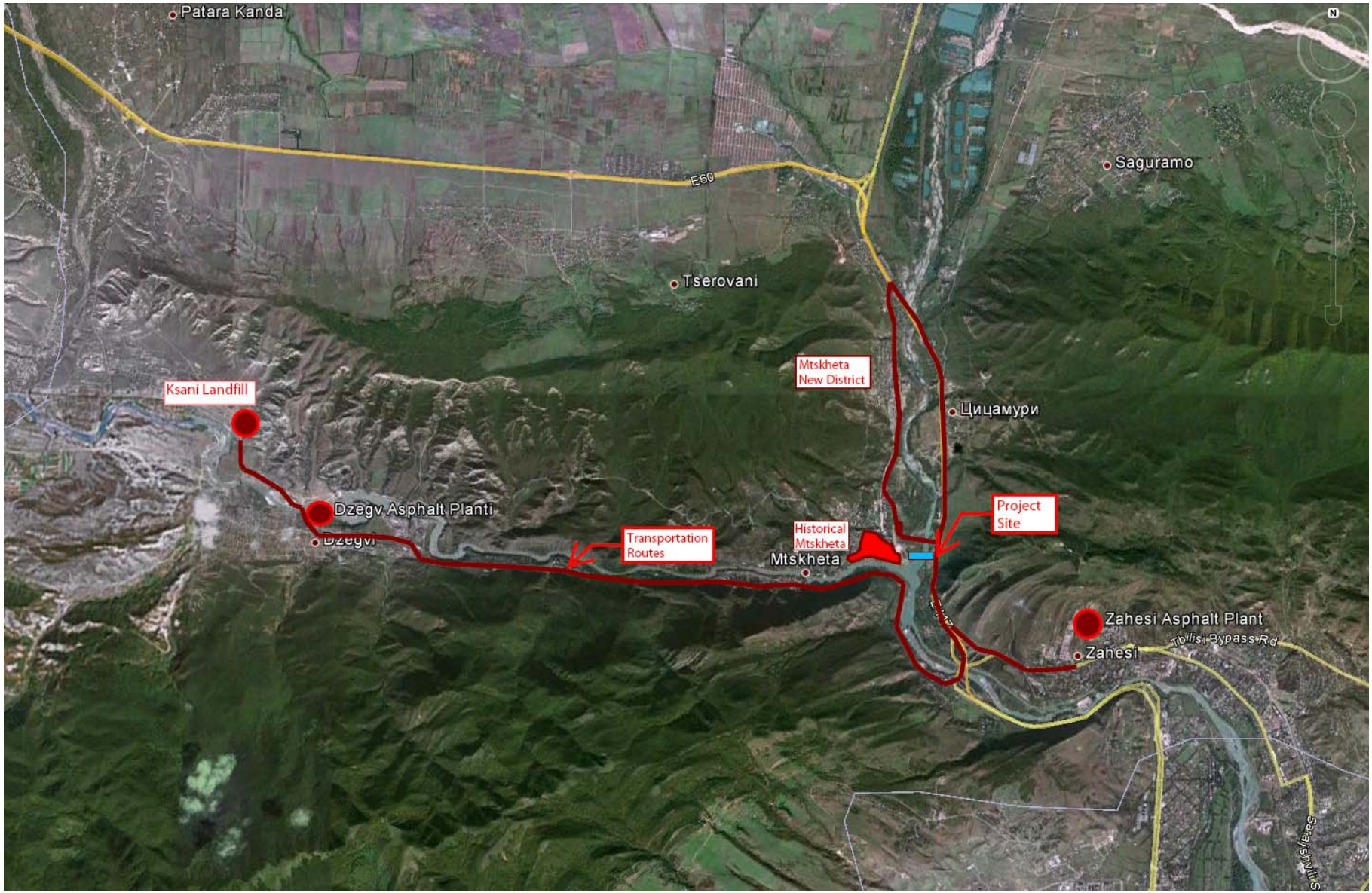


Fig. 3.7 Location of the nearest existing asphalt plants, Ksani Landfill and transportation routes

4. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate, Air Quality, Background Noise and Radiation

4.1.1.1 Climate

105. According to climatic zoning (Köppen classification), it is located in the moderately humid subtropical climatic zone and is characterized by moderately humid climate., with moderately cold winter, hot summer and two precipitation minimums during the year (Korzakhia M., 1964).

106. The average annual air temperature is $+10.8^0$; the absolute annual minimal air temperature is -29^0 and the absolute annual maximum air temperature is $+39^0$. The average annual amount of precipitations is 636 mm. There prevail western and eastern winds with the average wind velocity of 3.6 m/sec.

Table 4.1. Average monthly, annual and extremal air temperatures, t°C

Meteo-Station	Air t°	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Ann
Karsani	Average	0.3	0.8	4.6	9.6	15.0	18.4	21.7	21.7	17.5	12.2	6.5	1.7	10.8
	abs. maximum	16	18	25	29	31	34	36	37	34	29	25	20	37
	abs. minimui	-23	-16	-14	-5	0	6	8	7	0	-5	-7	-19	-23
Mukhrani	Average	-1.1	0.5	4.9	10.2	15.5	18.9	22.1	22	17.7	12.2	6.1	1	10.8
	abs. maximum	16	20	28	31	34	36	39	38	36	32	26	21	39
	abs. minimui	-29	-25	-19	-9	-3	3	5	5	-3	-9	-16	-24	-29

Table 4.2 Average monthly values of precipitation and annual summ, mm

Meteo-Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Ann
Karsani	39	45	45	77	149	109	75	58	68	55	54	39	813
Dzegvi	24	28	30	56	108	78	55	42	50	40	38	26	575
Mtskhetaa	27	31	34	61	122	86	60	47	54	44	41	29	636
Mukhrani	28	36	34	56	109	78	55	42	48	40	37	28	591

Table 4.3. Daily maximums of precipitations (mm) for different provisions (recurrency)

Meteo-Station	Average Maximum	Provision, %						Recorded Maximums	
		63	20	10	5	2	1	mm	TariRi
Mukhrani	40	31	52	64	74	87	97	87	24.VI.1952

Table 4.4. Repetition of wind direction and calms as % from annual sums.

Meteo- Station	N	NE	E	SE	S	SW	W	NW	Calm
Mukhrani	2	8	31	7	2	1	32	17	39

Table 4.5. Air Humidity

Meteo-Station	Humidity	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	weli
Mukhrani	Absolut.	4.9	5.2	5.9	8.2	12.2	14.9	17.4	17.0	14.0	10.3	7.7	5.6	10.3
	Relative %-Si	80	78	72	67	70	68	65	66	71	76	79	81	73
	deficiti	1.4	1.8	3.0	5.2	6.7	8.8	10.7	10.4	7.2	4.1	2.4	1.5	5.3

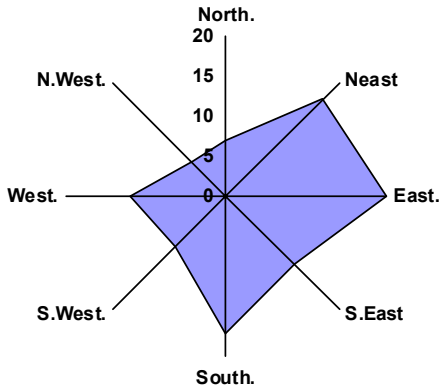


Table 4.6. Average Monthly and Annual Velocity of Wind, m/sec

Meteo-Station	fliugeri	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	weli
Dusheti	11 metri	1.3	1.6	1.7	1.6	1.6	1.6	1.4	1.4	1.4	1.4	1.2	1.0	1.4
Mukhrani	11 metri	3.3	4.7	4.7	4.6	4.0	3.7	4.0	3.2	3.2	3.0	2.8	2.6	3.6
Digomi	11 metri	3.7	3.9	4.6	4.5	4.4	4.0	5.2	4.0	3.3	2.7	2.9	3.1	3.9

4.1.1.2 Air Quality and Emissions

107. Before the breakdown of the Soviet Union, the State Hydro meteorological Services were responsible for regularly measuring the concentrations (3 times daily) of the basic air pollutants: particulate matter, SO_2, NO_2 and CO, as well as some specific pollutants from local stationary sources. These measurements were carried out in Georgia until 1991 in 11 large cities at 33 measuring sites. Over time, however, their scope has slowly been reduced. Reliable measurements of air quality after 1994 are not currently available. In most cities the maximum allowable concentrations (MAC) are exceeded.

108. Road traffic is the major source of air pollution in Georgia, followed by the energy sector and industry. Traffic intensity is high in larger cities and, in extreme cases, it amounts to 60,000 vehicles per day (e.g. in Tbilisi).

109. Georgia has about 3000 stationary sources of air pollution in its main industrial sectors such as energy, iron and steel, chemical and petrochemical, timber and paper, and food. At present, however, few are working at full capacity. The total emission of selected air pollutants is presented in table below. These data are obtained with the use of the CORINAIR methodology, on the basis of emission indicators and activity indicators (mainly in the form of energy consumption or production rate) for different sectors. They include the following stationary sources: power stations, fuel combustion in both industrial and non-industrial enterprises, and industrial processes. Mobile sources include road transport, railway transport, air transport, marine transport and "other" mobile sources.

Table 4.7. Dynamics of changes in the emissions of harmful substances into the atmosphere in different regions in 2001-2007

Quantity of emitted harmful substances, t/year in Mtskheta Mtianeti District						
2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
381	541	566	554	515	523	1645

4.1.1.3 Background noise

110. The Scientific Research Institute of Environmental Protection until its dissolution was responsible for the monitoring and management of noise, but there is no systematic nationwide monitoring of noise, because of limited resources. Noise is measured as a response to complaints by the public.

111. From 1999 to 2002, noise was measured in five sites in Tbilisi. The noise level at 7.5 m above the curb ranged from 71dB to 80 dB. Railroad noise 25 m from the track was 65 dB during the day and 63dB at night. Noise was also measured in 1999-2001 in Rustavi (73-75 dB), Poti (72-74 dB), Telavi (70dB) and Gori (72 dB). According to European standards, the maximum noise level for urban areas is 65 dB during the day and 55 dB at night. These sporadic measurements indicate that traffic noise has reached disturbing levels in the major cities, and the levels are expected to increase due to a rising trend in traffic density.

112. Therefore, there is no sufficient information to be sure that along the road section where bridge construction is planned, noise level is within the standards, although the expectations are that no real problems should arise in that regard. However, at the detailed design and IEE stage there is a need to monitor noise levels near the settlements and consider preventive measures against noise in planning.

113. The current Georgian standards for the noise level are based on former soviet sanitary norms No. 3077-84 and specify different noise levels for different zones. The most relevant standards are the noise limits inside the residential building and outside it (at the wall) which are as follows:
Inside the residential buildings:
For Leq (7a.m. - 11p.m.) the indicative(equivalent) sound = 40dB(A), maximum level = 55dB(A)
For Leq (11p.m. - 7a.m.) the indicative(equivalent) sound = 30dB(A), maximum level = 45dB(A)

114. Outside the residential buildings (measured at the wall):
For Leq (7a.m. - 11p.m.) the indicative(equivalent) sound = 55dB(A), maximum level = 70dB(A)
For Leq (11p.m. - 7a.m.) the indicative(equivalent) sound = 45dB(A), maximum level = 60dB(A)

115. The background noise was measured with the equipment UK “PCE-EM882”. The measurements were conducted in September 18 in 2 points at the left side of r. Aragvi (at a distance of 5 and 20m from the existing E-60 Highway) and 2 points at the right bank (5 and 20m from the river crossing site). The following methodology was used to measure the noise at every specified point: the data were recorded at each point by using the measuring equipment with 5-minute-long intervals for a half an hour (total 6 data were collected) and mean value of the background noise at each point was calculated.

Fig.4.1 Background noise measurements

116. The background noise on right side of the r.Aragvi varied from 48-55 dB. At the left side: average level of noise at 20m from the highway was 53dB and 58dB closer to the highway.

4.1.1.4 Background radiation

117. The measurements were conducted on September 18 with standard certified Russian equipment СРП 6801. Measurements were made along the total length of the planned bridge (both sides of river Aragvi) and intersection construction section (left bank of r. Aragvi).

Fig.4.2. Background radiation measurements

118. According to the data of measurements, the background radiation in the selected corridor is the mean value of the radiation background in Georgia and varies from 8 to 12 microroentgen/hr.

4.1.1.5 Data on r.Aragvi Water Quality

119. The source of presented data is IEE for Wastewater Treatment Plant is Mtskheta, 2010, prepared by Gergili Ltd for MDF.

Table 4.8. Physical-chemical parameters and biogenous compounds of r.Aragvi water near Mtskheta

pH	su-ni	fe-ri	simR-vrive, TVA	mg/l				perm. Jangv. mgO/l
				K^+	NH_4^+	NO_2^-	NO_3^-	
7.80	1	38	200	1.0	0.80	<0.01	1.90	3.80

Table 4.9. Chemical Composition of the r.Aragvi water near Mtskheta (Major Ions)

mg/l							saerTo sixiste, mg-ekv/l	S_1, mg/l	wylis indeqsi
Cl^-	SO_4^{2-}	HCO_3^-	Na^+	Mg^{2+}	Ca^{2+}	S1			
4.1	32.0	116	10.8	8.6	30.4	202	2.23	3.5	C_{II}^{Ca}

4.1.2 General Physical-geographical description of the Project Area

120. The design object is planned to construct over the river Aragvi, at the confluence of the rivers Mtkvari and Aragvi, at 200-250 m up the estuary, against the current and is distanced by about 20 km from Tbilisi. According to climatic zoning (Köppen classification), it is located in the moderately humid subtropical climatic zone and is characterized by moderately humid climate., with moderately cold winter, hot summer and two precipitation minimums during the year (Korzakhia M., 1964).

Fig. 4.3. Aero-photo of the city of Mtskheta. The view is photographed from the altitude of 7580 m

121. In a geographic respect, the city of Mtskheta is built over the extreme eastern edge of Shida Kartli plain. It is bordered by Saguramo ridge from the east, with “Saguramo Mta” (Saguramo Mountain) as its highest peak with the absolute height of 1385.5 m. From the west, it

is bordered by Trialeti ridge with its eastern piedmonts, with the peak “Gogoti” (the same as Gogoti hillock) as the nearest peak with its absolute altitude of 1095.1 m, with the peak “Didgori” with its absolute altitude of 1274.8 m bordering Mtskheta from south-west. The city of Mtskheta is located at 480 m altitude above sea level.

122. The area to be studied, according to the tectonic zoning by Gamkrelidze P. (1961) (See photo 3), is located in Mukhrani-Tiriponi subzone of eastern subsidence zone of the Georgian block. It is built mostly with Cainozoic deposits and is presented mostly by a tertiary portion. However, the most ancient deposits outcrop on the area adjacent to Mtskheta, south-west of the city, in Mtskheta anticline arch (the right bank of the river Mtkvari). These are Upper Cretaceous rocks (k_2). The tertiary formations are presented as Paleogenic (Pg) and Neogenic (Ng) age deposits, mostly with Paleocene-Lower Oligocene (Pne_1) and Miocene (Mio) deposits.

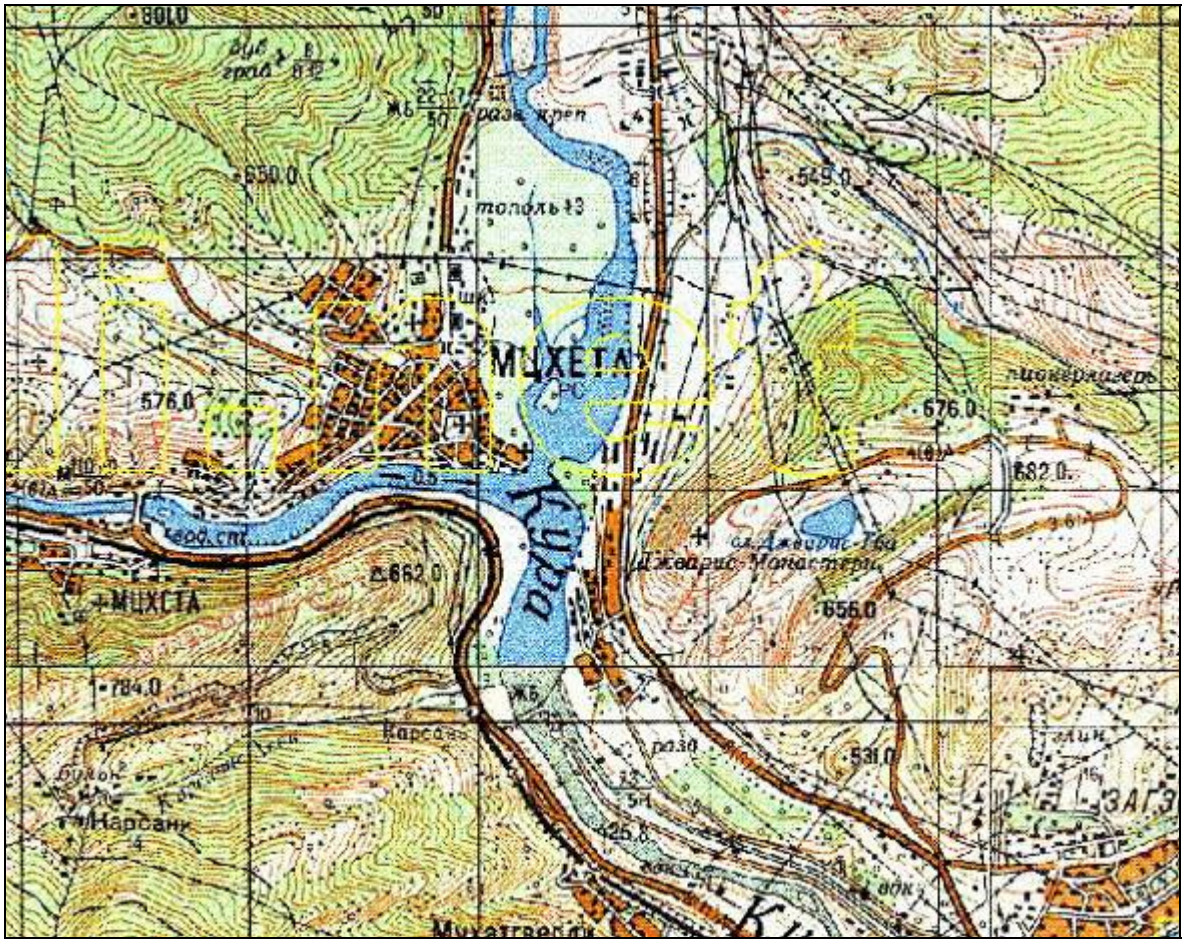


Fig. 4.4. Location of the geomorphological elements and hydrographic network in the city of Mtskheta and its adjacent territory (topographic scale 1:50 000)

GEOMORPHOLOGY

123. Geomorphologically the bridge project area belongs to the Georgian intermount trough area and is located between the eastern end of Mtskheta anticlinal ridge and the western end of the Saguramo range, in the river Aragvi bottom part. Here, the left bank of the river Aragvi represents the II above-flood plain terrace elevated at 16 meters from the rivers current level, while the right bank is a low technogenic terrace. The right terrace formed as a result of sand-gravelly sediments accumulation carried by the river to the Zahesi reservoir, on which later on an artificial mound was arranged in order to make use of the area no longer good for the reservoir.

124. The artificially plained area is quite wide and in the west it transfers into the Aragvi above-flood plain terrace II on which part of the city and Svetitskhoveli cathedral are located. The right terrace surface, on which Tbilisi-Natakhtari main highway is located, gradually goes up and then transfers into the steep slope of the mountain on which the Jvari monastery is located.

GEOLOGICAL STRUCTURE AND SEISMICITY

125. Stratigraphically this slope of the Mtskheta anticline, which also includes the survey area as weel, is structured with Lower Neogene, specifically, Mid-Eocene (N12) marine-mainland sediments. Lithologically, the sediments are represented by thin and medium-layered argillitelike clays, thin interlayeres of sandstone and hard sand. In the neighbourhood of Mtskheta, in the suite sometimes are mixed strata and members of marls, chalkstone or conglomerates, including members of massive sandstone layers, though, in the boreholes drilled on the site of the bridge crossing these lithologies have not revealed.

126. In the outcrops on the slopes of the valley, dip azimuth of the strata is northward (from 0 to 10 degrees and within the range from 325 to 360), while dip angle varies from 300 to 800. High dip angle is registered in the cores taken from the boreholes.

127. Within the investigated bridge crossing site, neogenebasic rocks are overcovered by 2-5 m thick layers of rounded cobbles and loam soil, as well as delluvial clays and technogenic fill soils.

128. Based on the geological literature and archive materials, near the survey site, south of it lies a regional tectonic fault, which on the east (from Martkopi side) follows along the southern basis of the Saguramo range, goes to the Mtkvari and the Aragvi confluence, and then, in the west follows along the Mtkvari bank. .

129. In accordance with the Construction Rules and Regulations currently effective in Georgia, Antiseismic Construction (PN01.01-09), seismicity of the investigated site is intensity 8 by MSK64 scale, with dimensionless seismic coefficient A= 0.16.

ENGINEERING HYDROGEOLOGICAL AND GEODYNAMIC CONDITION

130. Hydrogeologically, the greatest aqueous and water abundant stratum is STRATUM-4 of old alluvial rounded cobbles, which is in direct hydraulic connection with the river, is located on practically impermeable basic rocks – mudstone suite. The filler of the cobbles is various-grained sand, therefore, filtration coefficient of the stratum will presumably be from 50 to 80 in 24 hours. Also aqueous is the cobbles and sandy soils fill, located over STRATUM-4 on the right bank of the river –STRATUM-4. In borehole #1 drilled here, ground water level was registered at 0.9 m depth. High water table (2.5 m) was also registered in borehole #2 drilled on the left bank. As for borehoel #3, drilled on the high terrace, next to the highway, here ground water table was registered relatively deeper – at 5.6 m depth. Ground water here as well is contained in alluvial cobbles stratum. Presumably, being distanced from the river, ground water supply gradually decreases and within the area of Borehole #3, show of water must not be intense. In the excavation pit (if such is arranged based on construction technology) show of water will be active near the river banks.

131. In geodynamic terms, the only hazard for the bridge abutments and especially bridge access mounds is represented by the deep and lateral erosion processes taking place on the river Aragvi banks and river bed. Deep erosion is practically insignificant, as the river here joins the reservoir and the river bed has insignificant fall. Due to the same reason, lateral erosion is not active either, though, rising water level during floods, or drawdown of the upper (Zhinvali) reservoir creates hazard to the base of the bridge access mound.

Fig. 4.5 Plan of boreholes and cross-section

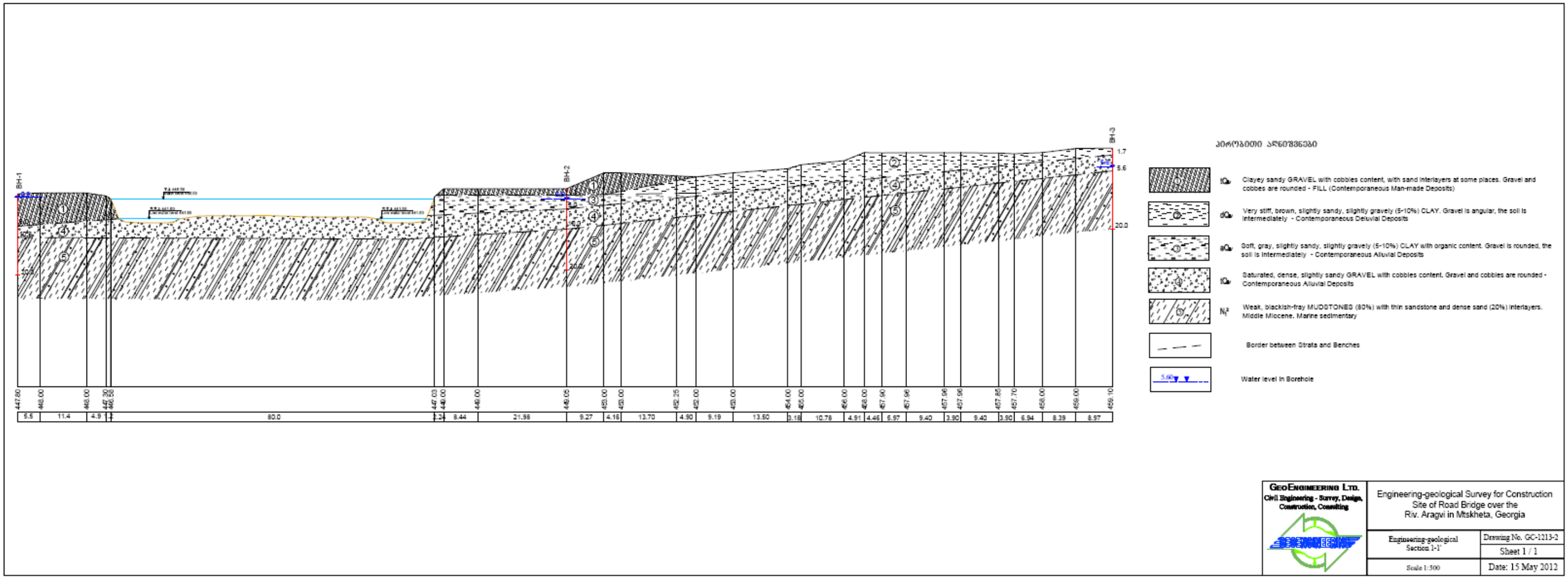


Fig. 4.5 Geological Cross-section

CONCLUSIONS

132. By climate conditions, the region including the project area is attributed to IIb subdistrict as per Georgian Design Norm – Construction Climatology - PN 01.05-08;

133. Lithologically, the area is represented by Lower Neogene (Mid-Eocene) (N12) marine sedimented rocks – mudstones and sandstones (STRATUM-5). On the Lower Neogene sediments suite lie contemporaneous alluvial (STRATUM-4 ans STRATUM-3), delluvial (STRATUM-2) and technogenic (STRATUM-1) clayey and gravelly soils;

134. The project bridge abutments should be based on hard rocks, namely on STRATUM-5. The base of bridge abutments should be deepened into the rock mass to such a level, that its bottom exceeds the elevation of hard rocks surface at not less than 4 meters depth. In calculations for the abutments base, values should be used from Table 3.13 and Table 4.1;

135. In geodynamic terms, slightly expressed deep erosion and relatively more actively expressed lateral erosion of the river Aragvi should be taken into account. The bases of the bridge access mounds also require protection against erosion processes;

136. In terms of hydrogeology, ground waters are contained in alluvial and technogenic soils located on hard rocks. The hard rocks themselves are practically impermeable in the depth. Deeper than the river level, different amount of ground water show is likely at any level;

137. Based on the performed chemical analyses, soil and ground waters reveal different degree of sulphate aggressiveness against concretes. Due to the said, for concretes it is recommended to use sulphate-resistant cement, especially for bridge abutments; the factor of chloride aggressiveness against concrete reinforcement should also be taken into consideration in case of its recurrent waterlogging.

138. Maximum allowable angle of inclination of about 5 m high temporary slope in clayey soils should be 1:075 (530), and in gravelly soils 1:1;

139. In accordance with the Construction Rules and Regulations currently effective in Georgia, Anti-seismic Construction (PN01.01-09), seismicity of the investigated site is intensity 8 by MSK64 scale, with dimensionless seismic coefficient A= 0.16.

4.1.3 BRIEF DESCRIPTION OF HYDROLOGICAL CONDITIONS OF RIVERS MTKVARI AND ARAGVI AT THE PROJECT SECTION

4.1.3.1 The river Mtkvari

140. The river Mtkvari is the major water artery of the eastern part of Southern Caucasus. It starts in Turkey at 2720 m above sea level and enters the Caspian Sea in Azerbaijan. The total length of the river is 1364 km, basin area is 188000 km2. The length from the start of the river till Tbilisi is about 478 km (till the mouth of the river Aragvi -452 km), the area of its water gathering basin is 21100km2 (till the mouth of the river Aragvi 1964 km2).

141. Flow regime of the river has been studied by the several hydro-meteorological stations and by means of special observations at Tbilisi water measurement station. The river Mtkvari is fed by the mixture of sources. The snow, rain, ground and glacier waters are involved in its formation. The period of high water levels is the spring period (from March till April - 50-60% of annual flow). The summer flow is 20-30% and the winter is 10-14%. The spring flooding starts at the end of March, reaches its maximum at the beginning of May, sometimes it lasts till June. Decreasing of flow level lasts till the end of July, sometimes till the mid of August. In some years the flooding phase is disturbed by inundations causing the instability of summer low water level. The water level rise is observed in September- October, often the water level is high due to

rainfalls. The winter water level is relatively stable, for this period water level and discharge are characterized with minimum values.

142. The river is characterized with instable freezing evens. The number of days of all freezing events reach 84 at Akhaldaba, below it exceeds not 63 days (in average -8-14 days).

143. The mean long-term discharge of the river Mtkvari is 205 m3/sec that is equal to flow modulus 8.7 l/sec. According to long-term observations this value varies within 15.4-6.6 l/sec from km2. Rising of levels connected with discharge values depend upon the river sections morphometry. Within the margins of Tbilisi (according to water control data) the amplitude of levels not exceeds 5.5m. The river stream is widely used for industrial, power supply and irrigation purposes.

4.1.3.2. The river Aragvi

144. The river Aragvi (Great Aragvi) is formed near the settlement of Pasanauri by the confluence of the White and the Black Aragvi rivers on 1040 m above sea level. The river Aragvi is the left tributary of the river Mtkvai, the confluence site is the city Mtskheta. The length of the river is 66 km, total fall is 597 m, average gradient 9.1‰, basin area, 2740 km2, the average altitude of the basin is 1600 m. The river has 716 tributaries with total length 1926 km. Out of these tributaries the rivers White and Black Aragvi, Arkala, Kerkhvi, Pshavi Aragvi, Dushetis khevi, Abanoskhevi, Tezami and Narekvavi are the bigger.

145. The ground strata is mostly sandstones, clay slates, limestones and conglomerates. The surface of the basin is represented by the less humus meadow soil, by the forest and alluvial carbonate soils.

146. At the altitude 2000-2800 m the vegetation is demonstrated by Alpine and Sub-Alpine vegetations. Forests are spread at the altitude 2000-900 m, below this elevation, on Mukhrani valley, the vegetation is demonstrated by the mixed sub-forest and steppe vegetation. There are a lot of outcome of water sources in the river canyon. Out of which are the Natakhtari water, Saguramo water and Bulachauri water sources. The flow rate of Nataktari water equals to 1.2 m3/sec, 0.26 m3/sec is for saguramo and for Bulachauri 0.125 m3/sec. The river is fed by snow, rain and ground waters. Its water regime is characterized with spring-summer flooding, autumn inundations and winter instable low water level.

147. In 1985, the water reservoir was put into operation at the village Jinvali, which regulates the river Aragvi flow in its lower course.

148. On the study section the river Aragvi is impounded by the head gate of derivation canal of Zemo Avchala hydrostation, which is constructed on the river Mtkvari. The impounding extends nearly at 2 km. The Aragvi river velocity is sharply decreased on the impounding section, but the depth is increased. For the mentioned section the maximum water levels of the Aragvi river are in close association with water levels of the Mtkvari river, therefore the brief hydrographical description of the river Mtkvari is given below.

4.1.3.3 The Project section

149. The study section is located on ~445 m from the river Aragvi mouth, in the zone of Zahesi hydro station impounding. The width of sharply outlined riverbed in the period of low water level is ~90 m, maximum width exceeds 180m. During the low water conditions (one of the options of the plan) the waterlog horizon 447.60m corresponds to maximum depth 5.8 m (level 441.19).

150. Zahesi – is the low pressure diverted type hydro station, except daily regulating reservoir it contains: small concrete dam with two 7.5 m wide submerged opening (for 10% reoccurrence discharge supply); the major 24 m high dam spillway with 13 m wide spans (gates, threshold

440.52 m) siphon spillway, 3 km long diversion canal. The total length of the dam protecting pressure reservoir is 150 m. The peak service discharge is 234 m^3/sec.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 Flora

151. Project is located in Zemo Kartli Lowland which is mainly characterized by occurrence of agricultural land with fragments of natural vegetation cover including beard-grass steppes *Bothriochloa ischaemum* steppes, spiny shrubwood steppes, degraded fragments of floodplain forests and riparian habitats.

Slope on the left bank of r. Aragvi adjacent to the Tbilisi National Park

The Project corridor crosses mainly beard-grass *B. ischaemum* and spiny shrubwood steppes.

152. The secondary beard-grass steppes are developed in the places previosly occupied by forests of foothill slopes (oakwoods, hornbeam forests) and flood-plains. They are formed with equal participation of *Bothriochloa ischaemum, Festuca valesiaca (F. sulcata), Stipa*-s species. The floristic composition of these secondary beard-grass steppes is comparatively rich.

153. Thus in the fragments of secondary beard-grass steppes the prevalence belongs to: *Bothriochloa ischaemum, Festuca valesiaca (F. sulcata), Elythrigia repens (Agropyron repens), Stipa stenophylla, S. lsessingiana, S. capillata.*

River Floodplain Landscape and Landscape on the Right Bank of Bridge

154. The vegetation cover within the floodplains on both banks of the r.Aragvi is represented by severely disrupted fragments of floodplain forests (*Salix australior, Populus canescens, P. nigra, Tamarix* spp., *Hippophaë rhamnoides*, etc.) are observed along the Aragvi River.

155. Degraded urban subarb landscape on the right bank of r. Aragvi is represented by steppe vegetation with thorny shrubbery. Thorny shrubbery is of secondary origin and has been mainly developed in the place of eliminated foothill and lower mountain belt forests. Thorny shrubbery is mainly represented with Christ's thorn, although Spirea (*Spiraea hypericifolia*) and rhamnus (*Rhamnus pallassii*) cenoses are also present. The most typical is Christ's thorn shrubbery with Spirea. The latter forms groves on rocky exposures. Rhamnus is distributed on the steep slopes of Mukhatgverdi and Karsani.

156. Apart from the above named edifiers, the thorny shrubbery is characterised with: barberry (*Berberis iberica, B. vulgaris*), ephedra (*Ephedra procera*), blackthorn (*Prunus spinosa*), black-wood (*Cotoneaster melanocarpa, C. multiflora*), dog-rose (*Rosa canina*), almond (*Amygdalus georgica*).

157. The periodically flooded patch of ground at the right bank of the bridge, which had developed as a result of construction of dam downstream and insufficiency of river-bank protection revetment, can not be considered as natural habitat. This is a zone of disruption of traditional suburban landscape due to flooding problems and currently the Municipality is implementing independent project aimed on covering this flooded patch of ground by filling materials and further landscaping.

4.2.1.1 Sensitive Areas and Georgia Red List Species Occurred in the Proposed Project corridor

158. After the completion of the detailed field botanical survey and literature review high or moderate sensitive areas were not identified in the designed project corridor.

159. It should be mentioned that Georgia Red List including 56 species of vegetation is not complete. Presently the existing list of Red List species is being modified. In particular, the herbaceous plants are being identified according to **IUCN** categories (identification of categories of their state and conservation status). After extrapolation of the aforementioned data an actual number of Georgia Red List species may significantly increase.

160. After the completion of the detailed field botanical survey Georgia Red List species were not identified in the designed project corridor. However, populations of some rare, endangered and vulnerable species are occurring in the project corridor, in particular - sea-buckthorn (*Hippophaë rhamnoides)*.

4.2.2 Fauna

161. Animals are closely integrated with landscapes. Consequently, main animal groups inhabiting specific areas are largely determined by a complex of physical-geographic and landscape conditions;

162. From zoogeographic point, this area contains "mixed" type of fauna, mainly represented by poorer version of faunistic complex of the Mtkvari district. Within this area, four types of landscapes are represented:

- river coast ecosystems
- hills covered with xeric vegetation,
- agrocoenosises
- industrial landscape.

163. On the left-hand bank of the Aragvi River the junction of highway and motorway going to Mtskheta comes close to the borders of the Tbilisi National park.

164. Hills covered with xeric vegetation - in close proximity to the road are mountain slopes, covered mainly with hornbeam bushes.

165. River coast ecosystems - the narrow strip of remains of a natural and semi-natural vegetation along the rivers Mtkvari and Aragvi banks consist of species typical for accumulative plain and floodplain landscape, belonging to the subtype of subhydromorphic landscapes. Remains of derivates of the former riparian vegetation – the floodplain (tugai) forests and shrubs are heavily degraded and replaced with cultural and introduced plants community within the area of possible access roads and bridge construction. This strip of the vegetation is separated from other plots of natural (hornbeam forest and xeric bushes) and agricultural vegetation by the E-60 highway on the left-hand bank of the Aragvi river.

166. Long time presence of human activity and dense population along the old highway obviously has had impact on fauna composition in vicinities of the road and city of Mtskheta. The bridge construction area lies within almost not sensitive area. Animals are closely integrated with habitats. Consequently, main animal groups inhabiting in the specific areas are largely determined by a complex of physical-geographic and landscape conditions. The most populated by animals sites are:

- on the left-hand bank - hills covered by dry forests in the Tbilisi National Park, on the left-hand bank of Aragvi river
- on the right-hand bank – river-bed – for fish and migratory waders and waterfowl

Species protected by law

167. Theoretically 17 species, listed in the Red Data List of Georgia (2006), can be found within the landscapes similar to the surroundings of the project area. Among them two species mammals (Caucasian squirrel and Mehylis' horseshoe bat) that could be suspected that use the forested hills at the work area as a home range and feeding ground. Other two species could be found on the open part of the considered area. However the field survey, did not confirm that the Brandt's hamster occurs in the proximity of the site of the proposed construction of a new bridge. It is more realistic that the mentioned species occur within the section of the Tbilisi National Park located closer to the project site.

168. The work area could have an importance for four red-listed bird species as feeding area, stop-over site during passage, in less concern as a wintering area and breeding range. Especially sensitive are nests of Egyptian Vulture on the slopes of the mountains near the construction sit, and probably still presented here nests of other raptors. The observations during the field survey did not confirm presence of any

169. Only the Mediterranean tortoise is red-listed reptile in the area of the work. It can be found in open habitats along the river.

170. One, protected by law, fish species - Golden Spined Loach occur in the Aragvi river and its tributaries.

171. 7 species of insects included in the Red Data List of Georgia are found within the considered area.

Mammals in the impact zone

172. Mammal fauna of the region counts 35 species. Of these species, 10 are endemics of the Caucasus (Kandaurov and Bukhnikashvili, 1996). It is hard suspect a presence of any stable population of the large mammals protected by law, such are a wild cat *(Felis silvestris),* a wolf *(Canis lupus),* because of small and heavily impacted area. At the same time, some small mammals (rodents and bats) and musteline could be found on the construction site in low quantity, but there are not valuable (from the nature conservation standpoint) populations of these species.

173. Within the work area are known presence of 10 bat species (See Table 4.18). All bats in Georgia are falling under protection according to EUROBATS Agreement.

174. All old trees should be inspected on the presence in it roosts of bats - in hollows. The trees cannot be cut without consultation with MoE officials and bat experts, if the bat colony (despite whatever included or not this species into the Georgian Red Data List or not) will be found. All bat species are protected according to EUROBATS Convention signed by Georgia in 2002. The pre-construction survey should be undertaken in appropriate time.

175. Highest densities of these mammalian species are observed in:

- at foothills covered by dry forests (western border of the Tbilisi national Park).
- remnants of riparian forests at confluence of the river Aragvi;

Birds in the zone of impact

176. The avifauna of the region consists of more than 145 species of birds, representing 17 orders. About 98 species of them are nesting here, 35 are migratory and 12 are wintering. There are noticeable abundant populations of hawks (*Accipiter gentilis*) and the population of the partridge (*Perdix perdix*), located near the confluence of the river Aragvi.

Amphibians and reptiles in the zone of impact

177. Near the construction area the high diversity of reptiles is found on southern slopes of the Saguramo ridge. There are found: snakes - Spotted Wipe Snake *(Coluber ravergieri),* Caucasian Ratsnake *(Elaphe hohenackerii),* endemic Deryugin's lizard *Darevskia derjugini* and a few other Caucasian rock are found. Amphibian complex includes four species, but only lake frog *(Rana ridibunda)* can be found within impact area in significant numbers. None of reptiles and amphibians will be extirpated as a species, but a lot of individuals can be killed during the crossing of new road to the bridge.

Ichthyofauna

178. There are 25-26 species of fish in the Mktvari River basin within the Georgian borders. About 15 of them could be found in the river at the construction site and downstream within the impact zone of construction. Among them are six endemic species of the River Mktvari and its basin *Chondrostoma cyri*, *Romanogobio persus*, *Barbus mursa*, *Acanthalburnus microlepis*, *Barbatula brandti*, *Alburnus filippi* and one endemic subspecies *Barbus capito*. Six species are used for fishery, some of them are important for a subsistence fishery e.g. barbel species (*Barbus* spp.), as well as Khramulya (*Capoeta capoeta)*. These species, plus *Barbus lacerta cyri* and *Leuciscus cephalus orientalis,* are found in high densities in Ortachala reservoir (near Metekhi power station). The latter two have been found their spawning grounds to the west of Mtskheta in Mtkvari River and to the north in the Aragvi River.

179. During construction the most vulnerable will be non-reophilous fish including the endemic species mentioned above, all of which have spawning grounds close of Mtskheta.

Table 4.10. Fish species occurring within the work area

№	laTinuri dasaxeleba/ Latin name	inglisuri dasaxeleba/ English name	qarTuli dasaxeleba/ Georgian name
1	*Leuciscus leuciscus*	Common dace or chub	qaSapi
2	*Chondrostoma cyri*	Kura nase	mtkvris tobi
3	*Capoeta capoeta*	Khramulya	xramili
4	*Cyprinus carpio*	Common carp	kobri
5	*Barbus lacerta*	Kura barbel	mtkvris wvera
6	*Barbus mursa*	Mursa	murwa
7	*Barbus capito*	Bulatmai barbel	Wanari
8	*Alburnus filippi*	Kura bleak	mtkvris TaRliTa
9	*Acanthalburnus microlepis*	Blackbrow bleak	Savworba
10	*Alburnoides bipunctatus*	Riffle minnow	aRmosavluri frita
11	*Barbatula brandti*	Kura stone loach	mtkvris goWala
12	*Sabanejewia aurata*	Goldside loach	winaaziuri gvelana
13	*Gambusia affinis*	Mosquito fish	gambuzia
14	*Romanogobio persus*	Kura gudgeon	mtkvris cimori
15	*Neogobius(Ponticola) constructor*	Ginger goby	kavkasiuri md. Rorjo

180. Additional field studies conducted at the detailed design stage did not confirmed presence of any spawning grounds of fish species. The most part of adjacent territories (300m downstream the project site and form 400m to 1300m upstream from the bridge location) are used for quarrying activities and accordingly no spawning grounds are presented within this zone.

181. Additional field studies conducted at the detailed design stage confirmed absence of breeding sites - nests of Egyptian Vulture and other protected by law and attractive birds within the project footprint zone.

4.2.3 Protected Areas

182. The only protected area located close to the project area, is Tbilisi National Park (TNP). The bridge and intersection layout at the left bank of r. Aragvi covers private agricultural lands and remnants of old building on State land and passes in a close vicinity to the TNP boarders. The minimum distance between the bridge facilities and the closest alignment of TNP border is 130m. The TNP borders pass uphill from the project site. Within the borders of TNP, a narrow strip of shrubbery from the TNP border till the top of the hill constitutes certain physical “buffer zone” between the industrial/Highway zone and main parts (“strict restriction zone”) of the TNP. The range of hills separates main part of TNP from the peripheral parts, located on the slopes facing the highway and road infrastructure. The buffer zone is characterized by much less biodiversity and sensitivity than the main part of TNP located on the other side of the hills. The project site is located 130m downhill from this “buffer zone”.

Tbilisi National Park

183. Tbilisi National Park was established on the basis of Saguramo Strict Nature Reserve, which was created in 1957. The Park is located at a distance of 25 km from Tbilisi and is included in the Green Zone of the city. The Saguramo Strict Nature Reserve was established with the purpose of maintenance of the forest characteristic for Georgia and protection of the forest habitants, among them the rare species such as Caucasian Red deer and lynx. Area of Tbilisi National Park is 24328 ha. It is situated near the two important cities of Georgia - Mtskheta and Tbilisi.

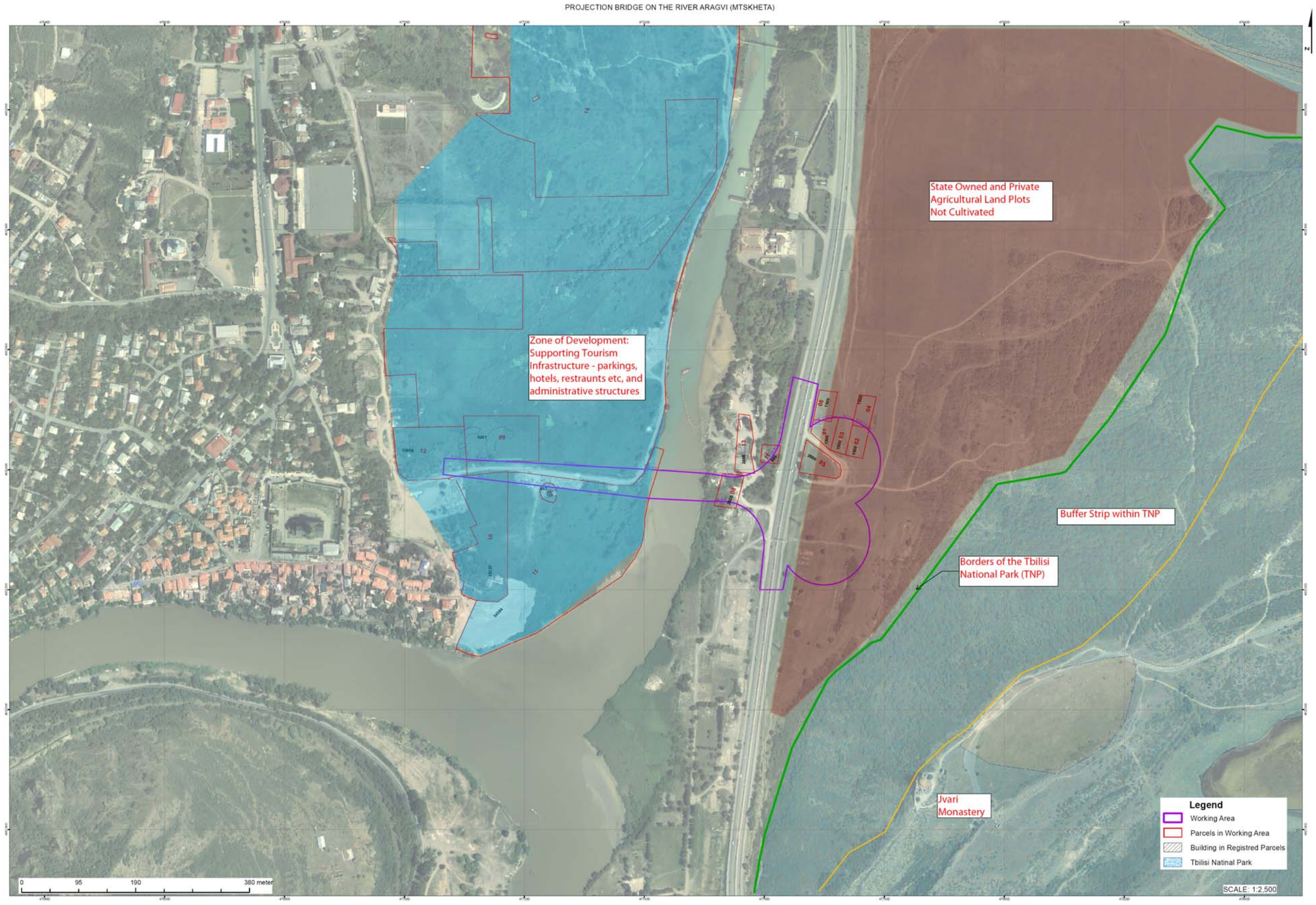


Fig.4.6 Land Use and Proximity to the Tbilisi National Park Borders

4.3. SOCIAL ENVIRONMENT

4.3.1 Socio-Economic Environment

184. Description of socio-economic environment is given for Mtskheta city, villages adjacent to the project area (v. Tsistamuri, Saguramo and other villages of Saguramo sub-district) and Mtskheta Rayon (District) as a whole.

4.3.1.1 Demographic Structure

Table 4.11. Number of population by territorial bodies and villages as of 1.01.2011

Name of Territorial Unit	Name of Settlements, Villages and Large Villages Included within	Number of people+ Resettled Persons
Mtskheta	Mtskheta, Mukhatgverdi, Armazi	7749
Saguramo	**Saguramo,** Akhalsopeli, Shankevani, **Tsitsamuri**	1768+252
Total for Mtskheta District		56900

185. Total of 56,900 people, of which 7700 are Mtskheta residents and 49200 live in villages.

Table 4.12

Territorial Body	*Village*	*Number of Households*	*Number of Individuals*	*Employed*	*Pensioners*	*Below Poverty Line*	*Under 18 Years*	*Above 18 Years*
Mtskheta	Mtskheta	2115	7749	*2700*	*1478*	*68*	*3000*	*4749*
	Mukhatgverdi	86	187	*27*	*35*	*17*	*35*	*152*
	Karsani	3	4	*1*	*1*	*1*	-	*1*
Saguramo	Saguramo	668	1425	*191*	*349*	*44*	*172*	*1253*
	Akhalsopeli	98	159	*18*	*11*	*4*	*19*	*140*
	Tsitsamuri	67	129	*21*	*31*	*1*	*11*	*118*
	Shankevani	44	74	*7*	*7*	*8*	*10*	*63*
Total for Mtskheta District		17795	46500	*10642*	*9000*	*2173*	*11649*	*34851*

186. Based upon the data of the state department of statistics of Georgia, we provide you with the information on increase and decrease of population by years

Table 4.13

Number by years	2001	2002*	2003	2004	2005	2006	2007	2008	2009	2010
Number of municipality population	66.1	64.8	64.4	63.9	64.2	65.2	65.0	46.5	46.6	56.9

187. Besides the local residents, currently many refugees are living in Mtskheta District and this may be significant for social impact analysis and identification of vulnerable social groups. The tables below reflect data on resettlement of refugees (total of 10400 people).

Table 4.14 Population (ethnic groups)

	Numbers by 2002 Census	Percentage with Total Population by 2002 Census
Total Population	64829	100
Georgians	58808	90,7
Abkhazians	20	0,03
Ossetians	1464	2,2
Russians	583	0,9
Ukrainians	113	0,2
Azeri	2236	3,4
Armenians	427	0,6
Jews	-	-
Greeks	129	-
Kurds	-	-
Other Nationality	1049	1,6

4.3.1.2 Economic Structure and Trends, Development of Various Sectors

4.3.1.2.1 Agriculture

188. Agricultural land in Mtskheta District:
total of 23,636 ha.
Of which:
Arable land – 12195 ha
Perennial crops – 3905 ha
Hay meadows – 271 ha
Pastures – 7265 ha
Non-agricultural – 40016 ha
Forests and waters – 30437 ha
Cultivated land – 50 %
Vine growing-viticulture – 300 t

Table 4.15. Volume of the produced agricultural goods in natural and cash units (thousand GEL)

#	Name	2010	Thousand GEL
1	Meat production (t)	3500	20000.0
2	Milk production (t)	14000	7000.0
3	Egg production (ten units)	10000	3000.0
4	Wool production (t)	15	45.0
5	Fruit (t)	500	500.0
6	Grape (t)	300	210.0
7	Wheat (t)	600	300.0
8	Barley (t)	60	24.0
9	Beans (t)	30	90.0
10	Maize (t)	300	150.0
11	Vegetables (t)	250	125.0
12	Annual grasses (hay) (t)	900	45.0

189. The main fields of agriculture are the following: vegetable and orchard growing, viticulture, fruit growing, livestock breeding, wheat growing. Many plants of various profile used to function in the municipality. Their part has stopped at present.

Main Prioritized Fields and Directions of the Development of Agrarian Sector of Mtskheta Municipality

190. Proceeding from the existing conditions of the municipality, further development of agricultural production and processing industries should be considered as prioritized directions. The main means of development of food processing industry in the municipality is agricultural production and possible volumes of its processing, which is the significant condition for budget inflow. The experience of production of ecologically clean produce for export and internal markets, various tins, tomato-pastas, natural juices, jams, compotes and other produce already exists within the objects of tinned industry, which are present in the municipality, but unfortunately at present closed due to financial problems. If they start functioning, the total produce within the food and processing industries should cost ten million GEL. Financial investment is necessary for this outcome.

191. Proximity to Tbilisi is economically profitable for agro-industrial complex of the municipality. As a result, the rapid development of food processing industry should be prioritized. If necessary financing is obtained, the budget income of the municipality will gradually increase for several million GEL.

192. It is noteworthy that a field with rich traditions – vine growing and multi-profile viticulture based upon vine growing should be prioritized and financed. In perspective the old traditional and unique varieties should be restored: Chinese, Pinot, Aliquot, etc. In the future if proper investment is involved the technology of less waste from stone-fruits could be introduced into the processing industry of ecologically clean produce and the tin plant could start functioning.

193. Proceeding from the soil-climate conditions of the municipality the restoration of old fields like vegetable and potato growing as well as green-house production is profitable.

194. Fairly large income reserve lies within the development of grain cultures. Edible wheat, maize and forage grain culture growing, increase of yield shall satisfy not only the population of the municipality but the entire country. Growing of autumn wheat and maize should be prioritized of grain cultures within the municipality with main focus on the growing of local and municipal hybrid varieties of large yield.

195. Favorable natural and geographical conditions of the municipality determine fast development of livestock and poultry breeding, bee keeping, fishing fields. Local and internal municipal markets should be loaded with cattle, pigs and poultry to satisfy the demand of the population. With the financial support of people employed in farming the profit of ten million GEL could be earned.

196. For the implementation of the activities listed in the program of agricultural development and achievement of the set goals irrigation of the arable land is necessary. Hence, damaged systems should be timely restored and material-technical conditions of irrigation systems put in repair.

197. The support of the fields, investment and introduction of flexible tax system determines significant growth of the income of the municipality and state budget, perspective of further socio-economic development of the municipality in the following years, employment of the population, reduction of unemployment rate and welfare of the population.

198. Poultry plant of medium capacity individual entrepreneur “Nozadze” functions in the municipality as well as 3 small plants with the same profile. Meat processing plant was also opened.

Volume of the Agricultural Produce (%)

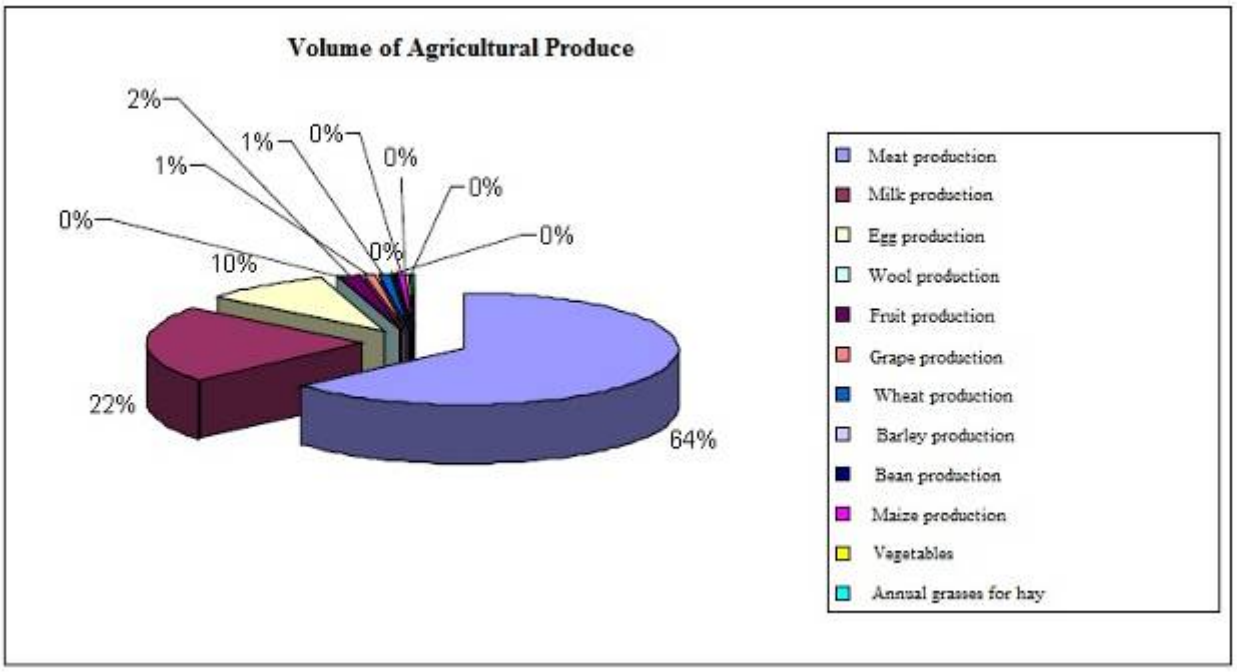


Table 4.16. Cattle and Poultry Numbers by 2006-2010 Data (Units)

#	Name	2005	2006	2007	2008	2009	2010
1	Cattle	18011	18840	18000	17422	15250	14681
2	Of which cows and she-buffalos	12400	12987	12360	11970	12885	12250
3	Pigs	4813	2308	2000	1612	1921	1710
4	Sheep and goat	9584	9650	10000	9501	5331	4977
5	Poultry (ten wings)	126	52	87	82	80	85
6	Bee (families)	-	-	-	-	2251	2644

4.3.1.2.2 Industry/Production

199. Several large plants function within Mtskheta municipality:

1. Kampa LLC produced juices – the turnover of the produce is 5.2 thousand GEL. It plans to attract large investment and grow;
2. JSC Mina produces glass empties – the volume of the production is 6818.0 thousand GEL. It plans to attract investment for increase of production and export;
3. Barambo LLC produces chocolate and other sweets;
4. Agro Consortium Tserovani produces various foods through processing of milk and soya;
5. Neoprint LLC produces paper, which is exported. The plant plans to increase the economic indexes by 10 % in the future;
6. Several poultry plants successfully function in the municipality. The volume of the production of one of such plants – individual entrepreneur “Elguja Nozadze” is 4.700 thousand GEL. It produces 540 t broiler meat annually;
7. Slaughter house equipped with the modern technologies started functioning in vil. Natakhtari recently;
8. Brewery Natakhtari functions in vil. Natakhtari;

9. Plant Berta started functioning in Akhali (New) Tserovani (refugee settlement). It produces various perfumery;
10. LLC Schirnhofer – meat processing plant functions in Zahesi;
11. A slaughter house with modern equipment is located in vil. Natakhtari;
12. Chateau Mukhrani LLC – wine plant is located in vil. Mukhrani.

200. The population is mainly employed in trade and services Small and medium size objects of retail trade function in the villages. Up to 20 physical persons and legal entities are involved construction business.

Mining and quarry exploitation

201. Mining and quarry exploitation – ten quarries function within the municipality (sand-gravel extraction) at r. Ksani and Mtkvari

Table 4.17. Quarries and Mines within the municipality

Type of fossil	Measure unit	Supplies	Note
Mtskheta district			
Dzegvi – to the west of Mtskheta on 1.3 km, in the vicinities of vil. Dzegvi			
Zeolite	thousand t	1675 840	Exploitation is suspended
Saskhori I – to the south-west of Mtskheta on 10 km, on 13 km from Kaspi cement combine			
Limestone for cement extraction	thousand t	143693	Not extracted
Saskhori II – to the west of railway station Dzegvi on 5 km			
Limestone for lime	thousand t	6547 11920	Not extracted
Dzegvi – to the west of Mtskheta on 15 km, in the vicinities of vil. Dzegvi			
Sand-gravel	thousand m^3	4500	Extracted
Nichbisi – on 5 km from Mtskheta, in 2-3 km from vil. Akhali (New) Nichbisi			
Sand	thousand m^3	2650	Extracted
Tsitsamuri-in the proximity of r. Aragvi and Mtkvari confluence, vicinities of Tsitsamuri			
Sand	thousand m^3	60	Extracted
Saguramo-r. Aragvi riverbed, in the vicinities of vil. Saguramo			
Sand	thousand m^3	70	Extracted
Tsikhisdziri – to the north of railway station Ksani on 1.5 km			
Sand-gravel	thousand m^3	6600	Not extracted
Samadlo (Saskhori) – within vil. Saskhori on right bank of r. Mtkvari			
Brick clay	thousand m^3	242	Not extracted
Mtskheta water intake: districts: Shua (Middle) Prone, Aghmosavleti (Eastern) Prone, Didi (Great) Liakhvi, Mejuda, Ksani, Aragvi to the north-west of t. Tbilisi			
Potable water for water supply of Mtskheta, Kaspi, Gori and Kareli villages	thousand m^3 daily	586.6	Extracted
Ksani water intake-left bank of r. Ksani between vil. Mukhrani and Tsikhisziri			
Potable water for water supply of Mtskheta, Kaspi, Gori and Kareli villages	thousand m^3 daily	170.1	Extracted
R. Tezami affluence-in r. Tezami ravine from r. Berebi ravine for 15 km till confluence with r. Aragvi			
Gold containing sand	thousand m^3	Has not been studied in detail. The strength of the sand is 03-3 m, gold composition – 0.1 gr/t	

4.3.1.2.3 Tourism

202. T. Mtskheta offers great opportunities for tourism development through its historical-cultural heritage and being the greatest tourist attraction, as part of UNESCO world heritage. Proceeding from the statistics of visitors, 16381 tourists from the USA, UK, France, Italy, Israel, Germany, Japan, Ukraine, Baltic Sea region, India, Korea, Azerbaijan, Taiwan, China and other countries visited Mtskheta from January, 2010 till and including 8 months of 2011 (in comparison with 2009-2010 the figures have significantly increased).

203. T. Mtskheta is a town-museum with great many historical monuments and places, which are attractive to local and international tourists. Attraction of tourists is also favored by proximity of Mtskheta to the capital. At present tourist flows are sporadic and the situation is not regulated and organized in this terms. It is noteworthy that tourism development is profitable both for the authorities and population.

Fig. 4.7 Historical part of Mtskheta

204. In 2009-2010-2011 the appearance of t. Mtskheta has changed. Revetment of areas adjacent to Svetitskhoveli has been undertaken, infrastructure renovated, private houses restored, rehabilitated and reconstructed. At present III and IV stages of rehabilitation works have been completed. The restoration of the town will continue for a couple of years. As a result, the oldest and first capital will be newly decorated.

205. Cultural Monuments within Mtskheta Municipality

1. T. Mtskheta, districts of the old town: Armaztsikhe-Bagineti-Kartli royal residence I-V c.c.A.D.;
2. Armaziskhevi residence of Kartli Pitiakhshs – I-V c.c. A.D., bath-house – IV c. B.C.-IV c. A.D.;
3. Beberi fortress – early feudal age;
4. Svetitskhoveli complex: domed monastery built in 1010-1029;
5. Samtavro – domed church IX-XI c.c., Samtavro sepulcher – III millennium B.C.;
6. St. Nino's Domed Church – V-VI c.c.;
7. Antioch church – V-VI c.c.;
8. Mtskheta Jvari Monastery – VI-VII c.c.;
9. Mtskheta Crypt – I-II c.c.;

10. Shiomghvime monastery complex – monastery complex: domed church VI c., large monastery XII c.;
11. Zedazeni – monastery complex: church VII-IX c.c., fortress – Middle Ages;
12. Zalisi remnants of town – II c. B.C.-VII c. A.D.;
13. Tsilkani Virgin Mary's Church – three-nave basilica V-Vi c.c., domed church – Middle Ages;
14. Mukhrani fortress wall XIII c. with two churches, Bagrationi dynasty ppalace XIX c.;
15. Kaloubani St. George's Church XII c.

206. Museums:

1. State Archeological Museum-Reserve of Great Mtskheta (t. Mtskheta)
2. Saguramo house-museum of Ilia Tchavtchavadze (vil. Saguramo)

207. Open Museums:

1. Bagineti – Kartli royal residence;
2. Armaziskhevi residence of Kartli Pitiakhshs;
3. Samtavro sepulcher;

Zalisi remnants of town

208. Recreational Areas:
Saguramo, Karsani (prophylactics, cardiology oriented resort)
Zedazeni, Tsitsamuri, Tserovani, Tskhvaritchami (climate, prophylactics)

209. Protected Areas:
Saguramo reserve is 22 425 ha (by recent situation – Tbilisi National Park). Its major part is covered with forests. The aim of the establishment of the protected areas is the protection of rare species and forest ecosystems, conservation of biological and landscape diversity and facilitation of recreational, tourist and educational activities.

210. Natural Monuments:
Tchermi rocks are located in Mtskheta municipality on the military road, on km 17 from Tbilisi between villages Mukhatgverdi and Dighomi at the altitude of 550-600 m above the sea level. Peculiar pseudo-karst forms have been formed as a result of impact of atmospheric factors on the rocks of the right slope of r. Mtkvari, which are composed of Oligocene-Miocene Arkosic sandstones. Name "Tchermi Rocks" refer to an old village Tcheremi, which existed in the area in the past. A natural arch (width – 3.2 m, height – 2.6 m, arch thickness – 0.7-1 m) known among the local population as "Chakiduli" ("Hung") should be noted. Several cave-like concavities are also present in the area. Their diameter is 0.5-1.5 m. # m long natural bridge has been preserved in a dry ravine some distance away. Other peculiar formations occur as well due to disintegration and movement of grains of Arkosic sandstones by water and wind.

211. Forest resources – area: 2800 ha

212. Species composition: from trees and plants: beech, hornbeam, oak, elm, maple, Colchic holly, European ash, whortleberry, Colchic ivy, boxwood, yew, old man's beard, etc.

213. Endemic species: Armazi Black Sea dogwood – endemic of Eastern Georgia. Low growing tree or shrub. Occurs only in Armazi ravine.

214. Main rivers: Mtkvari, Aragvi, Ksani, Tezami.

215. Ridges: Skhaltba, Saguramo, Trialeti, Satskepeli, Mskhaldidi, Kartli.

216. Animal world:
Mammals: roe deer, wild pig, Caucasian brown bear, wolf, fox, jackal, lynx, hare, badger, marten, weasel, otter, hamster.
Birds: partridge, quail, wild dove, blackbird, magpie, crow, sparrow.
Fish: common dace or chub, Kura nase, Khramulya, Kura barbell, Mursa, minnow, loach.

217. Public Gardens and Parks:
Mtskheta – 10 public gardens, 2 parks, with green zone the area is 120000 sq. m, of which parks and public gardens occupy 68000 sq. m.

218. The main concept of tourism development has been developed:

1. Study and identification of tourist trails, publishing in the form o brochure;
2. Arrangement of access roads and infrastructure of historical, cultural and religious attractions;
3. Advertising of historical, cultural and religious attractions;
4. Attraction and training-requalification of HR necessary for tourism.

4.3.1.3 Employment

219. The labor resource of the municipality is 30000 men (from 46500 people), which is 64.5 % of the population. The number of the employed equals to 9240 people (with the exclusion of few, according to the information disclosed by the Representative), which is % of labor force.

220. The number of the unemployed is (with the exclusion of few, according to the information disclosed by the Representative) 6795 men.

221. 4240 people from the total number of the employed are self-employed (with the exclusion of few, according to the information disclosed by the Representative).

222. The main fields of employment are: agriculture, small business (tourism, trade).

223. Average wages are 300-350 GEL.

224. Average salary in state sector is 350-400 GEL, in private sector – 500 GEL.

Table 4.18 Main Employers – Property Type

#	Types of employers	Property type
	Electro energetics	Private
	Natural gas supply	Private
	Wood processing, furniture manufacturing	Private
	Production of non-food consumption goods	Private
	Food industry	Private
	Air transport	Private
	Non-alcoholic beverage production	Private
	Fresh water manufacturing	Private
	Wine and alcoholic beverage production	Private
	Baking production	Private
	Agriculture	Private
	Architecture and construction	Private
	Trade (retail, wholesale) Transport-transportation-passenger transportation	Private
	Social field	State, private
	Communications	Private and state
	Hotels	Private
	Hotel-restaurants	Private
	Restaurants	Private
	Buffets	Private
	Financial mediation	Private
	Operations with real estate, leasing and commercial activities	Private
	Repair	Private
	El. installation works	Private
	Other services	Private

4.3.1.4 Infrastructure

225. Characterization of Transport Communications
Trans-Caucasus railway line passes the municipality as well as military road of Georgia and roads of local significance.

226. Transport Mainlines:
Tbilisi-Stepantsminda-Larsi
Tbilisi-Senaki-Leselidze highways
Length of railway and automobile roads
The length of railway in Mtskheta municipality is 26 km.
The length of local roads in Mtskheta municipality is 260.76 km.
Characterization of the state of internal roads: the state of internal roads is generally satisfactory. Repairs are being undertaken.
Characterization of the state of internal roads (asphalted, ground)
Asphalt-concrete cover – 98.35 km
Asphalt motorway – 36.89 km
Gravel road – 119.51 km
Number of bridges and their length:
Bridges – total 7/275 units/running meter
Iron-concrete – 5/151 units/running meter
Tbilisi-Stepantsminda-Larsi
Tbilisi-Senaki-Leselidze highways
Length of railway and automobile roads
The length of railway in Mtskheta municipality is 26 km.
The length of local roads in Mtskheta municipality is 260.76 km.
Characterization of the state of internal roads: the state of internal roads is generally satisfactory. Repairs are being undertaken.
Characterization of the state of internal roads (asphalted, ground)
Asphalt-concrete cover – 98.35 km
Asphalt motorway – 36.89 km
Gravel road – 119.51 km
Number of bridges and their length:
Bridges – total 7/275 units/running meter
Iron-concrete – 5/151 units/running meter

4.3.1.4.1 Highways and Local Motor Roads Infrastructure

Table 4.19

Administrative Unit	Distance from Community (Temi) Center till Municipality Center (km)	Distance to Village Community (Temi) Center (km)
T. Mtskheta territorial body		
T. Mtskheta		
Karsani		7.87
Mukhatgverdi		6.31
Saguramo Community		
Saguramo	13	
Akhalsopeli		2.5
Shankevani		6
Tsitsamuri		5.81

Table 4.20. Roads of International Significance

Name of automobile road	Road length km	With solid cover km	With cement-concrete cover km	With asphalt-concrete cover km
Tsitsamuri transport junction	0.9	0.9		0.9
Tsitsamuri ravine transport junction	0.6	0.6		0.6
Aragvi transport junction	0.4	0.4		0.4

Table 4.21. Roads of State Significance

Name of automobile road	Road length km	With solid cover km	With cement-concrete cover km	With asphalt-concrete cover km	With gravel cover km
Km 1-22.5of Zahesi-Mtskheta-Kavtiskhevi-Gori automobile road	22.5	22.5		22.5	
Km1-6.4 of Narekvavi-Mtskheta automobile road	6.4	6.4		6.4	
Km 1-20.8of Tsitsamuri-Saguramo-Tskhvaritchamia automobile road	20.8	20.8		20.8	
Km –11.4of Mtskheta-Shiomghvime monastery automobile road	11.4	11.4		5.6	6
Km 1-16.1of Natakhtari-Tsilkani-Mukhrani automobile road	16.1	16.1		16.1	
Km 1-6.7of Zahesi-Jvari monastery automobile road	6.7	6.7		6.7	

Table 4.22

Bridges within km 15,4 – km 27 section of Tbilisi-Senaki-Leselidze road					
Trestle work	1456 m				
Mtkvari bridges Right Left	 362 m 243,6 m				
Tsitsamuri junction Right Left	 36,4 m 34,2 m				
Saguramo junction Right Left	 113,8 m 112,3 m				
Aragvi bridges Right Left	 195,9 163,4				
Zahesi-Mtskheta-Kavtiskhevi-Gori					
Two bridges	15 m				
Zahesi-Jvari monastery					
Mtkvari bridge	77 m				
Channel bridge	29,7 m				
Natakhtari-Mukhrani					
Narekvavi bridge	33 m				

List of roads of local significance:

227. Below we provide data on local roads in close vicinity to the project area and Total figures for Mtskheta District

Table 4.23

Name of road	Total length km	Asphalt concrete km	Asphalt km	Gravel km	Bridges		Total units/rm
					total units/rm	iron-concrete units/rm	
Tsitsamuri-Saguramo-Tskhvaritchamia (0-20,8)	20.0	5.5	12,99	2.4			48/875.33
Mtskheta-Shiomghvime (0-11,4)	11.4		11,4				43/678.96
Access road to Guramishvili house-museum	0.8	0.8					112
Saguramo republic road, 4 km of Tchoporti-Jighaura	3.9			3.9			10104
Saguramo-2.2 Jighaura-Bitsmendi	4.9	3.3		1.6			440
Total Mtskheta District	260,76	98,35	36,89	119,41	7/275	5/151	261/4112.5

Table 4.24. The Length and Conditions of the Local Roads in Mtskheta Municipality

№	Municipality	Length of local roads km	Asphalt			Concrete			Ground		
			Length km	State		Length km	State		Length km	State	
				Good km	to Be rehabilitated km		Good km	to Be rehabilitated km		Good km	to Be rehabilitated km
	Mtskheta Municipality	530.0	121,0	47,0	74,0				409,0	140,0	269,0

Table 4.25. The Length and Conditions of the Local Bridges in Mtskheta Municipality

№	Municipality	Automobile						State					
		Quantity	Length m	Good		To be rehabilitated		Quantity	Length m	Good		To be rehabilitated	
				Quantity	Length m	Quantity	Length m			Quantity	Length m	Quantity	Length m
	Mtskheta Municipality	52	934,0	34	482,0	18	452,0	8	250,0	5	214,0	3	36,0

4.3.1.4.2 Other Infrastructure and Public Services

228. Water Supply and wastewater system
Number of main headworks and facilities – 49, of which 60 % require rehabilitation
Total length of potable water supply system – 132.5 km
Total length of sewerage system – 27 km
Conditions of potable water supply in Mtskheta town – 100 %, in villages – 60 %

229. Electricity and Gas Supply
Central gas pipeline passes near vil. Saguramo.

- Entire municipality is facilitated with electricity, except for vil. Vedzisi. In some villages the population depends on joint meter. Works are being undertaken to provide the population with individual meters;
- 50 % of the municipality is facilitated with natural gas;
- Communications occur via telephone, mobile phone and internet.

Social and Communal Services

230. Facilitation of Medical Service
Number of doctors – 143+20
Number of hospitals – 2, of which 1 is being built
Number of hospital cots – 40 cots
Number of ambulatory-polyclinic organizations – 2 polyclinics and 15 ambulatories
Number of emergency points and doctors – 2 points:
(In Mtskheta multi-profile hospital building and Akhali (New) Tserovani)

1. "Mtskheta Emergency Service 03" LLC – 12 doctors, 12 nurses, 4 operators
2. "Akhalgori Polyclinic Division" LLC, "Akhalgori 03 Service" LLC – total of 20 doctors

Number of registered pensioners – 9000 pensioners
Number of socially disabled and poor on state assistance – 2173
At local level the service of family doctor is available in ambulatories. In polyclinics licenses doctors of narrow specialization, echoscopy specialists, dentists, diagnostic cabinets are present in addition to the availability of family doctor service.

231. Education
At local level school and pre-school educational institutions are available to the population – 32 base schools and 19 pre-school institutions.

232. Institutions of higher and professional education do not function in the municipality.
820 pupils study in t. Mtskheta base schools (3 base schools). Total of 7592 pupils are in the municipality. Classes are held in Georgian in all of the base schools.

4.3.2. Cultural Heritage

233. Mtskheta is the old capital of Georgia, to which the establishment of state of Georgian people is connected. The history of Christianity in Georgia starts from Mtskheta. The greatest of Christian sacred artifacts for Georgians is buried in Mtskheta – the Robe of Christ. Since 1973 historical Great Mtskheta has been assigned the status of town-museum, since 1996 it has been included in the list of UNESCO world heritage monuments.

234. Since 1874 the following has been discovered in Mtskheta and its environments during archeological excavations in different periods: sepulchers and remnants of settlement of III-I millennia B.C. (Samtavro, Narekvavi, Tserovani, Tsitsamuri, Upper (Zemo) Avtchala, Nabaghrebi); remnants of different fortification and urban structures, palaces, monasteries, bath-houses, sepulcher of mausoleum type, sepulchers (Armaztsikhe – Bagineti, Armaziskhevi, Avtchaliskari, Tsitsamuri hill, Mogvtakari, Ghartiskari, Samtavro, Svetitskhoveli yard, territories adjacent to Antioch church) dating back to antiquity; remnants of settlement, sepulchers (Karniskhevi, Mukhatgverdi, Armaziskhevi, Samtavro, t. Mtskheta, territories around

Svetitskhoveli, Antioch, Kodmani – left and right banks of r. Aragvi) of early feudal age. We could continue with the list of monuments endlessly.

235. According to the legend, Mtskheta was built by Noah's grandchild, the mythical predecessor of Georgians – son of Kartlos, Mtskhetos.

236. Information on Mtskheta is present in the works of Georgian, Greek, Roman, Byzantine and Armenian historians. From IV-III c.c. B.C. till the beginning of VI c. A.D. Mtskheta had been the center of Kartli kingdom – "residence of great kings". The convenient location of Mtskheta played significant part in its development into the capital of the kingdom. Roads from Western Georgia, Meskheti, Northern Caucasus, Armenia, Albania joined at the town. Trade routes of world significance passed through Mtskheta – the so called Silk Road, Camel Road and Sheep Road.

237. The population of Great Mtskheta was abundant and multi-national ("six languages were spoken in Kartli"). Greeks, Assyrians, Armenians, Persians, Khazars lived in the town in addition to Georgians. According to historical sources, the Jewish colony of refugees from the devastation of Jerusalem by Nabuchadnezzar in 586 B.C. was especially large.

238. The multi-year archeological excavations confirm that antique Mtskheta consisted of the following districts: Mtskheta itself, Armaztsikhe-Bagineti, Armaziskhevi, Mogvta, Sarkine, Tsitsamuri, Nakulbakevi (Uriatubani – District of Jews), etc. Each district had its wall, gate, square, trading houses, bath-house, water supply system, etc. Fortresses of the districts formed the unified fortification system of Great Mtskheta. Its main component was the fortified internal fortress (Armaztsikhe) – the residence of kings on tall mountain of Bagineti. Armaziskhevi was the district of aristocrats and the residence of Pitiakhshs. The remnants of fortification structures, palaces, temples, sculptures and bath-houses confirm the presence of developed construction and architectural culture in the period. Only small part from 30 ha has been excavated till now. According to historical sources, pagan temples and idols were erected on hills (Armazi-Bagineti mountain, Ainina and Dainina at Armazi roadside, Zadeni on Tsitsamuri mountain, etc.), while lowland was covered with workshops, gardens-vineyards, cemeteries. Archeological material confirms that Great Mtskheta when being the capital was the center of craftsmanship-trade. The main fields of craftsmanship were pottery, metal works, stone works, carpentry and glass production; goldsmiths, inscription carvers, money producers were also present. Many Roman, Persian, Sasanian coins and precious items confirm the intensive relationships of Mtskheta with other countries. Strabo, Vitruvius, Arian, Dion Cassius wrote about the construction skills of Iberians.

239. Historical sources as well as epigraphic monuments of various periods discovered in Mtskheta and its vicinities showed that state apparatus, significant official positions were present in Iberia. Historical persons were revealed: "great king of Iberians" Xepharung, king Flavius Dade, queen Iamazaspi, Pitiakhshs – Agrippa, Asparug, Arzames, Bersuma, Zevakh (Javakh), court official (Ezosmozgvari) Iodmangan, Zevakh's wife Karpak and their daughter Serafita who passed away at the age of 21, head of painters of Mtskheta and architect Aurelius Akolis and his wife Bevrazuria, stone carver Plato, etc.

240. Kartli kingdom serving as a bridge between the east and west was a desired ally for such strong countries as Roman Empire and Iran. King of Iberia Parsman II, who was actively involved in the fight against Rome during Emperor Adrian, was turned into an ally by Emperor Antonius Pius and even his sculpture was erected on Mars square in Rome.

241. According to historical tradition, Nino of Cappadocia preached Christianity in the beginning of IV c. during the reign of king Mirian in Kartli. First the representatives of upper class were converted to Christianity. Then common people were baptized as well. In 337 Christianity was proclaimed the official religion. Kartli kingdom became one of the first Christian countries. First wooden church was built in royal garden of Mtskheta (at present Svetitskhoveli monastery

stands in its place). Afterwards three large wooden crosses were erected: one on the mountain where Mtskheta Jvari is situated now, second – on Tkhoti mountain and third – in Ujarma.

242. Many material cultural monuments are notable from Mtskheta and its vicinities dating back to the feudal age: Mtskheta Jvari (VI-VII c.c.), Svetitskhoveli (XI c.), Samtavro (XI c.), Zedazeni (established in VI c., Baptizer's basilica – VIII c.), Shiomgvime monastery (established in VI c., renovated in XII c.), Armazi Virgin Mary's monastery and fortress (XII c.), Antioch (VII-VIII c.c.), etc. Educational activities were widespread in Mtskheta of the feudal age. "Martyrdom of Evstati Mtskheteli" was written in VI c.; Arsen the Great (IX c.), Arsen II (X c.), bibliophile calligraphers Maghaladzes (XV c.), etc. are known from Mtskheta.

Fig. 4.8. Djvari

Fig. 4.9. Svetitskhoveli

243. The history of Christian Mtskheta is mainly the history of Catholicos and holy cloisters. Svetitskhoveli – Catholicos monastery was especially significant. Georgian church had gained great authority in Christian world over time and in IX c. Mtskheta Catholicos was assigned the right to make and consecrate chrism in Svetitskhoveli. The names of the earliest churches of Mtskheta (Bethlehem, Tabor church, Gethsemane. Antioch, etc.) made the pilgrims closer to the holy places of Palestine. Mtskheta was regarded as second Jerusalem. The main reason for such attitude was Svetitskhoveli as a monastery built on the grave of Christ – his robe (according to the legend, the robe was won by Jews from Mtskheta who were present at the crucifixion. The robe was brought to Mtskheta by Rabbi Elioz. He was greeted by Christianized sister, Sidonia at the city gates. She took Christ's robe and died from excitement. Sidonia embraced the robe so strongly, that nobody dared to take it away and she was buried with the robe). The history of Christianity starts with the burying of Christ's robe in Georgia. As a result, small chapel similar to Christ's Tomb church of Jerusalem was built in Svetitskhoveli monastery near Christ's robe in XV c. Almost all kings and Catholicoses of Georgia tried to contribute to elaboration of the monastery. Svetitskhoveli was the place where Georgian royal dynasty – Bagrationis were crowned, members of royal family and Catholicos-Patriarchs were buried in the monastery as well as kings of Georgia – Vakhtang Gorgasali, Erekle II and Giorgi XII.

244. The construction object is located in the eastern edge of Mtskheta at confluence of r. Mtkvari and Aragvi. Antioch church (V c.) is situated on a rock massif deeply cut in the area. The name of the church is connected with one of the main eastern centers of Christianity – t. Antioch. During the restoration activities in the 90s of the past c. a large tile of sandstone with Greek inscription was found. It was used as a step and the inscription names head of artists and architect Aurelius Akolis (this person is also known from other inscription found in Mtskheta). Small scale archeological excavations were conducted around the church. Remnants of gate and early church building dating back to antiquity were discovered. Sepulchers of IV-VI c.c. and IX-XII c.c. were also excavated.

245. Svetitskhoveli cathedral stands on the same cape in about hundred meters from Antioch. At present the fact that domed cathedral of XI c. was built on basilica built by King Vakhtang

Gorgasali in V c. is archeologically confirmed. This basilica, in its turn, covered the remnants of a wooden church built by king Mirian and St. Nino, while the wooden church was based upon the remnants of pagan temple. Remnants of massive building dating back to antiquity were found during excavations, namely, Corinthian Chapitels dating back to II c. A.D. In 2002 a prospecting shaft was cut at the eastern façade during the expertise of Svetitskhoveli fundament and an aristocrat's sepulcher was found. All items found in the sepulcher are samples of highly artistic culture. Writing tools should be especially noted: gilded silver case, where corrugated silver plate was put and case for styluses. Front side included additional golden case for ink-pot. The main case was decorated with embossed figures. Figures are put between columns and have inscriptions which inform us that the picture reflects comedy playwright Menander, epic writer Homer from VIII c. B.C. and significant Greek poet Demosthenes from IV c. B.C. The back side of the case depicts nine muses. All of them have suitable attributes and inscriptions. The researchers note that more or less similar parallel to the set is unknown and date the sepulcher by II-III c.c. A.D.

246. We provided you with the brief information on Mtskheta archeological potential. There is almost no section in Mtskheta and its vicinities, where archeological monument of some period has not been discovered. Thus, prior to commencement of work on the mentioned object archeologists should study the territory.

4.3.3 Land Use and Resettlement

247. The bridge infrastructure at the left bank of th r.Aragvi is developed on both sides of the Tbilisi-Senaki Highway (E-60): zone between the highway and borders of the Tbilisi National Park are State owned and private arable lands, which are not cultivated and used for agricultural needs. Private owners mainly consider these land plots as real estate for developing roadside businesses etc. The narrow strip of land between the highway and r.Aragvi within the project "footprint" is unused. Operational quarry is located North to the project area, adjacent to the designed bridge site. On the right side of the r.Aragvi, the undeveloped space between the r.Aragvi and residential area and historical sites is currently being reorganized: police and other administrative buildings and tourism infrastructure (parking, restoraunts, tourist centers, toilets etc.) are at the different stage of development. The design bridge will connect the highway on left bank of the r.Aragvi with this newly developing area on the right bank.

248. The bridge infrastructure will occupy 15 land plots with total area of 22,269 sq.m Out of this amount 8 land plots are State owned. Total area of affected State land is 15020 sq.m.

249. 7 out of 15 affected land plots (total area of 7,249sqm) are private. All affected private land plots are titled and officially registered in NAPR. These registered private land plots are attributed to v. Tsitsamuri, Mtskheta Rayon (District), Mtskheta-Mtianeti Region of Georgia.

5. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Introduction

250. **The impact area**. The proposed construction of the bridge on r.Aragvi near Mtskheta is a small scale development project and its environmental impacts are limited mostly to the construction ground and to some extent expand on material transportation routes. There are several quarries and borrow pits near Mtskheta and the civil works Contractor will select those, which are situated not far from the bridge site and suits material requirements. The mentioned quarries are located within 400 - 1300m from the project site (see fig.3.5). The asphalt plants are located at a distance of 2km and 7km. The Ksani landfill that will be used for transportation of the household wastes and some part of spoil (excess soil and rocks) is located at a distance of 9km. Asphalt plant sites and landfill are shown on fig. 3.6. All the mentioned facilities are located immediately close to the roads of E-60 highway and other roads of national importance - Zahesi-Mtskheta-Kavtiskhevi-Gori and Narekvavi-Mtskheta-Railway Station. Only 1 village (Dzegvi) will be crossed by the vehicles transporting asphalt from Dzegvi and disposing waste to the Ksani landfill. All these traffic flows are finally interfering at the level of that section of the Narekvavi-Mtskheta-Railway Station road, which passes the new district of Mtskheta town (see fig. 3.6). The historical part of Mtskheta is not crossed by these routes. In case if only these access roads will be used (see fig. 3.1), the vehicles transporting materials will no pass closer than 500m from the UNESCO heritage site and 350m from the border of the historical city. The end of the project road (access road to the bridge), which is located near the current parking site requires limited works – grading road and arranging pavement. This project section is located at a distance of 150 – 200m from the UNESCO site and 50m from the border of historical zone of Mtskheta. The activities having more high impacts (piling, construction of bridge superstructure) are conducted remotely from the borders of historical Mtskheta (about 400 – 500m).

251. The main receptor for the impacts is r. Mtkvari. Impact is temporary and local. The bridge will not cause distant or long-term changes of the river hydrology. No gross pollution is likely occur to cause distant or trans-boundary effects. No regional, countrywide or trans-boundary impacts are envisaged.

252. Within this IEE impacts are classified as minor, medium or high.

a) Impacts are attributed to low category, when the environmental receptor is not of a high value and the magnitude of imposed changes is low or medium. The effect of the low impact is usually short-term, reversible and does not impose any unacceptable and long-term changes of environmental features: change of topography, landscape, habitats, reduction of biodiversity or loss of endangered species, soil and water pollution, air pollution, damage of cultural heritage and health related problems. The low impacts either do not require any mitigation measures, or application of some less specific and simple, cost-efficient measures is sufficient.
b) Impacts are attributed to the “medium category”, when the environmental receptor is of medium value and the magnitude of imposed changes is low or medium. The medium scale impacts may cause short-term and reversible changes within broad physical area or long-term or irreversible changes within local area and on limited set of resources (e.g. on local population of some animal species, but not on the other populations of the same species and not on the macro-characteristics of biodiversity).
c) Impacts are classified as “high”, when the environmental receptor is of high value and the effects are of medium or high magnitude and also in cases, when the receptor is of medium value but the imposed changes are severe. Irreversible total destruction of local natural landscapes and green-fields of medium value or partial and limited damage of sensitive natural habitats (forests, wetlands etc.), as well as even limited intrusion in protected areas, all this is considered as “high impact”. Destruction of cultural heritage remains, as well as long-term or severe changes of natural factors imposing health risks (e.g. long-term minor exceeding of maximum admissible norms for noise or pollutants or short-term but extremely high fugitive emissions) are also considered as high impacts.

5.1 PHYSICAL ENVIRONMENT

5.1.1 Climate and Radiation

5.1.1.1 Design, Construction and Operation Phases

253. The designed bridge and adjacent infrastructure is a local small scale installation do not envisaging creation of any new water reservoirs or flooded zones, having no influence on temperature and emissions and do not changing traffic general parameters. The bridge will enable to redistribute and better organize local traffic, but will not affect general traffic volumes. Accordingly, installation of the bridge will not entail changes of local microclimate and will not contribute to the macroclimate changes or greenhouse gas emissions.

254. Transportation of toxic materials or radioactive wastes is prohibited and traffic across the new bridge is not associated with risks of radiation impacts. The background radiation level do not impose any risks on health and safety of local residents and construction workers.

255. Construction activities are limited to small scale civil works within the local area and transportation of materials from quarries and supplier sites. These activities will not affect climate. Climate in project area do not impose any specific difficulties or schedule limitations for civil works or risks for health of the workers

5.1.2 Air Quality

5.1.2.1 Construction Related Impacts on Air Quality

Impacts

256. Vehicle Emissions and Dust. Transmission line construction involves the use of heavy machinery, bulldozers, excavators, graders needed for land clearance and other earthworks, cranes for erecting towers, vehicles and equipment to transport construction materials, workers, remove debris from the work area. The operation of heavy machinery, vehicles and other construction equipment result in fugitive emissions of carbon monoxide, NOx, SO2, hydrocarbons, and particulate matter.

257. Dust generation during the construction works is associated with:

- Earthworks, including topsoil stripping, excavations in cuts, construction of embankments
- Transportation and storage of excavated ground (topsoil and subsoil to the storage locations; spoil to the disposal sites)
- Transportation of fine materials (sand, gravel, cement etc.) from supplier sites, borrow pits and quarries
- Storage of fine construction materials

258. Exhaust emissions are associated with the operations of vehicles and heavy equipment, like buldozers, excavators, cranes etc.

259. Emissions and dust generation may affect residents of houses located close to the construction sites (right bank of r.Aragvi) and residential areas along the material transportation routes. The vehicle and equipment emissions and dust are typical for any construction activities. The main receptor is 4 residential houses located on the right bank of r. Aragvi at a distance of 100m from the border of construction site. The rest buildings are located 10 - 20m farther and are screened by trees. Emissions and dust during transportation of materials will affect mainly the residents of the houses located along the road in New Mtskheta area. **This impact is temporary and is estimated to be medium scale if not properly mitigated. In case of**

application of good construction practices thei impacts could be minimized to minor and acceptable level.

Mitigation

260. The residential area is not affected significantly by the construction related emissions. However, emissions of heavy machinery involved in the construction should be managed by proper engine maintenance practice and usage of good quality fuel. The work of engines in a no-operation mode should be excluded.

261. Relatively high impact is connected with 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 temporary impact, and should be mitigated by periodical watering of the work sites.

262. Vehicle refuelling will 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 stored fuel).

263. If 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.

264. Mitigation measures will include:

- Damping down using water bowsers with spray bars or other technical means; Minimum 1 browser will be required for that purpose. However, the constructing contractor should not be limited by this figure, and if required additional browsers should be engaged.
- Materials transported to site will be covered/ wetted down to reduce dust. The construction site will be watered as appropriate. 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 damaged parts
- Sheeting of construction materials and storage piles; and
- Use of defined haulage routes and reductions in vehicle speed where required. Materials will be transported to site in off peak hours.

265. Materials transported to site will be covered/ wetted down to reduce dust. The construction site will be watered as appropriate. 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 damaged parts

266. Vehicle refueling will 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 stored fuel).

5.1.2.2 Bridge Operation Related Impacts on Air Quality

Impacts

267. The project has no tangible impact on overall characteristics of the local traffic. Construction of the bridge will not cause increase of the amount of vehicles entering Mtskheta, it will only redistribute the traffic currents. Thus the changes are mostly local and minor: the traffic and emission level may slightly increase only near the residential houses located at the right bank of the river, near the parking. This increase cannot be significant, as the mentioned residential area is not free from traffic (it is located near the parking site for tourists) and, currently the vehicles are approaching the concerned destination from the other side.

268. As it has been demonstrated in EIAs for different sections of the E-60 Highway (ADB financed Adjara Bypass and Tbilisi-Rustavi projects; WB financed Mtskheta (Agaiani) – Igoeti, Ruisi-Rikoti projects; JICA financed Kutaisi Bypass projects etc.) the current and forecasted values of ambient air pollution caused by the existing and perspective intensity of motor traffic will not exceed the standards. If the highway projects, which in average increase the traffic rates two or three fold do not lead to unacceptable levels of emission, the bridge operations will not lead even to local exceeding of the standard values. **The impact is of low magnitude and estimated as minor.**

269. Additional dust and vehicle emissions can occur also during bridge maintenance activities due to traffic on access roads and the operation of maintenance equipment. **The impact is short-term, of low magnitude and estimated as minor.**

Mitigation

270. RDMRDI should ensure good maintenance of the road and one of the positive outcomes of good maintenance is reduction of dust generation. RDMRDI should ensure incorporation of environmental considerations in the maintenance contracts and monitor implementation.

Conclusion

271. Impact of the project on air quality is minor, temporary (mostly limited to construction period and maintenance activities) and is easily manageable through application of good construction and vehicle/equipment maintenance practices. Existence of the bridge will not affect the traffic related emission level, as the main source of local emissions is the traffic on the highway, which is not affected by the project.

5.1.3 Noise

5.1.3.1 Construction Related Noise

Impacts

272. Evaluation of construction related noise relies upon known information on the noise produced by various equipment and activities at individual stages of construction. For example noise levels produced at 50 ft (15.24m) as provided by the U.S. Department of Transportation, FHWA, CADOT, and SBAG 1993; and Country Sanitation Districts of Los Angeles County 1994 are about:

Table 5.1

Source of Noise	Equivalent noise level, dBA
1. Construction machinery and mechanisms	
backhoes	84 - 85
bulldozers	84 - 85
graders	91 - 92
compressors	80 - 88
jackhammers	85 - 98
pile drivers	96 - 107

:

Table 5.2 (source: U.S. Environmental Protection Agency, 1972,)

Source of Noise	Equivalent noise level, dBA
Construction machinery and mechanisms	
Compacters (rollers)	72 - 75
Front loaders	72 - 83
Backhoes	72 - 92
Tractors	78 - 95
Scrapers, graders	80 - 95
Pavers	85 - 88
Trucks	83 - 93
Compressors	75 - 88
crane, movable	75 - 85
Jackhammers and rock drills	82 - 98
Vibrator	70 - 82
Saws	72 - 82

273. Noise generated by mobile sources naturally attenuates at a certain distance. Attenuation follows logarithmic pattern. In case of construction related noise, point source propagation model should be applied. Point-source propagation can be defined as follows: Sound $level_1$ – Sound $level_2$ = 20 log r_2/r_1. This means that for every doubling of distance, the sound level decreases by 6dBA ("inverse square law").

Table 5.3

Distance from the Edge of the Construction Ground m	Predicted Noise Level Average Value - dBa	Predicted Noise Level Maximum Value - dBa
5	80	90
10	74	84
20	68	78
40	62	72
80	56	66
160	50	60

274. As a result of rough estimation of construction related noise, we can assume that the noise impact will not exceed radius of 160m. According to Georgian regulations, 60dB is admissible average level of daytime noise near construction sites and roads. 60dB noise is generated at a distance of 50m from the work-site. The bridge construction ground at the right bank of the r. Aragvi is closest located at a distance of 200 - 500m from the closest residential houses. The major construction sites are situated closer to the river bank. Temporary increase of the noise level near the construction ground is an acceptable impact. **The impact is temporary, of moderate magnitude and estimated as medium.**

Mitigation

275. Mitigation of this minor impact is possible by engine maintenance practice and avoidance of engine work in non-operational mode. The only limitation that could be recommended is to deploy high noise devices, like crushers, outside the residential zone and exclude the night-time works at the right bank of the r. Aragvi.

276. All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or local people. All vehicles will be checked and repaired in case of need to eliminate increased level of noise due to damaged parts.

277. Regular maintenance of diesel engines will be undertaken to ensure that emissions are minimized, for example by cleaning fuel injectors. Routine maintenance will be to a high

standard to ensure that vehicles are safe and that emissions and noise are minimized. All plant used on site will be regularly maintained so as to be in good working order at all times to minimize potentially polluting exhaust emissions.

5.1.3.2 Traffic Related Noise

Impacts

278. The average measured level of noise at 20m from the highway (left bank of. r.Aragvi) was 53dB and 58dB. It is logical to assume that the traffic and traffic related noise will not be higher on the bridge and adjacent territories, as compared with the highway. Accordingly we can assume that the traffic related noise level will be within the admissible norms (60db for the residential areas adjacent to the road). Thus the impact on residential zone is acceptable. The bridge will not have significant additional noise impact of the Tbilisi National Park, as the tmain source of the impact (traffic on the highway) will not change. **The impact is of low magnitude and estimated as minor.**

Mitigation

279. Despite the fact that traffic related noise is not expected to exceed standard limits, some minimal mitigation measures still are required. Introduction of the speed limitation and control measures for the settled areas should be sufficient to mitigate the noise impacts to the acceptable level.

5.1.4 Topography, Geomorphology, Geohazards

5.1.4.1 Construction Phase Impacts

Impacts

280. No landslide or mudflow gullies at the project site. The bridge design is adequate for local seismic risks. River bank and embankment erosion is the only problem, that should be taken into account during the design and construction. According to the detailed design it is not required construction of any revetments and river bank protection installations. Eroded river-bank sites have been carefully analyzed during the detailed design – they are not falling within the zone of bridge infrastructure and erosion will not be stimulated due to construction activities. And vices versa, no riverbank erosion processes are affecting the designed bridge infrastructure. Permanent monitoring of the adjacent sections of the river bank is needed to identify any lateral or local scouring risks and plan protection measures.

281. Construction related potential impacts:

- Erosion from road cuts and fills
- and temporary sedimentation of natural drainage ways.
- Erosion of lands below the road bed and embankments receiving concentrated outflow from covered or open drains

282. The project is of small scale, limited to local area, not affecting natural slopes. Stimulation of the erosion processes due to the construction activities is excpected mostly for artificial embankements envisaged by the project. **This impact is estimated as minor due to limited area and is easily manageable**. Erosion of the banks will not be stimulated by the project – on the contrary: the bridge structures will stabilize adjacent sections of the river banks.

Mitigation

283. The measures, by which Contractor will address the protection of “slopes” adjacent to the highway, bridge site and interchange against erosion before permanent reinstatement, are outlined below. Mostly these are embankment slopes. Temporary erosion control measures will be introduced as necessary, paying special attention to:

- Construction activities that increase the potential for erosion from the slope sides and/or sediment mobilization in watercourses;
- Straw bale barriers in locations requiring small volumes of sediment interception;

284. Temporary erosion control measures will be left in place until the slopes of embankments are stabilized to the approval of Road Department. The purpose of temporary erosion control measures is to:
- Interrupt surface water run-off;
- Slow the velocity of water runoff to the extent practical;
- Divert water off exposed check dam areas;

Prevent and minimize sediment transportation off the construction sites

285. The impacts should be mitigated by anti-erosion measures:
- install temporary and permanent drainage systems
- install berms
- revegetate f embankment slopes
- install sediment catchment basins etc.

5.1.4.2 Operation Related Impacts

Impacts

286. Bridge operation activities will not stimulate soil erosion, but soil erosion may affect bridge operations. Erosion of embankment slopes, as well as river bank erosion are the potential impacts to be addressed. Stimulation of erosion at the right terrace of the river bank (upper reaches) and left bank (lower reaches) is the issue to be considered. **For today the impacts are estimated as minor**, but permanent monitoring is needed to apply adequate measures in case if the risks will increase in future.

Mitigation

Erosion and land stability control and landscaping.

287. Usually, it is recommended to prohibit operation of quarries located within the floodplain in close vicinity to the bridge structures. The reason is that quarrying operations may result in increased scoring of the bridge area. however, in this particular case the existence of the quarry in close vicinity to the bridge (left bank) is welcomed, as the bridge site constitutes the zone of accumulation of sediments and the quarry activities will to some extent balance overloading by sediments of the bridge site.

288. Road Department (RDMRDI) should ensure permanent erosion and land stability control and monitoring of landscape restoration after completion of construction works, as well as timely implementation of corrective actions. Corrective actions include, but are not limited to maintenance of drainage systems and implementation of anti-erosion measures (berms, vegetation cover etc.) whenever required.

289. Currently no specific river bank protection structures are planned. However, permanent monitoring is required and revetment structures could be installed in case of need.

Conclusion

290. The project area is not complex in term of geoetechnical conditions. The project area is not prone to hazardous geological processes. Erosion processes during construction and at the operation stage could be easily managed by common anti-erosion techniques.

5.1.5 Soil

5.1.5.1 Construction Phase Impacts

291. Three types of impacts on soils are expected: erosion, loss of topsoil and loss its qualitative characteristics. The construction of the bridge will cause limited activation of soil erosion in new cuts and fills. Erosion impacts and mitigation measures are addressed in 5.1.4.

Impact

Soil Pollution

292. Soil could be polluted due to improper fueling operations and fuel leakages. **In case of improper management the impact could be of medium scale.** Potential pollutants from a project of this nature include the following (this list is not exhaustive):

- Diesel fuel, lubrication oils and hydraulic fluids, antifreeze, etc. from construction vehicles and machinery
- Miscellaneous pollutants (e.g. asphalt, cement and concrete)
- Construction wastes (packaging, stones and gravel, cement and concrete residue, wood, etc.)

293. 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, yeat could become a source of pollution (medium impact).

Mitigation

294. Pollution Prevention and mitigation procedures should be implemented during construction, as it is described below:

295. Contractors will ensure the proper handling of lubricants, fuel and solvents. All tanks will 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. The bund will be impermeable (e.g. concrete-lined), without drainage points or other breaches. Accumulated rainwater in bunds will be pumped out of the bund to either drains or the ground if uncontaminated. In case of fuel spillage the spilled fuel should be recollected and contaminated bund treated by the absorbents: sawdust, sand or straw.

296. All fuel / hydrocarbon dispensing nozzles are to be of a drip control design and securely locked when not in use.

297. Vehicles will not be left without supervision during refueling process. All refueling operations on the working sites will use absorbent pads and/or straw to minimize spills, which will be put in place prior to the commencement of refueling operations. Soiled ground and absorbents will be removed, stored and treated as hazardous waste. In case of significant spill authorized and responsible person will be informed, works will be stopped till the elimination of pollution risk Refueling will 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 equipments will be regularly revised to prevent leakage due to inappropriate condition of refueling equipments. Equipment and storages will be isolated and guarded to prevent pollution due to cases of stealing or vandalism. All mobile plant, including but not limited to cranes, compressors, generators, bulldozers, excavators etc. and storage tanks will be maintained and operated such that all leaks and spills of materials will be minimized. Daily plant checks (Vehicle Maintenance Procedure) will be undertaken to ensure no leaks or other problems are apparent. Vehicle maintenance, cleaning, degreasing etc will be undertaken in designated areas of hard-standing, not over made unstable ground (embankments etc.).

Impact

Topsoil losses due to topsoil stripping and storage

298. Two types of impacts on topsoil are expected: loss of topsoil and loss of its qualitative characteristics. During removal of topsoil, its mechanical damage and loss is expected. Moreover, as a result of topsoil removal and long-term storage its main characteristics such as fertility, structure and chemical composition could be changed. Improper management of construction vehicle traffic and handling-disposal of construction materials may lead to trampling and damage of topsoil around the construction site.

- Topsoil loss due to improper stripping and mixing with subsoil
- Improper storage of topsoil (mixing with subsoil stockpiles; improper shape and location of the stockpile)
- Topsoil washout due to improper storage and reinstatement

Due to local character of th impact and limited area, this potential impact is estimated as **medium** grade.

Mitigation

299. Topsoil of cultivated land used for temporary work areas will be stripped off and stockpiled, to be replaced when the construction is completed and the cultivated land rehabilitated. The top soil along the Project road and interchanges will also be stripped, preserved for reuse. There may potentially be some topsoil washout due to improper storage and reinstatement. Contractors will be encouraged to minimize usage of productive agricultural land and convert them to their original state after completion of civil works. Embankments should be monitored during construction for signs of erosion; long-term material stockpiles will be covered to prevent wind erosion.

300. 22,269sqm of the land will be stripped from topsoil on average for 02m depth. 4,454 m^3 of topsoil will be stockpiled. Cost of these operations equal 4,454 m^3 x 4 Gel = 17,816 GEL. The storage of topsoil in stockpiles, no more than 2m high with side slopes at a maximum angle of 45^0, will take into consideration the following:

- Segregation of the topsoil from the subsoil stockpiles
- Dedicated storage locations that prevent the stockpiles being compacted by vehicle movements or contaminated by other materials;
- Segregation from subsoil stockpiles;
- No storage where there is a potential for flooding;
- No storage at less than 100 m from river/streams, subject to site specific topography.

301. Contractor will protect the stockpiles from flooding and run-off by placing berms or equivalent around the outside where necessary. Topsoil stockpiles will be monitored and should any adverse conditions be identified corrective actions will include: (i) anaerobic conditions - turning the stockpile or creating ventilation holes through the stockpile; and (ii) erosion - temporary protective silt fencing will be erected;

302. Topsoil removed from the construction sites will be used for reinstatement of the topsoil on the embankments or in the adjacent construction corridor affected by the project activities. Topsoil will be reinstated separately from subsoil, with care taken to avoid mixing of the materials. The topsoil reinstatement will be sufficient to restore the fertile depth to the initial conditions as judged by the topsoil strip during visual observation and comparison of the reinstated site and adjacent land. When replacing the topsoil Contractor will program the works such that the areas farthest away from the stockpiles are reinstated first with reinstatement getting progressively closer to the stockpiles, thus reducing the number of vehicle movements over the reinstated topsoil. The reinstated topsoil will then be harrowed, where practical, to protect the stability and promote vegetative growth.

303. Subsoil Storage. The storage of subsoil in stockpiles, no more than 3m high with side slopes at a maximum angle of 600, will take into consideration the following:

- Dedicated storage locations where the stockpiles will not be compacted by vehicle movements or contaminated by other materials; and
- Segregation from topsoil stockpiles.

304. In the event that the subsoil stockpiles experience significant erosion Contractor will institute corrective action such as installing erosion matting over the stockpiles.

5.1.5.2 Operation Related Impacts

Impacts
305. Fuel leakages and spills during the bridge operations and roadside litter may result in soil pollution. Storm-water may expend the contamination area transporting fuel contaminated water at some distance and causing pollution of soil and water. **Mostly - minor impact**. Gross contamination due to accidents is unlikely.

Mitigation
306. Traffic across the bridge should be controlled to prevent accidents and accidental spillages. Signs and special installations limiting speed should be installed.

307. The bridge design should include oil catchment and separation system to enable cleaning of storm-water washing the bridge.

5.1.6 Surface and Ground Water

5.1.6.1 Construction Phase Impacts

Impacts
308. Water pollution may result from a variety of sources, including the following:
- Cement slurries from concrete works may enter the river
- Water contamination due to drilling activities (discharge pollutants such as residual bentonite or cement slurries). Dry drilling activities are applied in this project and no bentonite will be used. However, the risk of contamination due to cement slurry should be taken into account.
- Spillages of fuel, oil or other hazardous substance, especially during refueling
- Silt suspended in runoff waters (“construction water”)
- Washing of vehicles or equipment or disturbance of watercourse banks and bed during watercourse crossings by heavy machinery
- Exposure of contaminated land and groundwater

309. Spillages etc may travel quickly downhill to a watercourse or water body. 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 prompt action is taken in the event of any potential water pollution incident. The impact is estimated as **medium grade**.

310. Once the working width has been stripped of topsoil, the subsoil becomes exposed. During earthworks in a wet weather this may result in uncontrolled release of suspended solids from the work area. River Aragvi is the major receptor sensitive to the increased sediment load. The impact is estimated as **minor grade** due to limited area affected (slopes of embankements).

311. Water use. Water will be required for maintenance works and for dust protection measures (water bowsers). The amount of required water is not high and the sources exist in the vicinity of the project sites (river Aragvi). However, the water intake and discharge limits should be calculated and relevant regulations should be met by the constructing contractor.

Mitigation

312. Pollution Prevention Measures: Specific mitigation measures should be implemented at the construction site for prevention of water and soil pollution:

Civil works Contractor will arrange sedimentation catchments and will control concrete works during the bridge construction to prevent cement slurries from entering the river.

313. Civil works Contractor will arrange sedimentation catchments and will control drilling activities to prevent discharge of pollutants. The pipe will be pulled out carefully while new portions of slurry are added step-by step. Spillage risks are minimal in case of proper operations and careful supervision. However, sediment catchment basins will be applied to retain any small portion of slurry and to prevent water contamination.

314. Prevent operation of vehicles in the river and if there is no alternative, inspection of vehicles will be required to ensure that there is no leakage of fuel and lubricating materials.

315. Contractors will ensure the proper handling of lubricants, fuel and solvents. Fuel and lubricant storage tanks will not be located within 50m of any watercourse, well or dry gorges. All tanks will 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. The bund will be impermeable (e.g. concrete-lined), without drainage points or other breaches. Accumulated rainwater in bunds will be pumped out of the bund to either drains or the ground if uncontaminated. In case of fuel spillage the spilled fuel should be recollected and contaminated bund treated by the absorbents: sawdust, sand or straw.

316. All fuel / hydrocarbon dispensing nozzles are to be of a drip control design and securely locked when not in use.

317. No fuel storage or refueling of vehicles or equipment will be allowed within 50m of r. Aragvi. Vehicles will not be left without supervision during refueling process. All refueling operations on the working sites will use absorbent pads and/or straw to minimize spills, which will be put in place prior to the commencement of refueling operations. Ground water and surface water pollution risk will be reduced or eliminated in case of immediate removal of polluted ground. Soiled ground and absorbents will be removed, stored and treated as hazardous waste. In case of significant spill authorized and responsible person will be informed, works will be stopped till the elimination of pollution risk Refueling will 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 equipments will be regularly revised to prevent leakage due to inappropriate condition of refueling equipments. Equipment and storages will be isolated and guarded to prevent pollution due to cases of stealing or vandalism. All mobile plant, including but not limited to cranes, compressors, generators, bulldozers, excavators etc. and storage tanks will be maintained and operated such that all leaks and spills of materials will be minimized. Daily plant checks (Vehicle Maintenance Procedure) will be undertaken to ensure no leaks or other problems are apparent. Vehicle maintenance, cleaning, degreasing etc will be undertaken in designated areas of hard-standing, not over made 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 any watercourse, well or dry gorge. The storage of potentially polluting materials, refueling and maintenance of mobile plant within 50m of all watercourses/water bodies, dry riverbeds and within designated wetlands and aquifers will be prohibited.

318. Erosion control measures will be applied during construction activities to prevent increased runoff into the watercourses.

319. Contractor will 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 watercourses by selecting areas that are not free draining into any watercourse.

320. Where any area of the spread is at risk from silt pollution washing off into a watercourse of water body, effective measures will be put in place to ensure that such pollution does not occur. Such measures may include:
• Use of silt fences
• Use of straw bales to deflect and filter water
• Use of a system of bunds and grips to prevent water from entering watercourses, etc.
• 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.

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

322. No impacts are envisaged on groundwater (depth is more than 5m), as no deep excavations are planned within the frames of present project

5.1.6.2 Operation Related Impacts

Impacts
323. Fuel leakages and spills during the bridge operations and roadside litter may result in soil pollution. Storm-water may expend the contamination area transporting fuel contaminated water at some distance and causing pollution of soil and water. The impact is estimated as **minor grade.**

Mitigation
324. Roadside litter and fuel pollution. Road Department should coordinate with the local Governmental institutions and private companies and facilitate arrangement and proper functionality of supporting facilities and services (fueling stations, waste management services)

325. Traffic across the bridge should be controlled to prevent accidents and accidental spillages. Signs and special installations limiting speed should be installed.

326. The bridge design should include oil catchment and separation system to enable cleaning of storm-water washing the bridge.

5.2 BIOLOGICAL ENVIRONMENT

5.2.1 Landscape and Flora

5.2.1.1 Construction Phase Impacts

Impacts
327. No valuable landscapes are affected by the project. The new infrastructure is just an extension of the existing highway. The existing and licensed borrow and quarry sites are proposed for material supply, thus no new impacts are envisaged on the landscape.

328. The project site is not sensitive; Georgia Red List species were not identified in the designed project corridor and no significant impacts on floral communities is envisaged.

However, several trees (from 30 to 40) and certain amount of bushes will be cut down, inclusive 12 sea-buckthorn (*Hippophaë rhamnoides*) shrubs. Currently sea-buckthorn is not in red data list. However, it is considered as endangered and vulnerable specie and some time ago was presented in Red Data Book of Georgia. The impact on sea-buckthorn is estimated as **medium grade.**

329. The periodically flooded patch of ground at the right bank of the bridge, which had developed as a result of construction of dam downstream and insufficiency of river-bank protection revetment, can not be considered as natural habitat. This is a zone of disruption of traditional suburban landscape due to flooding problems and currently the Municipality is implementing independent project aimed on covering this flooded patch of ground by filling materials and further landscaping

Mitigation

Landscape Reinstatement and Protection of Flora

330. Construction Contractor will demarcate exact borders of the construction corridor. Additional botanical assessment should be conducted within the refined construction corridor just before commencing construction activities (pre-entry survey), to prepare inventory of all trees and bushes subject for clearance and to mark them. These actions should be undertaken by Construction contractor in coordination with the municipal authorities.

331. After the specification of affected individual plants of endangered species (sea-buckthorn - *Hippophaë rhamnoides*) within the project impact zone, relevant mitigation measures should be elaborated. First of all, care should be taken to ensure that they are kept intact during the project implementation (possible design changes or deviations). In case if the endangered species are damaged, compensatory planting of the species should be facilitated with the proportion of 1:10, so 10 trees should be planted instead of 1 cut tree (sapling of sea-buckthorn). According to preliminary data, total of 120 saplings may be needed for planting. Cost of sea-buckthorn seedlings is about 5 Gel and they are available in Sartichala Plant Nursery. Maximum value of compensation planting could be calculated as: 12 cut bushes x 10 x5Gel + 500Gel for workers = 1100 Gel.

332. All the work sites (except permanently occupied by the road, bridge, interchanges and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover). So far as very limited bush clearance is required for the project, preservation of top-soil is sufficient for reinstating the natural grass vegetation cover as well. Replanting of bushes and trees is considered".

5.2.1.2 Operation Related Impacts

Impacts

333. No new impacts are envisaged at the operation stage. However, the construction stage impacts are long-term and need long-term mitigation measures, which are out of competence of the construction contractor and MDF.

Mitigation

334. Landscaping and planting of greenery. In a long-term perspective and in relation with the entire length of highway RDMRDI should plan development of the roadside zone applying proper landscaping and greenery planting strategies. Visual and aesthetic, as well as emission screening aspects should be taken into consideration.

5.2.2 Fauna

5.2.2.1 Construction Phase Impacts

Impacts

335. Although the impact area of construction and operation of the Mtskheta bridge is situated within the quite strongly transformed landscapes, it could not be excluded a possibility of some impact on the fauna.

336. On the **site** expected impacts are:

- obstacles for seasonal movements for amphibians and reptiles occurring in the work area
- destroying of some bats roosts in the trees with hollows during the clearing works (tree cutting before road construction)
- disturbance of protected species of birds-of-prey on the nests
- increasing water turbidity and the drying out of the riverbed sites during spawning season.
- a temporary ban of fish movements along the river from spawning places (upstream of proposed place of bridge) to fattening and nursing areas downstream of it.

337. The impact on fish species could be theoretically considered as the most significant of the expected impacts on fauna. However, additional site survey has demonstrated that within the project area there are no spawning grounds important for the fish biodiversity conservation. Within 300m downstream from the project site there are licenses issued for quarrying activities. Within 1300m upstream several functional quarries are located (see fig.3.5). The expert Ichthyologists do not consider need of any seasonal restrictions for the works within the river-bed, especially taking into account that the river bed will be closed only partially and the free flow will be maintained uninterruptedly. The impact is estimated as **medium grade.**

338. Residual adverse impacts during operation of bridge will be permanent, but minor:

- Creation of barriers for migration of small animals (amphibians and reptiles)
- Potential destruction of bat shelters (trees with roosts – if any).
- Pollution of the river and aquatic habitat by the effluent waters from the road-bed and roadside litter in case of leakages or accidental spillages

Mitigation

339. The proposed mitigation measures should include:

- The expert Ichtyiologists do not consider need of any seasonal restrictions for the works within the river-bed, especially taking into account that the river bed will be closed only partially and the free flow will be maintained uninterruptedly. No significant losses of fish species are expected as a result of properly organized construction activities. The main point is to prevent cement slurry from entering the river and minimize sediment load due to erosion. For that purpose sediment catchment basins will be organized to prevent contamination of the river water by cement slurry and sediment run-off. Bentonite is not used during drilling activities. The mentioned measures are much more important than seasonal restrictions. However, in order to reduce the risks almost to zero point, the preferable seazon for conducting civil works within the riverbed is indicated - from beginning of August till end of March. This should not be understood as a restriction for civil works in other seasons.
- During the works within the river bed, sufficient free flow of the river should be ensured to allow migration of the fish species (see description of works p.3.4.4).
- The flood prone areas in the immediate vicinity of the project site, as well as shrubs are not unique or important habitats for breeding birds, waterfowls etc. There are hundreds of similar sites along the river and most of them are located remotely from the active urban zone, while the project site is located close to highway and new

development area, within the official urban zone. The individual birds could easily move to other sites. The main point is not to damage them while starting construction. Due to that reason pre-entry survey and preventive measures are proposed Construction. Contractor will demarcate exact borders of the construction corridor. An additional pre-construction survey is needed at the mobilization stage to identify nests of birds and holes used by small animals within the frames of the refined construction corridor. All old trees should be inspected on the presence in it roosts of bats - in hollows. The trees cannot be cut without consultation with MoE officials and bat experts, if the bat colony has been found. Smooth methods to scare off birds, bats and small animals will be applied. e.g. for bats, in case if the colonies are identified – acoustic methods will be feasible, and representatives from the institute of zoology could be involved for that purpose (however, no bat colonies have been detected up to now within the project area.).

340. Use of best world practices during the construction of the new bridge to minimize impact of this, including:

- To take measures to reduce amount of dust emission
- To take measures to reduce level of noise during operation
- To clean the work area and its surroundings from household solid waste and building waste: do not dispose it on the open temporal dumps and do not throw out it in the river valley or into the water
- Prevent fuel and mineral oil leakage into the water and on the soil
- Open holes, trenches and precipices should be fenced with something preventing falling of animals: for the large species it could be a bright tape, for the small animals it is possible to use any flat material (a tin or a polyethylene film), in trenches and holes at the night could be putted boards or large branches (with one end) to allow the fallen small animals to leave it. The holes and trenches should be checked before fulfilling.
- Designed underpass will serve for the underground passages of the small animals (amphibians and reptiles).
- Install bat boxes (to compensate felled trees with roosts) in case of bat colonies are identified during the pre-entry study.

341. Especially, for the freshwater ecosystems and for of the impact on mitigating ichthyofauna:

- Prevent increasing of the water turbidity in the river during construction works and the transfer of slurry (suspension of sediments), in a considerable quantity, downstream during the fish spawning period.
- Prevent poaching of workers, especially with using of electricity or poisons (calcium carbide e.g.)

5.2.2.2 Operation Related Impacts

Impacts

342. No additional traffic noise and emissions will be imposed on habitats and fauna species, as the bridge is connecting existing and operational highway with the urban development area. Fuel leakages and contamination of the river water by fuel should be considered as a potential impact. The impact is estimated as **minor grade.**

Mitigation

343. The effluent waters from the road-bed – water pollution and litter transport to the river can be mitigated by proper construction and operation of the catchment system to collect the surface run-off waters and separate fuel remains.

5.2.3 Protected Areas

5.2.3.1 Construction and Operation Phase Impacts

Impacts

344. The project site is located at a distance of 130 – 150m from the South -West border of the Tbilisi National Park (TNP). No new impacts are generally envisaged, so far as the new infrastructure is just an extension of the existing highway. Physical buffer strip exists between the official borders of the TNP and its main part separated by range of hills. The hill slopes within buffer zone, are covered mainly with hornbeam bushes. The buffer zone is characterized by much less biodiversity and sensitivity than the main part of TNP located on the other side of the hills. During the Detailed Design phase care has been taken that the bridge and interchange footprint does not intrude the borders of the TNP. Only distant impacts, like noise or emissions may theoretically affect the buffer zone; however these temporary impacts are of very low magnitude at the distance of 130- 300m, and besides the area is already permanently affected by the highway traffic noise and emissions. Additional noise or emissions related to construction operations are negligible and will not increase the baseline values. Construction noise and emissions will not change significantly the background values determined by the highway traffic. Animal species inhabiting the border zone of TNP are adapted to these impact factors. Besides, they have enough space and similar habitats to move for several tens of meters in case if they are disturbed. **No impact on TNP**.

345. Poaching is unlikely factor, however can not be neglected.

Mitigation

346. Strict control of workers to exclude poaching.

5.3 SOCIAL ENVIRONMENT

5.3.1 General Socio-Economic Impacts

347. The proposed project will have short-term and long-term impact on the local communities. The social impact of the bridge construction project should be viewed under the broader context of developing tourism infrastructure in the region and in whole country. This overall positive Impact will be tangible for socio-economic development of the country.

348. Benefit of the project for local communities is mostly indirect. Currently the most part of the residents of surrounding villages, as well as significant part of Mtskheta residents are self-employers working on their agricultural land parcels. Only small part of agricultural products is produced for sale: most part of the harvested products is intended for internal consumption by the households. Low demand on agricultural products makes agricultural plants less profitable. Indirectly, development of tourism will support development of agriculture and services required for tourism (small hotels, trade, café, artisan shops etc).

349. At the same time certain direct benefits (although limited) also are associated with the project:

- Creation of new jobs during the construction works
- Stabile power supply

5.3.1.1 Construction Related Social Impacts

350. In short term perspective, the project will have some benefit for local population, providing job opportunities (about 30 new jobs could be available for local residents).

351. Impact: The negative impact related to the construction nuisance (dust, emissions, noise) is temporary, insignificant and manageable by application good construction practices.
Mitigation measure: Dust control by application of watering. Use as minimum as 2 browsers; Noise control, installation of mufflers on equipment, daytime works;

352. Impact: Creation of vectors of disease e.g. temporary breeding habitats for mosquito as stagnant pools of water, stagnant water bodies in borrow pits, quarries, etc. suited to mosquito breeding and other disease vectors.
Mitigation measure: pools should be drained down. Remove all created pools till spring-time. Reinstate relief and landscape.

353. Impact: Recontamination by infectious biological materials (e.g. Anthrax) during earth works near the pest holes (i.e. not registered Anthrax sites).
Mitigation measure: 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.

354. Impact: Hazardous driving conditions where construction interferes with pre- existing roads.
Mitigation measure: Provide in design for proper markers and safety signs on roads, including lights. Instruct the drivers

355. Impact: Infrastructure. The main infrastructure elements that could be affected are the power transmission lines, water supply systems and irrigation pipes and channels.
Mitigation measure: Replace the affected infrastructure elements. Permanent monitoring during construction. Full reinstatement in case of damage.

356. Impact: Potential conflicts with local population due to impacts on water supply or power resources, other infrastructure, access to land or facilities, disturbance caused by noise, conflicts with workers etc.
Mitigation measure: Construction contractor should assign liaison officer and develop liaison plan. All conflict matters should be resolved through negotiation and sound compromise.

5.3.1.2 Transportation Related Impacts

357. Transportation of construction materials, especially pre-fabricated concretes and steels, through the narrow and busy roads surrounding the town on the right bank could have significant environmental impacts and traffic safety issues on the local community, as well as impacts on residential buildings, historical monuments and tourists. Although quarries and borrow pits could be outside the area and pre-identified to the existing licensed suppliers, transportation to the project site should be carefully considered.

358. Heavy trucks are needed to deliver required amount of inert materials to the needed sites within the construction corridor. Different types of impacts are anticipated in that regard:

- Impacts on historical part of the Mtskheta city and UNESCO protected sites
- Noise & Vibration Impacts
- Traffic congestion (nuisance)
- Air pollution (dust; emissions)
- Mud on roads
- Refueling, maintenance and vehicle cleaning and related risks of soil and water contamination

359. The mentioned impacts (except the impacts on historical part of the Mtskheta city) **are temporary, insignificant and manageable**. The impact is estimated as **medium grade.** Long-term impact on local traffic should be beneficial. As we have mentioned earlier, the main transportation roads convenient for transportation of construction materials (see fig. 3.1) do not

cross historical part of Mtskheta. Actually, these roads do not cross “old Mtskheta City” at all, but only new districts, developed near the railway station and suburb areas. Therefore, the transportation related impact risks are not high, however they should be properly managed.

Mitigation

360. The mitigation measure, in this case is limited to strict instruction to use for delivery of construction materials and removal of wastes only those transportation routes, which do not cross the historical part of Mtskheta, and to prohibit any construction related transportations through the historical part of Mtskheta city. Enforcement of these instructions should be strictly monitored.

361. Mitigation measures against noise, emissions and dust are provided in p. 5.1.2; 5.1.3; 5.1.5; and 5.1.6. Further we focus on traffic safety issues. Road vehicles shall have small turning radius, equipped with sound signals and light signals which should be in good operating conditions. Parking place shall be fenced with barriers and equipped with red signals of emergency stop during the day and with red signal floodlight at night.

362. Roadmen shall be provided with special uniforms and special footwear. It is required to observe overall safety measures such as fencing of work site, various safety activities. The Contractor should ensure special shelter for protecting workers from unfavorable weather conditions.

363. Alternate access will be provided for vehicles and pedestrians. Appropriate lighting and signs will be employed.

5.3.1.3 Health and Safety Impacts and Mitigation

364. Community Safety and Work Site Safety should be ensured in accordance with the Georgian regulations and international good practices.

365. Community safety issues are mostly connected to material transportation issues, which were addressed in p. 5.3.1.2. Some other impacts are also discussed in 5.3.1.1.

366. The project site is located at a distance from the residential or tourist area. Thus there are not expected impacts, like limitation or obstruction of access routes, risks of falling in excavated pits and trenches etc. However, the trenches and pits should be marked by tape and barriers could be installed where possible. This is considered as a protective measure for community representatives, as well as for workers.

367. It is required to observe safety measures, industrial sanitation and fire precaution measures and instructions whilst performing the works, as well as to train the staff.

368. In terms of occupational health and work-site safety, the Contractor is required to instruct the staff on safety measures prior to the commencement of works. Rules of working in confined spaces, height, traffic management, used of personal protective equipment, protection against severe weather conditions etc. should be implemented and monitored.

369. The Contractor is responsible to perform the works in accordance with labor protection and safety requirements as well as industrial sanitation requirements.

5.3.1.4 Protection of the Infrastructural Elements

370. During the mobilization and preconstruction stage required activities are planned to remove the existing cables, communication lines, water supply pipelines and local gas pipelines to the safe sites. All of these infrastructural systems should be uninterruptedly functional during and after completion of construction activities. Permanent monitoring is required to avoid

damage of the infrastructure systems, which are not removed. All the damaged systems should be reinstated.

371. Relocation, replacement and rerouting of all utilities located on the Project:

- optical fibre cable 750 m;
- pipe d-1200 mm – 600 m;
- pipe d-500 mm – 950 m.

372. The owners of underground pipes and cables confined within the construction site shall be given corresponding notification concerning the commencement of works in order to avoid any damage to their property.

373. Relocation of power lines, water-supply lines and pipelines shall be done by specialized organizations. Works shall be performed so that to prevent traffic disturbance. The construction site shall be supplied with the following: installation of indicating, warning and guiding road signs at both ends of the road section, installation of guide posts each 20 m along the road section in order to mark the construction site. Works shall be temporarily stopped on the road section provided that traffic safety procedures haven't been ensured and shall not be resumed until traffic safety is ensured on one lane of the road.

5.3.1.5 Operation Phase Impacts

374. Prevention and mitigation of accident risks associated with vehicular traffic and transport, that may result in spills of toxic materials injuries or loss of life Emergency preparedness. The Ministry of Interior (Department for Managing Emergency Situations) should facilitate development of legislation and emergency response plans regulating transportation of hazardous materials. The system of measures may include but not limited to:

- Design and implement safety measures and an emergency plan to contain damages from accidental spills.
- Designate special routes for hazardous materials transport.
- Regulation of transport of toxic materials to minimize danger.
- Prohibition of toxic waste transport through ecologically sensitive areas.

5.3.2 Current Economic Activities on the River, Land Use and Resettlement Impacts

Impact

375. Current economic activities on the r. Aragvi and Mtkvari are limited to construction and operation of Hydropower stations and to quarrying within the river floodplain. r. Mtkvari is not used for commercial fishing, transportation or other economic activities. The closest HPP (Zahesi) is 3km downstream and is not affected by the project. The closest quarry is located at the territory adjacent to the project site and further within 400 – 1300m distance from the bridge site. Generally, the quarrying operations are prohibited within 200m radius from bridges to avoid increased scouring. However, in this particular case quarrying operations are welcomed, as the bridge site constitutes sediment accumulation zone and quarrying will allow avoiding overloading of bridge site by silt and alluvium sediments. **The project has no impact on any economic activity related to the river Aragvi or Mtkvari**.

376. The bridge infrastructure will occupy 15 land plots with total area of 22,269 sq.m Out of this amount 8 land plots are State owned. Total area of affected State land is 15020 sq.m.

377. 7 out of 15 affected land plots (total area of 7,249sqm) are private. All affected private land plots are titled and officially registered in NAPR. These registered private land plots are attributed to v. Tsitsamuri, Mtskheta Rayon (District), Mtskheta-Mtianeti Region of Georgia.

Land Categories by Tenure	No of Affected Plots	Area (sq.m)	No of AH*
Type 1. Private registered land	7	7,249	7
Type 2. Private legalizable land	0	0	0
Subtotal Private Land	7	7,249	7
Type 3. Non-used Public land	8	15,020	8
Total	**15**	22,269	15

378. All the affected private land plots are attributed to the not used agricultural land category. The survey team has not found evidence of any agricultural activity at the site. The plots are not fenced, no residue of maize plantation after harvesting (clearly visible at the cultivated plots) has been observed. The character of grass and bush cover (see fig. 5.1 and 5.2) confirms that the land has not been cultivated for long time. The municipal authorities also confirm that no crops are cultivated on the affected land plots and accordingly no harvest lost is entailed by the project.

Fig.5.1

Fig. 5.2

379. No businesses interruption and/or income losses are associated with the project implementation. The cadastral map with marked State and private land affected by the project is given on fig. 5.3.

380. Land area affected and relative AH by category are detailed below in Table 5.4.

Table 5.4. Categories of Affected Lands for Acquisition

Land Categories by Tenure	No of Affected Plots	Area (sq.m)	No of AH
Type 1. Not used agricultural private land	7	7,249	7
Type 2. Private non-agricultural	0	0	0
Subtotal Private Land	7	7,249	7
Type 3. Non-used Public land	8	15,020	8
Total	**15**	22,269	15

Fig. 5.3 Land Acquisition Layout Superimposed on Cadastral Map

Mitigation

599. The affected households will be paid compensation with rate 36 GEL per 1 sqm. This proposed price has been derived by the independent valuators as fair market price for land compensation. The price was derived based on existing data on actual transactions and trade negotiations related to similar land plots in the same region, close to the project area.

5.3.3 Cultural Heritage

5.3.3.1 Construction Impacts

Impacts

381. No aboveground monuments are in the vicinity of the construction ground and material supply routes. However, in case if by some unlikely reason the construction contractor will use the roads crossing central part of the Mtskheta city for transportation of materials, the vibration impacts on monuments could be significant. The impact is estimated as **medium grade.**

382. Taking into account the historical significance of the area, it should be acknowledged that the land clearance works, grading and excavations are associated with the risks of damaging underground archaeological remnants. The impact is estimated as **medium grade.**

383. The border of the historical part of the City is located East – North from the construction ground at the right bank of r. Aragvi (at a distance of 50m from the end of the bridge). UNESCO heritage site is located at a distance of 500m. Civil works at the construction site will not have any impact on the historical part of the city and tourist sites. However, the transportation of construction materials theoretically may have impact on historical monuments, as well on tourists. It should be stressed, that the main transportation roads convenient for transportation of construction materials (see fig. 3.1) do not cross historical part of Mtskheta.

Mitigation

384. Thus the mitigation measure, in this case is limited to strict instruction to use only these transportation routes for delivery of construction materials and removal of wastes and to prohibit any construction related transportations through Mtskheta city.

385. The design of the bridge takes into account the impacts on scenery and landscape of the site, given the fact that the bridge will be located visibly between the two famous churches. During the informal[1] consultation with the representatives of the Cultural Heritage Protection Agency, the design has been considered as acceptable. Within the construction permitting process the Ministry of the Culture and Monument Protection will provide archaeological clearance and positive conclusion regarding the project. Presented architectural design is considered as aesthetically acceptable and do not impose any negative perceptional impacts (see fig. 3.3).

386. Despite the fact that the construction sites are not located near any known subterranean monuments, destruction of archeological layers during the construction process is probable. To avoid this risk, 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.

387. At the construction stage archaeological monitoring ("Chance Finds Procedure") 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.

Chance Finds Procedure:

388. Construction Contractor engages 1 especially dedicated archaeologist (archaeological supervisor) for conducting daily supervision activities during the earthwork operations. Good practice is to agree the candidature of person assigned for that task with the Ministry of Culture and Monument Protection.

389. The Ministry of Culture and Monument Protection may also assign a person or company for periodical supervision of construction works, although this is practiced only in exclusive cases of sensitive projects.

390. Archaeological supervisor conducts daily monitoring at all construction sites, where the earthworks (land clearance; grading; excavations etc.) are planned according to the schedule.

[1] No requirement for any formal approval from CHPA exists, according to Georgian regulations.

391. Besides that, archaeological supervisor instructs the workers to report him immediately in case of any chance finding of potential archaeological relics.

392. In case of finding any artifacts of potential archaeological value, following steps are taken:

1. Construction workers are obliged to stop works and immediately report to the Archaeological Supervisor.

2. Archaeological supervisor reports to the Chief Engineer at site and requests to stop activities at the site of finding. Archaeological supervisor executes first checking of the finding and the site where finding was made

3. In case the finding has no potential archaeological value, the Archaeological Supervisor reports to the Chief Engineer and the works are restarted. Appropriate record regarding the case is made in record book.

4. In case if the finding is estimated as potential archaeological relic, the Archaeological Supervisor reports to Chief Engineer of the Construction Contractor and to MDF Environmental Specialist (and supervising company / Engineer) requesting to stop construction activities and to inform the Ministry of Culture and Monument Protection about the incident.

5. Chief Engineer of the Construction Contractor also reports to MDF informing about the stopped operations and requesting immediate engagement of the Ministry of Culture and Monument Protection.

6. Ministry of Culture and Monument Protection will assign expert or group of experts and conduct necessary archaeological works at the site to identify the problem.

7. In simpler cases, after removal of the movable artifacts, fixing materials and conducting other required works, the experts of the Ministry of Culture and Monument Protection will issue decision on recommencement of stopped construction works.

8. In exclusive cases of valuable and spatially spread findings, the Ministry of Culture and Monument Protection may issue request to relocate the RoW shifting it on a safe distance from the archaeological site.

5.3.3.2 Operation Phase Impacts

393. Operation of bridge will not cause direct impacts on the archaeological sites and aboveground monuments. The bridge and adjacent road infrastructure is located aside from the historical part of Mtskheta. Indirect impact due to increased tourist flows also are not relevant, as the bridge does not affected the amount of visitors, but only safety and convenience of their transportation.

5.4 WASTE MANAGEMENT

394. The waste generation and management is discussed in separate paragraph in more details, as the waste related pollution has impact on physical, biological and social environment and constitutes important aspect of the project management.

5.4.1 Construction Related Wastes

395. Improper handling, storage, use and disposal of construction materials and wastes could pose a risk of water/ soil contamination at the construction site and storage site. Improper

maintenance and fuelling of equipment could also lead to the potential contamination of soil/ water.

396. Usually, the major waste generation during construction activities is related to generation of spoil (excess soil and rocks) in cuts and inert materials resulting from the demolition of existing structures.

397. Part of spoil material generated in cuts will be used for filling embankments. However, substantial amounts of material will require disposal. Balance of fill and cut is given below:

- Volume of fill - 47320 m^3;
- Volume of cut – 99740 m^3.

About 50000 m^3 of spoil needs to be disposed.

398. Various wastes will be produced throughout the construction process. The main waste producing areas are: construction sites and construction camps. In this particular case the camp will be adjacent to the construction ground. Small amounts of waste are expected along the access and heavy equipment movement routes with ground and soil pollution.

Waste Classification

399. During the construction of the bypass the following types of waste will be produced:

1. Household;
2. Hazardous industrial;
3. Non-hazardous industrial;
4. Inert.

Household Waste

Both hazardous and non-hazardous household waste will be produced:

- Food waste (non-hazardous);
- Office waste (non-hazardous);
- Empty glass or plastic bottles (non-hazardous);
- Sewage (hazardous);
- Sweeping waste (proceeding from the object specifics, could be hazardous or non-hazardous);
- Bulb waste (hazardous);
- Medicinal waste (hazardous).

Non-Hazardous Industrial Waste

- Packaging (wood, paper, carton, plastic);
- Expired or unusable metal parts;
- Damaged or expired tools;
- Personal safety means and clothes.

Hazardous Industrial Waste

- Polluted soil;
- Polluted rags and oil absorbing fabric;
- Polluted water;
- Polluted industrial equipment in disrepair;
- Paint vessels and brushes;
- Lubricant vessels;
- Empty vessels of packaging;
- Polluted personal safety equipment and clothing.

Inert Waste

- Natural materials (ground and stone-gravel, broken rock) – not expected to be significant in amount;

- metal remains like steel/ferro-concrete reinforcement
- Wood (cut trees and shrubs in small amount).

400. The total amount of the Inert Construction Waste to be disposed of is estimated as 50,000 cubic meters.

Table 5.5. Anticipated Waste Generation

Type of waste	Waste class	Quantity
Household waste	**Non-hazardous**	**80-100 m³ annually**
Office waste -(sweeping waste, glass and plastic bottles, stationary waste, etc)	**Non-hazardous**	**10-15 m³ annually**
Sewage	**Hazardous**	**1500 m³ annually**
Bulbs in disrepair	**Hazardous**	**50-70 units**
Printer cartridges	**Hazardous**	**2-3 units annually**
Medicial waste	**Hazardous**	**0.1kg annually**
Damaged or expired tools	**Non-hazardous**	**1-2m³ annually**
Personal protection equipment and clothing	**Non-hazardous**	**1 m³**
Oil contaminated rags and absorbent materials	**Hazardous**	**Depends on intensity of the leakage** 1 m³ annually
Cut wood and shrubs	**Non-hazardous**	In total - not more than 10 m³

Hazardous Construction Wastes

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

- paints used for painting metal elements of bridge (guardrails etc.)
- bitumen
- liquid fuels;
- lubricants, hydraulic oils;
- chemicals, such as anti-freeze;
- contaminated soil;
- spillage control materials used to absorb oil and chemical spillages;
- machine/engine filter cartridges;
- oily rags, spent filters, contaminated soil, etc)

5.4.2 Construction Waste Management

Inert construction waste handling

402. Generally, it is recognized that the best option has always been the avoidance of waste generation resulting in minimizing the quantities and hazard. Then it is recognized that it is better to reuse, restore and recycle the waste rather than to process it, and the placement is the last resort.

403. The stripped topsoil layer must be stored on the pre-selected sites as maximum 2-meter-high embankments. Main part of top-soil could be used for covering embankment slopes enabling its revegetation.

404. The total amount of the Inert Construction Waste (rocks, spoil, remnants of demolished structures) generated during the planned construction activities could be quantified based on the earth works balance. A great part of the accumulated inert remains can be used in construction of embankments and revetment. About 50,000 m^3 of spoil needs to be disposed.

405. Coarse inert waste, as well as remains of fine materials (excessive soil, rocks etc.) can be used for the ongoing local municipality project, aimed to drain, dry up and cover the bogged site located on the territories adjacent to the project site, and to reinforce the banks of the river Aragvi at the same place (see fig. 3.2). The spoil will not be just stockpiled, but will be used as a filling material to prepare ground for planned development and related constructions. This periodically flooded patch of ground at the right bank of the bridge, which had developed as a result of construction of dam downstream and insufficiency of river-bank protection revetment, cannot be considered as natural habitat. This is a zone of disruption of traditional suburban landscape due to flooding problems. The reconstruction of the bogged area – filling with inert materials with further planned landscaping and development of tourism infrastructure is ongoing. Filling materials are transported from the remote borrow pits. Recently – police office construction has commenced at certain subsection of this area. The proposed site is located in immediate vicinity, adjacent to the West side of construction ground, while the border of the historical part of the City is located East – North from the construction ground (at a distance of 300m from the end of the bridge and 800m from the bogged area). Disposal of spoil (soil and rocks) in this area has following clear environmental benefits:

- Reduction of volumes of filling materials to be transported from remote borrow pits and quarries to cover the flooded area.
- Reduction of volumes of inert construction waste to be transported from construction ground to the landfills
- Avoidance of transportation of the spoil materials within the UNESCO heritage site, as well as buffer zone (“historical Mtskheta”).

406. The spoil will not be just stockpiled, but will be used as a filling material, being leveled and graded. (In principle, using the spoil for filling project related embankements is the same approach as using spoil as filling material for another project in the area). After leveling there are two options: a) theoretically this part of land could be covered by the topsoil stripped within the RoW. However, this option could be applicable only in case of some delay in development plans of the Municipality. In reality, the leveled ground will be paved and used for construction of tourism infrastructure.

407. In addition to that Ksani Landfill, located at the distance of 9km will be used for disposing the excessive amounts of the spoil material, which can not be used as filling material within the proposed development area, adjacent to the project site. This excessive spoil could be used as a filling and covering material on the Ksani Landfill (see fig. 3.7).

408. There are several specialized organizations dealing with the metal wastes. The metal waste operators identified at this staged and proposed for consideration are:

- Progrifi Ltd; 141 A.Tsereteli ave. Tbilisi; Zip code 0154
  Temi Ltd; 63 Kostava str. Tbilisi;Zip code 0179
- EXICOM; Ltd Ltd; 12 Dolidze str. Tbilisi; Zip code 0171
- EXICOM Ltd ; 12 Dolidze str. Tbilisi; Zip code 0171
- Baraconi Ltd; 141 A.Tsereteli ave. Tbilisi; Zip code 0119
- Ardur Ltd; Orkhevi, 15 Akhvlediani str. Zip code 0103

409. All other nonhazardous waste (garbage, litter etc.) from the construction sites and camps will be disposed on municipal landfills in cooperation with the official municipal waste operators. For that purpose, Mtskheta Communal Services Ltd will be contracted, who is licensed waste operator specialized on disposing municipal solid wastes Cost of services is 200 GEL per months. Small amount of hazardous waste (polluted rags and oil absorbing fabric; contaminated soil, Lubricant vessels; Bulb waste etc.) will be temporarily stored in camps and disposed off with the involvement of licensed hazardous waste operators (e.g. Sanitary Ltd; Mtskheta

Communal Services Ltd). Most part of these (nonhazardous and hazardous) wastes are generated or collected at the Equipment Yard site. The Waste Management Procedures for Camps is elaborated as separate document and is provided in the annex 7.

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

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

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

Hazardous Construction Wastes

412. According to local legislation (Order #36/N of the Minister of Labour, Health and Social Protection of 24.02.2003) small amounts of listed types of hazardous wastes could be disposed on municipal landfills. Disposal of the most part of hazardous wastes should be agreed with the MoE and local authorities. Constructing Contractor shall collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at the temporary storage sites and further at the locations approved by MoE or pass it to the licensed operator (e.g. Sanitari Ltd), having environmental permit on operation of the hazardous wastes. Residual fuel and lubricants could be also given for disposal to Mtskheta Communal Services Ltd, who is licensed waste operator specialized on disposing municipal solid wastes and fuel/oil residues.

Garbage and Litter

413. Garbage and litter generated in equipment yards and worksites will be temporarily stored in a bins located at the site and then passed to the licensed operator for disposal. Mtskheta Communal Services Ltd is licensed waste operator specialized on disposing municipal solid waste. The municipal landfill is located near the v. Dzegvi at d distance of 7km from Mtskheta.

5.5 QUARRIES AND BORROW PITS

5.5.1 Construction Related Impacts at the Quarrying Sites

414. As it could be seen from the earthwaorks balance, embankment construction (47,320 m^3 of fill) will mainly utilize materials from road cut (99,740 $m^{3)}$. Materials supply from the quarries is related to the pavement construction needs.

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

416. The dust and emission impacts should be taken into account during planning mitigation measures, as well as potential river contamination due to improper fueling and vehicle operations. These additional potential impacts should be subject for the management plan.

5.5.2 Mitigation of Impacts Related to Quarrying Sites and Borrow Pit Operations

417. Embankment construction (47,320 m^3 of fill) will mainly utilize materials from road cut (99,740 $m^{3)}$. Materials supply from the quarries is related to the pavement construction needs.

418. Generally quarry sites are the major sources of environmental impact due to dust and noise pollution, loss of biodiversity, and generation of spills. Operation of the quarries above the approved limits may cause change of floodplain hydrology and trigger erosion and landscape degradation. The operating procedure for borrow pits shall consider following principles: (i) maximize the amount of fill that can be effectively used from the pit, (ii) minimize erosion and sedimentation, (iii) preserve the water quality of the rivers, (iv) protect air quality during excavation, (v) prevent wildlife from falling into the pit, and (vi) reinstatement of the site after construction. Only approved borrow and quarry sites will be used by the contractors and produce copy of necessary government licenses to the client before procurement.

419. The mitigation plan to be followed by the Contractor at the borrow sites is: (i) only borrow areas approved by the environmental authority will be used for the project; (ii) pits management, (including restoration if it will follow the completion of certain works) shall be in full compliance with all applicable environmental standards and specifications; (iii) the excavation and restoration of borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the MoE and RD; (iv) borrow pit areas will be graded to ensure drainage and visual uniformity or to create permanent tanks/dams. Additional borrow pits, if necessary, will not be opened without the restoration of those areas no longer in use, and without the approval of MoE. Topsoil from the opening of borrow pits will be saved and reused to revegetate the pits to the satisfaction of the MoE.

420. General environmental requirements for selecting material suppliers (existence of licenses; closeness to the project site; Transportation routes crossing minimum of residential areas;) General principles recommended for borrow pit and quarruies management:

- Do not use borrow excavation until all suitable roadway excavation is used. Use select borrow and select topping as shown on the plans.
- Develop and restore Government located and provided borrow sources as approved by the Engineer.
- Do not excavate beyond the established limits.
- The borrow pit shall be landscaped after the excavation.

421. After the closure of the borrow pits, reinstatement and landscaping plan should be implemented by Construction Contractor.

422. Local roads will be damaged during transportation of borrow materials and by the construction equipment. In order to reduce impact on all borrow sites and local roads, contractors will water the local roads close to the settlements used by the borrow trucks and rehabilitate the local roads to their original conditions.

423. The measures aimed on mitigation of the dust and emission impacts, as well as potential river contamination due to improper fueling and vehicle operation, should be the same as above described pollution prevention measures, but control on this sensitive site should be more strict. Road Department and Constructing Contractor's environmental personnel should pay more attention to the quarrying site during monitoring.

424. The MoE and Environmental Inspectorate are in charge to control compliance of the quarrying company's performance. The Road Department will control the licenses of Construction Contractors in case they are exploring some quarries and borrow pits.

5.6 CAMPS AND EQUIPMENT YARDS

5.6.1 Anticipated Impacts at the Construction Camp Site

425. The potential impacts related to the construction and operation of the camp could be summarized as follows:

- Potential damage of topsoil

- Contamination related to fuel storage and fuelling operations
- Waste and wastewater management

5.6.2 Mitigation of Impacts Related to Construction Camps

426. One construction camp to serve approximately 40 workers will be required for the project. In fact, this is supposed to be the equipment yards with 2 or 3 trailers but not complete construction camps. The accommodation for the workers will be provided in the nearest villages. The workers will not live in the trailers, which are supposed to be used as office, storage site and building for the guard personnel. The yard will be used for storage of equipment and machinery, fueling, simple maintenance works. The exact location will be selected by the constructing contractor. The location should be selected to comply with the following criteria:

- transformed urban or rural landscape not sensitive from ecological standpoint
- the fueling facilities could be located at a distance of 50m and more from the surface water objects
- the camps should not be located closer than 350m to the residential settlements. The distance should be sufficient for reducing the noise impact to acceptable level and not too large, so far as it is supposed that the accommodation and sanitary-hygienic facilities are available for the workers in the villages.

Using these criteria, the IEE team has proposed two locations for the equipment yrads: 1 larger yard on the left side of the r. and the smaller one on the right bank (see fig. 3.2)

Waste Management Plan for Construction Camp is given in annex 2. Here below we provide brief summary.

427. The following categories of waste are expected during object exploitation:

- Household waste;
- Office waste (paper, cartridges, bulbs, etc.);
- Packaging (wood, paper, etc.);
- Oil contaminated clothes, filters, absorption pillows;
- Oil contaminated soil;
- Polymer waste;
- Medical waste.

428. The amount of household waste produced during plant functioning is connected with the staff number. According to the preliminary data, up to 40 people shall be employed. Following the accepted norm, 0.70 m^3 of household waste is produced per employee annually. Proceeding from the above, the amount of household waste per year will be: 0.70 X 40 = 28 m^3. The installation of closed containers is planned for household waste at the object. The removal of this waste and disposal at the grounds will be conducted on the basis of the contract with the municipal cleaning service.

429. Oil contaminated mass as well as other hazardous waste shall be temporarily allocated within the plant in accordance with environmental and hygienic requirements and proceeding from the collection passed to the organization with appropriate environmental impact permit for further processing/disposal/treatment.

430. Wooden packaging material shall be passed to the local population for further re-use.

431. The management of waste produced at the object (classification, inventory, segregation, collection, storage, passing and transportation) and monitoring shall be conducted in accordance with the principles, procedures and rules described in Annex 2.

5.7. ASPHALT PLANT OPERATIONS

432. Asphalt will be provided to constructing contractor by the suppliers and, therefore, the asphalt plant related impacts are not direct impact of the project. Only licensed suppliers with all

required environmental permits will be used for the project needs. The amount of asphalt needed for the bridge construction is not that high to have any tangible input in regional or country wide emissions.

433. 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 IEE should be prepared and environmental Impact Permit should be obtained for installation and operation of the plant. However, installation of the own asphalt plant is extremely unlikely decision for such small scale project. The Contractor can use materials provided from the nearest suppliers: e.g. Asphalt plants located in Dzegvi (Tsekuri Ltd; GZA-2003) and in Zahesi (see fig. 3.7). Criteria for selecting suppliers: a) existence of licenses and permits; b) closeness to the project site; c) transportation routes with minimal crossing of the residential areas.

5.8 SUMMARY ANTICIPATED IMPACTS BY PROJECT ACTIVITIES

434. This paragraph provides brief description of anticipated site-specific impacts related to the design, construction and operation phases of Construction of the r.Aragvi bridge in Mtskheta.

Environmental Impacts – Design and Pre-construction Phase

#	I. Design Related Impacts	Yes/No	Comments
1	Alignment alternatives and potential impacts: ▪ geohazards prone sites; ▪ sensitive ecosystems ▪ archaeology ▪ landuse	Yes	Site selection and design solutions determining "project footprint" is important factor for impact minimization.
2	Siting alternatives for borrow pits, waste disposal sites, asphalt mixing sites, workers camps, fueling and storage places and equipment yards	Yes	Dust/air pollution, water pollution, landscape degradation impacts will depend on proper siting at the detailed engineering stage or at the mobilization stage (planning conducted by the constructing contractor)
3	Soil Erosion – Design of temporary and permanent drainage systems, retaining walls, berms and embankments, design of anti-erosion engineering measures and reinstatement plan	Yes	Proper design is important for minimizing erosion of the river bank terrace slopes and secondary impacts: landscape degradation and increased sedimentation of watercourses, slow destruction of the highway pavement
4	Planning and design of interchanges and interception sites	Yes	Interference on local transportation and access; Safety of traffic;
5	Compliance with international design standards	Yes	Safety; efficiency of operations and maintenance
6	Noise and traffic emission nuisance	Yes	Noise and emissions related to traffic are tangible only in densely populated areas where the residential houses are located close to the road. Therefore, this is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
7	Damage of infrastructure elements.	Yes	Within the limits the right-of-way - the road crosses • optical fibre cable 750 m; • pipe d-1200 mm – 600 m; • pipe d-500 mm – 950 m.

Environmental Impacts - Construction Phase

#	II. Construction Phase. Potential Impacts During Rehabilitation Works	Severity	Sites
1	Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) in the right-of-way occupied by the highway.	Minor	Whole layout of bridge and interchane infrastructure; Landscapes of low environmental sensitivity; Connects highway on the left side of r.r Aragvi with the parking area and other construction grounds located on the right side of the river. The interchange infrastructure goes in close vicinity to the TNP borders. No additional impact on TNP is envisaged, although detailed analysis of the final layout is needed at the DD stage to be sure that borders of the TNP are not affected..
2	Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) on the access roads, in the borrow pit sites, waste dumps, construction camps and equipment yards.	Medium	Borrow pit sites and quarries (r.Aragvia nd Mtkvari floodplain). The impact of the project is minimal, as the quarries are already operated by licensed companies without regard to the project. Waste dumps, construction camps and equipment yards finally will be defined at the preconstruction stage by the constructing contractor. Sites described in IIEE are only proposed as potential locations.
3	Landslides, slumps, slips and other mass movements in road cuts triggered by the construction activities.	Very minor	No landslide or mudflow gullies at the project site. River bank erosion is the only problem, that should be taken into account during the design and construction. Stimulation of erosion at the right terrace of the river bank (upper reaches) and left bank (lower reaches) is the issue to be considered.
4	Erosion stimulated from fresh road cuts and fills and temporary sedimentation of natural drainage ways. Erosion of lands below the road bed receiving concentrated outflow from covered or open drains.	Minor	Stimulation of the river bank left terrace erosion is the issue to be considered.
5	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	Minor	Stimulation of the river bank left terrace erosion and related increas of sedimentation is the issue to be considered
6	Impact of construction activities on aquatic ecosystems of the rivers and streams crossed by the bridge	From Minor to Medium	**River Aragvi and Mtkvari**
7	Soil and water contamination during construction by oil, grease, fuel and paint in the RoW, access roads, construction camps and equipment yards and asphalt mixing sites.	Minor	**Contamination risks for the surface: River Aragvi and Mtkvari** **Soil contamination:** On the both sided of the r.Aragvi, within the bridge "footprint", camp sites, quarries Of the bridge

8	Poor sanitation and solid waste disposal in construction camps and work sites (sewerage, sanitation, waste management)	Medium	Camps will not provide accommodation for the workers. They will live in nearest villages. Sites -to be defined at preconstruction stage by the constructing contractor
9	Construction wastes and spoil – Roadside litter and garbage	Medium	Spoil generated at cut sites;
10	Dust and exhaust vehicle/equipment emissions from operations during construction	Medium	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
11	Air pollution from asphalt plants.	Medium	Supplier site
12	Noise pollution from vehicle operation during construction	Medium	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
13	Health hazards by noise, air emissions and dust raised and blown by vehicles during construction activities.	Medium	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
14	Impacts on Archaeological Sites **Impacts on historical part of the Mtskheta city and UNESCO protected sites**	Medium to high	The whole project footprint **Access roads for the construction material transportation**
15	Hazardous driving conditions where construction interferes with pre- existing roads.	Minor	Sites of connection with the highway
16	Impact on existing infrastructure Within the limits the right-of-way - the road crosses • optical fibre cable 750 m; • pipe d-1200 mm – 600 m; • pipe d-500 mm – 950 m.	medium or high	The Detailed Design includes relocation of the mentioned structures.
17	Accident risks associated with vehicular traffic and transport, that may result in spills of toxic materials, detonation of explosive load, injuries or loss of life	Minor	Sites of connection with the highway

Character of Main of the Anticipated Impacts - Construction Stage

Activity	Impact	Character of impact							
		Direct	Indirect	Positive	Negative	Reversible	Irreversible	Temporary	Residual
Land clearance and grading in the RoW	Destruction of natural landscape, habitats, erosion	+			+		+		+
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	

Construction of the new carriageway; pavement	Destruction of natural landscape, habitats, erosion								
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Exploration of borrow pits	Destruction of natural landscape, habitats, erosion	+			**+**		**+**		**+**
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution	+			+	+		+	
Transportation of sand, gravel, stones from borrow pits. Material supply.	Destruction of natural landscape, habitats, erosion								
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Demolition of part of existing pavement during rehabilitation of the existing carriageway	Destruction of natural landscape, habitats, erosion								
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Disposal of spoil and wastes	Destruction of natural landscape, habitats, erosion	+			**+**	**+**		**+**	
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	

Environmental Impacts - Operation Phase

#	III. Operations Phase (Impact of Physical Installations; Traffic and Emergencies)	Yes/No Severity	Sites
20	Long-term degradation of natural landscape (relief, soil cover, vegetation, habitats) in the certain part of the right-of-way (land strips adjacent to the highway – affected by construction activities).	Very Minor	No sensitive landscapes, habitats and ecosystems affected;
23	Erosion from road cuts and fills and temporary sedimentation of natural drainage ways. Erosion of lands below the road bed receiving concentrated outflow from covered or open drains.	Minor	Left bank of the r.Aragvi
25	Changes of hydrological patterns of the rivers and streams crossed by the highways induced by installation of bridges, revetments, river-bank protection installations and other hydro technical installations and related impacts on infrastructure, arable lands and ecosystems located on adjacent territories	Minor	The project will not have additional impact on river bank erosion. Monitoring and riverbank protection measures are required.
26	Alteration of overland drainage and subsoil drainage patterns (where road cuts water tables, etc.)	Very Minor	Left bank of the r.Aragvi
27	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	Very Minor	Left bank of the r.Aragvi
28	Soil and water contamination by oil, grease, fuel and paint alongside the highway	Minor	Bridge area
31	Dust and air pollution from vehicle traffic	Minor	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
32	Noise pollution from vehicle operation, in populated areas traversed by the highway, notably metropolitan areas or densely settled rural areas.	Minor	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
33	Roadside litter.	Minor	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
36	Health hazards by dust raised and blown by vehicles.	Minor	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.
37	Dislocation and compulsory resettlement of people living on the right of way	Minor	No physical relocation or loss of crops and assets attached to the land. Loss of 14 agricultural land plots.
#	**Potential Operation Phase Emergency Related Impacts**	**Yes/No** **Severity**	
42	Accident risks associated with vehicular traffic and transport, that may result in spills of toxic materials injuries or loss of life(see 'Hazardous Materials Management' section), injuries or loss of life (see 'Public Health and Safety section)	Very Minor	This is more relevant to the project site located on right bank of r. Aragvi - close to residential houses.

Character of Main of the Anticipated Impacts - Operation Stage

Activity/Factor	Impact	Character of impact							
		Direct	Indirect	Positive	Negative	Reversible	Irreversible	Temporary	Residual or long-term
Physical existence of linear installation	Destruction of natural landscape, habitats, erosion	+					+		+
	Emissions								
	Noise, vibration								
	Ground pollution and/or waste generation								
	Ground and surface water pollution								
Traffic	Destruction of natural landscape, habitats, erosion								
	Emissions	+			+				+
	Noise, vibration	+			+				+
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Maintenance works	Destruction of natural landscape, habitats, erosion								
	Emissions	+			+				+
	Noise, vibration	+			+				+
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Accidents	Destruction of natural landscape, habitats, erosion		+		+	+		+	
	Emissions		+		+	+		+	
	Noise, vibration								
	Ground pollution and/or waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	

6. ANALYSIS OF ALTERNATIVES

6.1 No Project Alternative

435. Caurrently, Mtskheta is linked to Tbilisi and the motorway by means of secondary road Zahesi-Mtskheta-Kavtiskhevi-Gori, Zahesi-Mtskheta road section, Narekvavi-Mtskheta-Railway Station road.

436. Zahesi-Mtskheta section of the secondary road Zahesi-Mtskheta-Kavtiskhevi-Gori is located on the right bank of the river Mtkvari. Width of road bed ranges within 7.0 m - 9.0 m. Width of shoulders is 0.5m - 1.5 m. The road is characterized by frequent sharp bends in plan and small radii. The road doesn't meet safety requirements, there are frequent accidents on the road ending in death toll, also resulting in economic losses.

437. The road Narekvavi-Mtskheta-Railway Station starts at km 5 of the road Zahesi-Mtskheta-Kavtiskhevi-Gori. The road crosses the river Mtkvari by steel reinforced concrete bridge and afterwards total section is located within the limits of Mtskheta. The bridge doesn't meet requirements as regards increased traffic flow and modern loads.

438. No-project variant means the conservation of the defficient situation and insufficient road/bridge capacity and low traffic safety will be maintained what will accordingly hamper the development of Mtskheta as a tourist destination. Construction of the new bridge will improve travel safety, will increase capacity of the roads to Mtskheta and shorten the travel distance. The need of the new bridge and its feasibility have been clearly demonstrated within the feasibility study.

439. On the other hand, construction of the bridge across the r. Aragvi is not large scale project and the area is not of that much environmentally sensitive to expect some extraordinary impacts. This is typical B category project. Thus, there is no reason for supporting "No-project" alternative.

6.2 Alternatives of the Bridge location and Layout

440. The FS was developed based on the study and evaluation of topographic maps and data available. Direction of the route and location of the bridge was selected based on the existing data on the project area (topographic maps, geological, conditions, climate and land ownership) and field studies, including topographical survey. Two main directions have been evaluated:

a) Alternative 1. Construction of the new bridge to replace existing bridge over the r. Mtkvari (Zahesi-Mtskheta-Kavtiskhevi-Gori road)
b) Alternative 2. Construction of the new bridge over the r. Aragvi, connecting the highway with the currently undeveloped area proposed for developing supporting tourism infrastructure (parkings, cafes etc.)

441. Comparative analysis of environmental and social impacts is given below:

Table 6.1 Comparison of Alternatives

	Alternative 1.	**Alternative 2.**
Crossed river	Mtkvari	Aragvi
Distance from the highway to the final tourist destination and new development area	3km	300m
Construction Impact on Mtskheta residents (traffic safety, disturbance; noise, emission and dust impacts etc.)	Transportation of materials and construction activities are carried out within the Mtskheta center and disturbance of the residents	Construction activities are carried out in subarbs and only several residential houses are under the minor impact.

	is high	
Traffic related disturbance	Increased traffic crosses the central part of the Mtskheta city and disturbance is high	Increased traffic does not affect the central part of the Mtskheta city. The main flow stops at the parking area and disturbance of Mtskheta residents is minimalh
Resettlement impacts	Improvement of the curves and construction of the bridge according to standard requirements will require physical relocation of several residents	No physical relocation is required. The resettlement impacts are minimal: only several unused private land plots are affected.
Impacts on other environmental receptors (flora, fauna, water resources, ambient air, soil, erosion etc.)	From low to medium: similar for both alternatives	From low to medium: similar for both alternatives
Traffic safety	The sharp bend and lack of space makes impossible adherence to international standards and construction of interchange	Design is following international standards and the interchange will ensure uninterrupted traffic conditions for the E-60 highway
Waste	Demolishion of the old bridge will generat significant amount of additional inert wastes, which can not be used as filling materials and should be disposed on remote landfills	No wastes from demolition of existing structures

442. According to the table 6.1 it is clear that the alternative 1 is preferable: in this case the route is shorter and the safe road could be developed without reconstruction of the lengthy sections of the old road from highway till the existing bridge (3km); Demolishion of the old bridge will generat 1500 m^3 of additional inert wastes, which can not be used as filling materials and should be disposed on remote landfills. The resettlement impact and disturbance of the residential area is also lower for the Alternative 2. Alternative 2 appeared to be more feasible from engineering standpoint as well.

443. After determining the location of the bridge, the layout options were analyzed. Three principle alternatives of layout are compared - further, as the layout is the factor that determines the "footprint" of the project and land acquisition requirements.

444. The alternative layouts and related cadastral maps are shown below on fig. 6.1 (alternative 1) and fig. 6.2 (alternative 2). Table summarizing comparison of alternatives from the resettlement impacts standpoint is given below.

445. The footprint on landscape is less for the alternative 3 (22,144 sq.m occupied), as compared with the other alternatives (30,000 or 41,000 sq.m.). This minimizes the visual impacts of the project, as well as impacts on local flora and fauna. However, this is minor difference, and landscape impact, as well as other environmental factors had less influence on selection of the preferred option, as they are mostly similar for all alternatives.

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446. Resettlement factors were more insignificant than environmental, but really important for decision making were engineering and cost-benefit aspects. Comparison of the resettlement impacts is given in table 6.2.

Table 6.2 Resettlement impacts of layout alternatives

Comparison Item	Alternative 1	Alternative 2	Alternative 3
Amount of affected land plots	19	21	15
Total area of affected land	30,113	41,621 sq.m	22,144 sq.m
Amount of Affected State land plots	9	7	8
Total area of affected State land plots	15,629	19,513 sq.m	15020 sq.m
Amount of Affected private land plots	10	14	7
Total area of affected private land plots	14,484 sq.m	22,108 sq.m	7124 sq.m
Affected structures	No	No	No
Affected trees	No	No	No
Affected crops	No	No	No
Affected businesses	No	No	No
Loss of income	No	No	No

447. As it can be seen from the table, the alternative 3 has relatively less resettlement impact. This option appeared to be also the best alternative from the engineering standpoint and was finally selected as the preferable alternative.

6.3. Conclusion

448. At the initial stage, the location for the project bridge was selected in a way to minimize environmental and social impacts. The land is stabile and is not prone to geological hazards. No sensitive ecosystems are presented within the footprint. The project footprint bypasses peripheral part of the TNP, passing in close vicinity with the borders. The number of affected private land is low and the land is not cultivated or otherwise used for income generation. The known historical monuments are not within the frames of the project "footprint".

449. All alignment alternatives, which have been considered, fall within the same zone and the difference was not significant from the environmental or social standpoint.

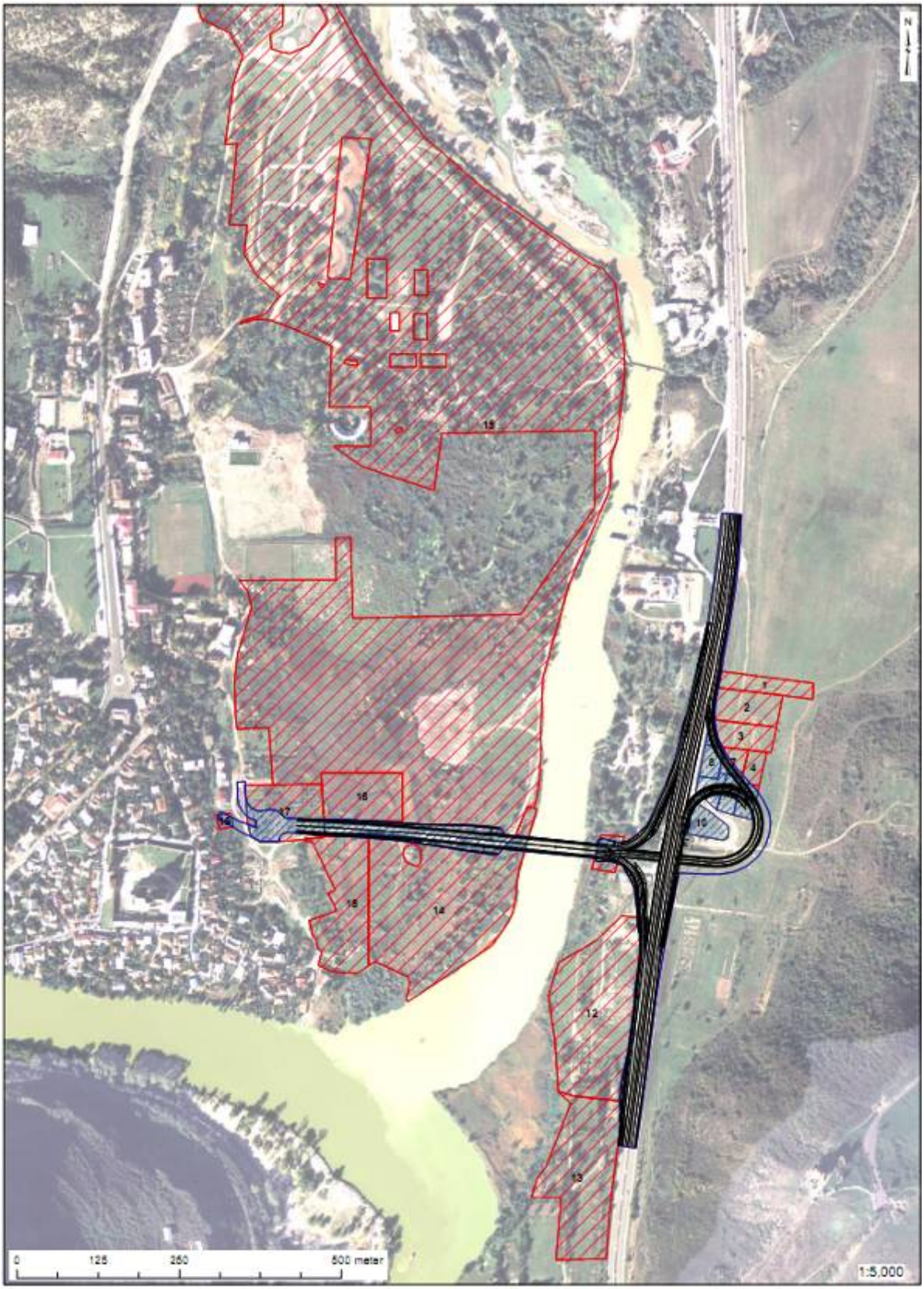


Fig. 6.1. Alternative 1 Layout on Cadastral Map

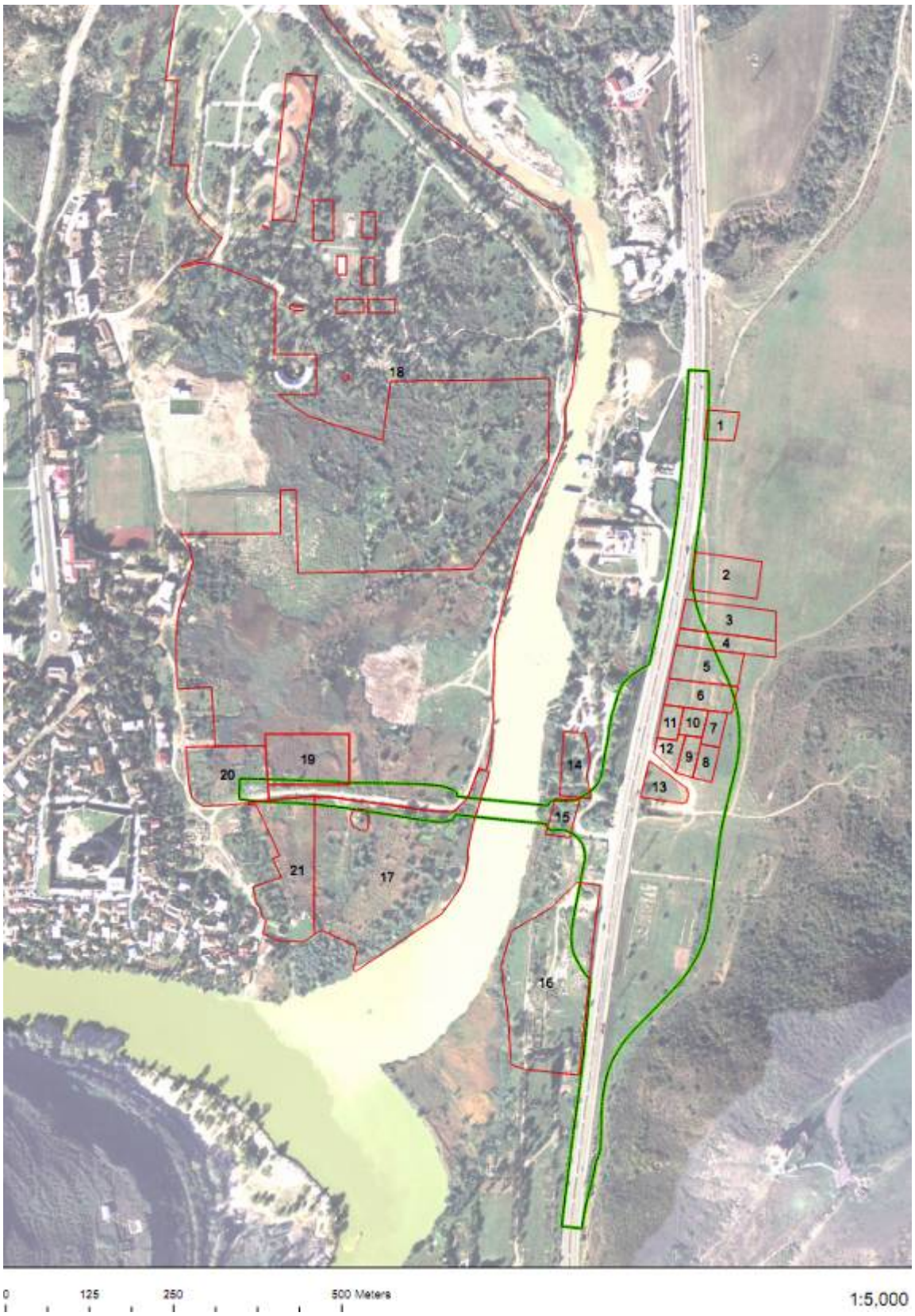


Fig. 6.2 Alternative 2 Layout on Cadastral Map

Fig. 6.3 Alternative 3 Layout on Cadastral Map

7. PUBLIC REVIEW AND CONSULTATION

7.1 REGULATORY REQUIREMENTS FOR PUBLIC REVIEW

Legislation and regulations of Georgia

450. In April 2000 Georgia ratified Aarhus convention. This UNECE convention facilitates and regulates information availability, public society involvement in the decision making and law availability issues for the field of environmental protection. It implements the principle of the need of involvement of all interested parties in order to reach steady development. The convention provides the field of environmental protection to be turned within the area of governmental accountability, transparency and responsibility. Social involvement provides for the better projects creation, better development and cogovernance.

452. The Georgian legislation requires public consultation only for the projects, which require Environmental Impact Assessment. These requirements are set forth in the law on Environmental Impact Permit (2008).

453. The details of the legal requirement related to public consultations in the EIA process is described in chapter 2.1

ADB/WB Requirements

454. Consistent with the IFI's principles of host-country ownership of the projects implemented under its loans, Banks will ensure meaningful public consultation in the development of Bank loan-related IEEs and make public the results of IEEs. Public disclosure and consultation procedures are defined in ADB SPS 2009 and WB BP 17.50 – "Disclosure of Operational Information" and described in details in WB Environmental Sourcebook Vol. I chapter 7 and Updates #5 - "Public Involvement in Environmental Assessment: Requirements, Opportunities and Issues". The Bank requests consultations for A and B Category projects. For the category A projects WB requires two consultation meetings (one at scoping, and one on draft EA) and disclosure of draft and final documents in country and through Bank website.

7.2 PUBLIC CONSULTATION SCHEME

455. At this stage, preliminary individual consultations have been conducted with the affected land owners. Out of 7 affected households 6 live in Tbilisi in different districts and only 1 lives in Mtskheta. All affected households were met individually (During a period of June 12 – 14), informed of project features and ADB SPS 2009. Besides that consultations were carried out with local municipality (June 20 of 2012) and with the National Agency for the Cultural Heritage Protection (June 8 of 2012). In order to comply with the Georgian legislation and the ADB requirements and to ensure meaningful consultations, following further actions are planned:

Disclosure of documents

456. The electronic versions of the final draft IEE, after clearance by ADB, will be placed on the MDF web-site

457. The hard copies of Project environmental documentation (draft IEE and Executive Summary) will be placed in:
- the MDF office
- Mtskheta Municipality

Public consultation meetings

458. Preliminary consultations have been carried out in limited scope with affected individuals, municipality and the National Agency for protection of the cultural heritage. According to EARF

for the SUTIP program, for category B projects at least one consultation will be conducted, when the draft IEE has been completed. To harmonize the EARF requirements with the Georgian local procedures, the public consultation meeting will be carried out after the clearance of the draft IEE by ADB and receiving informal no-objection for publication of the document. 50 days after publishing the document (presumably August 30 – September 3 of 2012) the meeting will be carried out in Mtskheta Municipal Office and records of the meeting will be attached to the submission package for MoEP.

Information about the planned meetings

459. Information about the public consultation process will be maid available for public through:

- distribution of information via the CENN internet resources
- placing information on the MDF web-site
- publication in 1 central newspaper located in Tbilisi and 1 local newspaper

460. The disseminated announcement will contain information on:

- where the interested parties can find the electronic versions and hard copies of the disclosed documents
- place and schedule of the planned public consultation meetings
- the deadlines for providing comments
- details of contact persons for submitting comments

8. GRIEVANCE REDRESS MECHANISM

461. During implementation of the Project, there might be several issues related to environmental hazards and disputes on entitlement processes may occur due to the Project activities. For example, intensive schedule of construction activities; inappropriate timing of construction vehicle flow; waste; noise and air pollution from construction activities; ecological disturbances; cultural conflicts between migrant workers, are some of the environmental issues that are likely to arise from the Project activities.

462. According to the existing legal and administrative system in Georgia, there are several entities responsible for addressing environmental complaints of population and interested parties. The administrative bodies directly responsible for environmental protection within the project area are MoE and rayonal (Mtskhetai) municipal offices (gamgeoba). The affected population and stakeholders may send their grievances, related to the project-induced environmental impacts directly to the mentioned administrative bodies responsible for environmental protection.

463. Regarding more specific issues, related to the risks or damage of the monuments or structures within the historical part of Mtskheta City and any negative impact on tourism (traffic safety; pollution or disturbance related to material transportation etc.) the Agency for Cultural Heritage Protection could be addressed by the affected parties. MDF, as EA will deliver grievances to relevant authorities, in case if such grievances are sent to MDF. Agency for Tourism Development has no any regulatory role and capacity for reviewing grievances and no enforcement mechanisms are in place to improve impacts on tourism. Local municipality is the body to be addressed by tourists or persons having any grievance related to tourism.

464. The official administrative bodies are obliged to respond to the grievances that have been received from population or other interested parties in accordance with the requirements of the Administrative Code of Georgia. However, the described system is not flexible and convenient for affected persons and does not provide efficient pre-litigation mechanisms for grievance resolution.

465. In accordance with the ADB SPS 2009 requirements, a Grievance Redress mechanism will be set up for the Project to deal with both the environmental and social issues of the Project. MDF as the Executive Agency (EA) has overall responsibility for project implementation and environmental compliance. MDF as the EA will facilitate the grievance resolution by implementing a project-specific Grievance Redress Process (GRP). Besides that, the requirements of the new accountability policy related to grievances of the adversely affected people should be implemented. Accountability is a mechanism adopted by ADB In May 2003, a whereby people adversely affected by ADB-financed projects can express their grievances; seek solutions; and report alleged violations of ADB's operational policies and procedures, including safeguard policies. The accountability mechanism replaced ADB's Inspection Function (1995). ADB's accountability mechanism comprises two separate, but related, functions: (i) consultation, led by ADB's special project facilitator, to assist people adversely affected by ADB-assisted projects in finding solutions to their problems; and (ii) providing a process through which those affected by projects can file requests for compliance review by ADB's Compliance Review Panel.

466. MDF will facilitate the establishment of a Grievance Redress Committee (GRC) and Grievance Focal Points (GFPs) in Mtskheta prior to the CW Contractor's mobilization to the construction site. The functions of the GRC and GFPs are to address concerns and grievances of the local communities and affected parties as necessary.

467. The GRC will comprise representatives from local authorities, affected parties, and other reputed NGOs or persons, as mutually agreed with the local authorities and affected persons. It will also comprise the Contractor's Environmental Specialist and Cultural Heritage Protection Specialist, Supervising Company's (SC) Environmental Specialist and Cultural Heritage

Protection Specialist (presumably archaeologist) and EA Safeguards/Environmental specialist. The role of the GRC is to address the Project related grievances of the affected parties that are unable to be resolved satisfactorily through the initial stages of the Grievance Redress Mechanism (GRM).

468. EA will assist residents of Mtskheta city and affected community to identify local representatives to act as Grievance Focal Points (GFP).

469. GFPs are designated personnel from within the community who will be responsible for:

i) acting as community representatives in formal meetings between the project team (contractor, SC, EA) and the local community he/she represents

ii) communicating community members' grievances and concerns to the contractor during project implementation.

470. The sufficient number of GFPs for Mtskheta bridge project is – 2 persons.

A pre-mobilization public consultation meeting will be convened by the EA Environmental Specialist and attended by GFPs, contractor, SC, EA representative and other interested parties (eg. local NGOs). The objectives of the meeting will be as follows:

(i) Introduction of key personnel of each stakeholder including roles and responsibilities,
(ii) Presentation of project information of immediate concern to the communities by the contractor (timing and location of specific construction activities, design issues, access constraints etc.) This will include a brief summary of the EMP - its purpose and implementation arrangements;
(iii) Establishment and clarification of the GRM to be implemented during project implementation including routine (proactive) public relations activities proposed by the project team (contractor, SC, EA) to ensure communities are continually advised of project progress and associated constraints throughout project implementation;
(iv) Identification of members of the Grievance Redress Committee (GRC)

471. Following the pre-mobilization public consultation meeting, environmental complaints associated with the construction activity will be routinely handled through the GRM as explained below and shown on Figure 8.2

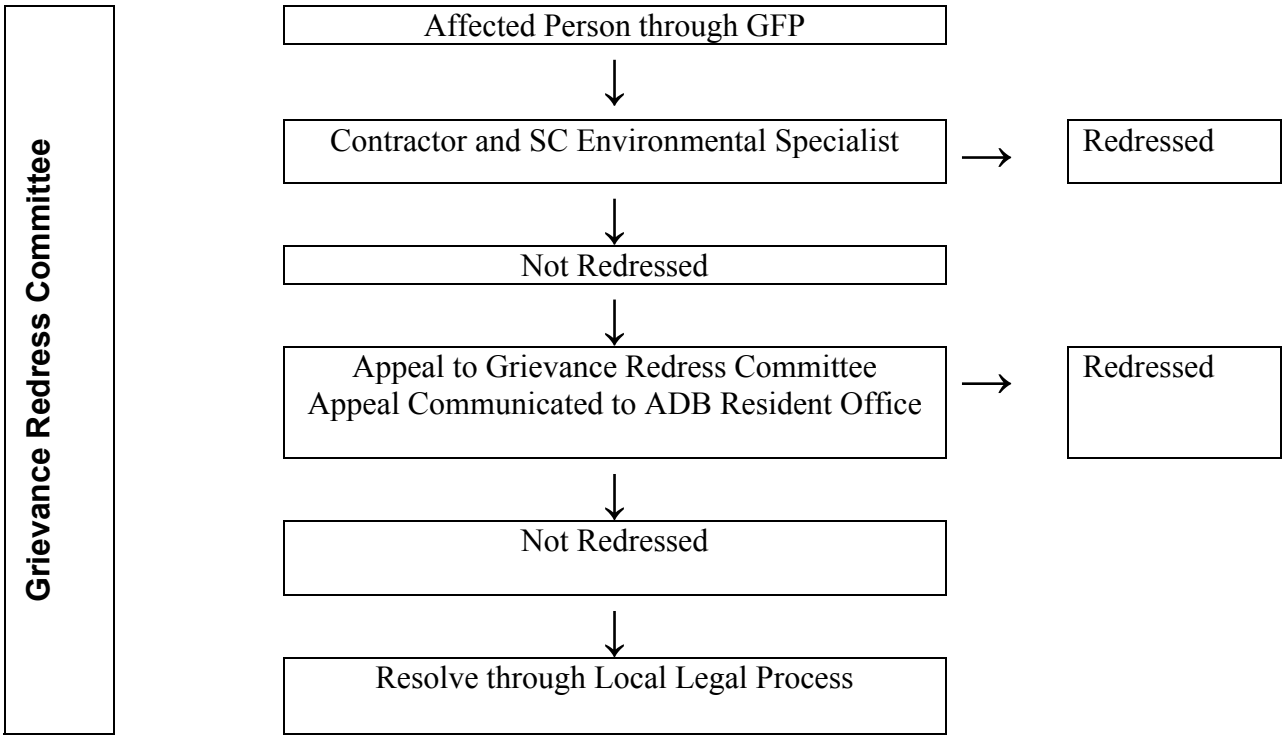
(i) affected persons will lodge their environmental complaint/grievance with their respective community's nominated GFP.
(ii) The GFP will deliver the individual's complaint to the Contractor and SC's Environmental Specialist .
(iii) The Contractor and SC will record the complaint in the Environmental Complaints Register (ECR) in the presence of the GFP.
(iv) The GFP will discuss the complaint with the Contractor and SC's Environmental Specialist and try to resolve it;
(v) If the Complaint is not resolved within 2 weeks the GFP will present the complaint to the Grievance Redress Committee (GRC). GRC will notify ADB resident Office in Tbilisi about received complaints and will send a copy of written grievance or summary/minnutes of oral communication to ADB. In case of need (e.g. gross contamination; damage of archaeological remnants) the GRC will inform and involve Ministry of Environmental Protection and/or Ministry of Culture and Monuments Protection
(vi) The GRC will have to resolve the complaint within a period of 2 weeks and the resolved complaint will have to be communicated back to the affected individual or community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register.

(vii) Should the complaint not be resolved through the GRC, the issue will be adjudicated through local legal processes.

(viii) In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution.

(ix) EA will also keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the SC and will ensure that they are resolved in a timely manner.

Figure 8.1 Grievance Redress Mechanism



9. ENVIRONMENTAL MANAGEMENT PLAN

Introduction

472. The Environmental Management Plan (EMP) documents the impacts identified in the EIA report, the actions required to mitigate those impacts to acceptable levels in accordance with the Georgian legal requirements and the ADB safeguard policy, and the monitoring activities that are to be undertaken as part of the project to confirm that the mitigation actions have been effective in achieving their objectives or to initiate corrective actions required.

473. The EMP also details the institutional arrangements and capacities that currently exist, or that will be put in place as part of the project implementation, to ensure that the environmental due diligence (including the EMP) has comprehensively considered both the national and ADB requirements for environmental protection, has identified all likely environmental impacts and proposed appropriate mitigation measures, and has the systems in place to ensure that effective procedures for environmental monitoring and control of the project impacts and mitigation measures are implemented throughout the life of the project

474. The environmental impacts associated with project have been detailed above in the chapter 5 of this EIA. Mitigation measures required to address the impacts identified in the EIA have been summarized in each of the relevant sections covering the physical, biological and socio-economic environment affected by the project. The impacts identified and the specific mitigation measures proposed to address them have been consolidated into the environmental mitigation plan presented in p. 9.3 in a form of matrix, which includes time frames, responsibilities and where applicable, estimated costs for each measure.

475. The environmental mitigation plan specifies the need for the civil works Contractor to provide its own detailed Contractor's Environmental Managemen Plan (CEMPs,) based on current EMP, but supplemented with the descriptopn of the schedule of planned activities, persons responsible for implementation of EMP and monitoring, as well as with method statements for spillage control and construction waste management.

476. An environmental monitoring plan is presented in p. 9.4, which outlines the activities and responsibilities associated with monitoring the effectiveness of the proposed mitigation plan and ensuring compliance with the recommendations of the EIA.

9.1 IMPLEMENTATION ARRANGEMENTS AND RESPONSIBILITIES

477. The main institutions that will be involved in implementation of the EMP and monitoring are the executing agency (EA), the Supervision Consultant (SC) the Contractor and to a lesser extent the Ministry of Environmental Protection and Municipal Authorities.
MDF as the executing agency will be responsible for the day to day management of the project including implementation of the EMP. The EA currently has one Environmental and Social Specialist and one Resettlement Specialist, who are responsible for management of the environmental and social aspects associated with development of all donor funded projects for which MDF is the responsible Executing Agency (EA).

478. The MDF's Environmental and Social Specialists responsibilities in respect of implementation of the EMP are as follows:

(i) Ensure that all relevant EMP requirements (including environmental designs and mitigation measures) are duly incorporated into the project bidding documents.
(ii) Obtain necessary permits and/or clearance, as required, from MoEP and other relevant government agencies, ensuring that all necessary regulatory clearances are obtained before commencing any civil work on the project.
(iii) Ensure that contractors have access to the EMP and EIA report.

(iv) Ensure that contractors understand their responsibilities to mitigate environmental problems associated with their construction activities and facilitate training of their staff in implementation of the EMP.
(v) Approve the Environmental Management Plan prepared by the Contractor before he takes possession of construction site
(vi) Monitor the contractor's implementation of the EMP in accordance with the environmental monitoring plan.
(vii) Submit monthly Environmental Monitoring Reports to ADB.
(viii) In case unpredicted environmental impacts occur during the project implementation, prepare and implement as necessary an environmental emergency program in consultation with MoEP, any other relevant government agencies, and ADB.

479. Technical supervisor (SC) 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.

480. The SC will include a part time international environmental specialist (6 weeks per year for 3 years) and fulltime site-based national environmental specialist to assist the PIU supervise and monitor implementation of the EMP during construction.

481. A Non Compliance Notice will be issued to the contractor if the SC requires action to be taken. The contractor will be required to prepare a corrective action plan which is to be implemented by a date agreed with the SC. Non-compliance will be ranked according to the following criteria:

- Non Compliance Level l: A situation that is not consistent with requirements of the EMP, but not believed to represent an immediate or severe social or environmental risk. Repeated Level I concerns may become Level II concerns if left unattended.
- Non Compliance Level II: A situation that has not yet resulted in clearly identified damage or irreversible impact, but which demonstrates potential significance. Level II requires expeditious corrective action and site-specific attention to prevent severe effects. Repeated Level II concerns may become Level III concerns if left unattended.
- Non Compliance Level III: A critical situation that will result in significant social or environmental damage occurring or a reasonable expectation of very severe impending damage. Intentional disregard of Non Compliance Notices or specific prohibitions is also classified as a Level III concern.

482. The failure to prepare a corrective action plan or to implement it within the required timeframe will result in the Employer undertaking the work at the Contractor's expense (as will be specified in the Contract).

483. Construction contractor is obligated to follow EMP and good construction practice. In order to meet this obligation, a contractor shall establish environmental management team and procedures.

484. The **Contractor** will appoint a full time **Environmental Manager** (EM) to be a senior member of the construction management team based on site for the duration of the contract. The EM shall have a university degree (preferably at Masters level) in Environmental Science or related discipline and have at least 10 years work experience in environmental management of infrastructure projects.

485. Key responsibilities of the Contractor (through the EM) are as follows:

(i) Preparing the Contractor's environmental management plan (CEMP) for approval by the Employer (EA) prior to the Contractors taking possession of the construction site (see below)
(ii) Ensuring the CEMP is implemented effectively throughout the construction period.
(iii) Coordinating community relations issues through acting as the Contractor's community relations focal point (proactive community consultation, complaints investigation and grievance resolution)
(iv) Establishing and maintaining site records of:
- weekly site inspections using checklists based on SEMP,
- environmental accidents/incidents including resolution activities
- environmental monitoring data,
- non-compliance notifications issued by the DSC
- Corrective action plans issued to the DSC in response to non-compliance notices.
- Community relations activities including maintaining complaints register
- Monitoring reports
- Routine reporting of SEMP compliance and community liaison activities (see below).
- Adhoc reporting to the Employer's Engineer of environmental incidents/spillages including actions taken to resolve issues

Contractor's Environmental Management Plan (CEMP)

486. Following the award of the contract and prior to construction commencing the Contractor will review the EMP and develop this into a detailed Contractor's Environmental Management Plan (CEMP) that amplifies the conditions established in the EMP that are specific for the project, the tasks involved and schedule of construction activities. The CEMP will identify persons who will be responsible for supervising the work within the contractor's team. The CEMP will include a matrix of mitigation measures corresponding to specific activities. As a stand alone documents the CEMP will be supplemented with method statements for spillage control and construction waste management. The spillage control method statement includes proper location and organization of fuel storage, filling stations and vehicle washing sites.

487. The CEMP will also include a monitoring plan and a reporting program corresponding to the requirements of the EMP. The CEMP will be submitted to EA for approval at least 10 days before taking possession of work site.

Site Induction

488. Following approval of the CEMP by the EA, the Contractor will be required to attend a site induction meeting with the SC's International Environmental Specialist whereby the CEMP is confirmed with the Contractor to ensure that all compliance conditions are clearly understood. Following confirmation of the CEMP with the Contractor the SC's International Environmental Specialist advises the SC Team Leader that the Contractor is now cleared to take possession of the Site and may commence moving equipment to the Site.

489. The Contractor will be responsible for ensuring that all sub-contractors abide by the conditions of the CEMP.

Reporting

490. **The Contractor** will prepare a monthly concise report (Maximum 3 pages and appendices, if required) in respect of compliance with EMP/CEMP requirements that will be submitted to the EA through the SC. The report will contain the following sections.
(i) Details of any environmental incidents
(ii) Status of all non-conformance identified during audits and inspections that are identified by non compliance notices.

(iii) Complaints from the public and proactive community relations activities
(iv) Monthly Accident Report
(v) Waste volumes, types and disposal
(vi) Details of any contaminated areas that have been identified and rehabilitated.
(vii) Details of any archaeological discoveries.
(viii) Details of any ecological issues.
(ix) Other relevant environmental issues.

The Contractor will have a duty to immediately report to the SC if any serious environmental breach has occurred during construction e.g. clearing of sensitive areas, serious oil spills etc.

491. The SC provides EA with monthly reports including review of the environmental and social aspects of the Contractor's performance, as well as HSE issues. In case of any serious accident or repeated violation requiring immediate reaction of the EA and authorities, SC sends appropriate notice to EA immediately.

492. MDF as the Executing Agency will submit monthly reports to ADB reflecting project progress and compliance with the safeguards requirements. The monthly reports will include SC monthly reports and short explanatory not of MDF specialists.

493. ADBs responsibilities in regard to implementation of environmental safeguards requirements for the project include: undertaking periodic monitoring of the EMP implementation and due diligence as part of an overall project review mission; and if required, provide advice to MDF in carrying out its responsibilities to implement the EMP for the project.

Institutional Capacity Building Requirements for MDF

494. Within MDF, ithe environmental and social apecialist and several monitoring officers are included in the staff. Current environmental capacity of the MDF needs strengthening to ensure full environmental compliance of the Project. Although day-to-day quality control of works will be outsourced to the engineering supervisor of works, MDF should have in-house human resources to oversee performance of such technical supervisor and to work out decision to address issues which the supervisor may bring up for MDF's attention. The proposed capacity building is provision of training to the MDF environmental specialist and monitoring team on ADB safeguards issues and environmental monitoring.

9.2 COSTS OF IMPLEMENTATION

495. The costs of environmental activities associated with the construction will be included in the contract for construction.

496. **Waste Management**. Costs of spoil and rock disposal is not significant, as the substantial part of the spoil generated in cuts will be used for construction of fills (embankments). The rest of spoil will be used for drying up and covering bogged area adjacent to the construction ground. However, if we consider that some part of spoil will be transported to Ksani Landfill and take maximum amount of materials to be transported as 20,000m^3 , the cost of transportation will be about 10,000 GEL. Cost of services of the Municipal waste operator about 2,500 GEL per year.

497. **Pollution Prevention**: 2 Kits of absorbent materials will cost 720 GEL. Construction of local fuel spillage containment systems and oil separators for equipment yards – 5000 GEL.

498. **Ecology.** Replanting of Sea-buckthorn shrubs. Compensatory planting of the species should be facilitated with the proportion of 1:10; Cost of sea-buckthorn seedlings is about 5 Gel and they are available in Sartichala Plant Nursery. Maximum value of compensation planting

could be calculated as: 12 cutted bushes x 10 x5Gel + 500Gel for workers = 1100 Gel. Preentry ecological survey involving 2 specialists – 4000 GEL.

499. Topsoilstorage. 22,269sqm of the land will be stripped from topsoil on average for 02m depth. 4,454 m^3 of topsoil will be stockpiled. Cost of these operations equal 4,454 m^3 x 4 Gel = 17,816 GEL

500. Managerial Expences. Some not significant expenses are foreseen with respect to the following public consultation on the IEE and EMP and will be borne by the Roads Department.The main expenses are associated with the need to hire environmental and H&S specialists and Cultural Heritage Protection specialist. Cots for hring local specialists are approximately 100,000 Gel annually for Construction Contractor and 100,000 GEL for Engineer - Construction Supervising Company (CSC). CSC has to involve also international environmental specialist. The related cost is estimated as 200,000 GEL.

501. Capacity building program for MDF environmental team including training of personnel will cost around 10,000 GEL.

9.3. Environmental Management Matrix

Table 9.1. Construction Phase

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Responsibility for Monitoring
Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) in the **Right-of-Way** occupied by the highway. **Character of impact**: immediate drastic changes of landscape in the construction corridor.	Whole layout Sea-buckthorn shrubs on the both sides of the bridge will be destroyed.	pre-entry survey and prevention of damage to fauna prior to start up of construction on separate sections (inspection of bat living sites; inspection of nests in RoW). Preentry ecological survey involving 2 specialists – 4000 GEL. installation of sticks in pits and trenches for escaping small mammals. Landscaping and reinstatement of sites adjacent to the land permanently occupied by the road infrastructure. Replanting of Sea-buckthorn shrubs. Compensatory planting of the species should be facilitated with the proportion of 1:10; Cost of sea-buckthorn seedlings is about 5 Gel and they are available in Sartichala Plant Nursery. Maximum value of compensation planting could be calculated as: 12 cutted bushes x 10 x5Gel + 500Gel for workers = 1100 Gel	Design stage prior to start up of land clearance construction period from land clearance – till reinstatement develop before construction start up. implement before completion	Constructing Contractor	MDF CSC Inspectorate of MoE
Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) on the access roads, in the **borrow pit** sites, **waste dumps**, **construction camps** and **equipment yard**s. **Character of impact**: immediate	Camp site; Quarry sites; (e.g. Aragvi or Mtkvarii floodplain). Waste dumps, construction camps and equipment yards to be defined at the	**Mitigation strategy**: prevalence of preventive measures: - Optimal siting. Agree the site with the local authorities; - Pre-entry survey, replanting of rare species (if required), prevention of damage to fauna, - top-soil storage **long-term (remediation)**:		Designing Contractor Constructing Contractor	MDF CSC Inspectorate of MoE

drastic changes of landscape in the construction corridor.	preconstruction stage by the constructing contractor.	Develop and implement Landscaping plan. Top-soil storage and use for reinstatement and landscaping;			
Lateral erosion of river Aragvi Banks.	Left bank - upper reach; Right bank - lower reach;	The detailed deign considers general and local scouring, as well as tendency of lateral erosion. Permanent monitoring.	Detailed design stage and construction stage Prior to start up of eartworks at the site Construction period	Design and Constructing company.	MDF Inspectorate of MoE
Erosion stimulated from fresh road cuts and fills and temporary sedimentation of natural drainage ways. **Character of impact: immediate**; Fresh road cuts may immediately trigger intensive erosion during construction and drastic increase of sedimentation	At the river bank terrace slopes; Cut slopes;	**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	Construction period	Constructing Contractor	MDF CSC Inspectorate of MoE
Erosion of lands below the road bed receiving concentrated outflow from covered or open drains.	Under the bridge and interchange structures.	- Increase number of drain outlets. - Place drain outlets so as to avoid cascade effect. - Line receiving surface with stones, concrete.	Construction period	Constructing Contractor	MDF CSC
Topsoil losses due to improper storage and handling	Whole layout: the sections of road;	**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	Construction period: starting from topsoil stripping and ending with reinstatement;	Constructing Contractor	MDF CSC Inspectorate of MoE

		- Handling will damage the structure of the topsoil. **Topsoil Storage** The storage of topsoil in stockpiles, no more than 2m high with side slopes at a maximum angle of 45^0, will take into consideration the following: - Dedicated storage locations that prevent the stockpiles being compacted by vehicle movements or contaminated by other materials; - Segregation from subsoil stockpiles; - No storage where there is a potential for flooding; - No storage at less than 25m from river/streams, subject to site specific topography. In the event that the topsoil stockpiles experience significant erosion Contractor will implement corrective action such as installing erosion matting over the stockpiles if further surface compaction and/or seeding fails. Contractor will protect the stockpiles from flooding and run-off by placing berms or equivalent around the outside where necessary. Top-soil storage, preservation and use for reinstatement and landscaping; 22,269sqm of the land will be stripped from topsoil on average for 02m depth. 4,454 m3 of topsoil will be stockpiled. Cost of these operations equal 4,454 m3 x 4 Gel = 17,816 GEL **Reinstatement of Topsoil** Topsoil removed from the highway itinerary will be used for reinstatement of the topsoil in the adjacent Construction Corridor affected by the project activities. Topsoil from the sites, which will not be reinstated to the initial conditions will be distributed carefully on the surrounding area. Topsoil will be reinstated separately from subsoil, with care taken to avoid mixing of the materials.			
Increased suspended sediment in streams affected by erosion at construction sites and fresh road	At the river bank terrace slopes; Cut slopes;	**Mitigation strategy**: prevention through implementing temporary anti-erosion measures – temporary drainage, temporary sediment	Construction period	Constructing Contractor	MDF CSC

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		catchments etc. - Protect susceptible surfaces with r fabric, - Establishment of retention ponds to reduce sediment loads before water enters streams			Inspectorate of MoE
Soil and water contamination during construction by cement slurry, , oil, lubricants, fuel and paint in the RoW, and equipment yards	Soil - the whole alignment; **Rivers - Aragvi and Mtkvari**,	Civil works Contractor will arrange sedimentation cathcments and will control concrete works during the bridge construction to prevent cement slurries from entering the river. - **Collect and recycle lubricants. Store the lubricants and fuel residue in special room in the camp. Use impermeable tray for placing lubricant containers.** - **Ensure proper fueling of the vehicles and machinery**. Avoid refueling near watercourses; All refueling operations on the working sites will use absorbent pads and/or straw to minimize spills, which will be put in place prior to the commencement of refueling operations. Ground water and surface water pollution risk will be reduced or eliminated in case of immediate removal of polluted ground. Soiled ground and absorbents will be removed, stored and treated as hazardous waste. In case of significant spill authorized and responsible person will be informed, works will be stopped till the elimination of pollution risk Refueling will 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 equipments will be regularly revised to prevent leakage due to inappropriate condition of refueling equipments. Equipment and storages will be isolated and guarded to prevent pollution due to cases of stealing or vandalism.	Construction period	Constructing Contractor	MDF CSC Inspectorate of MoE

		- **Check vehicles (leaking of fuel etc.) and ensure proper maintenance of vehicles and equipment** All mobile plant, including but not limited to cranes, compressors, generators, bulldozers, excavators etc. and storage tanks will be maintained and operated such that all leaks and spills of materials will be minimized. Daily plant checks (Vehicle Maintenance Procedure) will be undertaken to ensure no leaks or other problems are apparent. Vehicle maintenance, cleaning, degreasing etc will be undertaken in designated areas of hard-standing, not over made ground. Maintenance points will not be located within 50m of any watercourse, well or dry gorge. The storage of potentially polluting materials, refueling and maintenance of mobile plant within 50m of all watercourses/water bodies, dry riverbeds and within designated wetlands and aquifers will be prohibited. - **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;** - **The personnel involved in the handling of fuel, hazardous and non-hazardous waste will undergo specific training in fuel and lubricant handling procedures**			
Poor sanitation and solid waste disposal in construction camps and work sites (sewerage, sanitation, waste management)	camp sites	Provide adequately located and maintained waste disposal facilities (containers). Ensure accommodation of the working personnel in nearest villages. In case if the Constructing Contractor decides to establish large camp and accommodate its personnel in the camp – provide	Construction period	Constructing Contractor	MDF CSC Inspectorate of MoE

		adequate latrines. Install (if required) septic tanks according to standards. Contract municipal waste operators for disposing household waste, garbage and small amounts of nonhazardous construction waste etc. Cost – 200 GEL per month. Collect oil and fuel residues and contaminated rags, and sorbents. Small amounts could be disposed by municipal waste operators. In case of large amounts – the disposal site and mode should be agreed with MoE. The personnel involved in the handling of hazardous and non-hazardous waste will undergo specific training in: - Waste handling - Waste treatment; and - Waste storage. Burning of waste on any construction site is forbidden with the exception of stub and small branches from felled trees and bushes, which is better to be burned in order to avoid pest dissemination.			
Construction wastes alongside the RoW and roadside litter. Disposal of excess soil and rock. certain part of the cut material (soil and rocks) should be disposed Spoil – Demolition of old pavement Concrete and metal constructions	Construction sites	Provide for disposal facilities agreed with local municipalities; Demolished metal constructions should be disposed as a scrap. Contract operators having all required permits on metal scarp operations. The most pat of excessive soil not used for construction needs should be moved to the adjacent bogged are for further use as filling material nneded to dry up and cover this bogged site. In case if some portion of the spoil cannot be used as a filling material on a said site, transport spoil to Ksani	Mobilization stage Construction period	Constructing Contractor	MDF CSC Inspectorate of MoE

		Landfill. Cost of transporting 1000m^3 – 500GEL. The personnel involved in the handling of hazardous and non-hazardous waste will undergo specific training in: - Waste handling - Waste treatment; and - Waste storage. Burning of waste on any construction site is forbidden with the exception of stub and small branches from felled trees and bushes, which is better to be burned in order to avoid pest dissemination.	Construction period Mobilization phase and Construction period		
Dust generation and air pollution from vehicle operations during construction in populated areas traversed by the highway, notably metropolitan areas or densely settled rural areas.	the whole alignment Right bank - residential area in Mtskheta.	- 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. The construction site will be watered as appropriate. 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 damaged parts. All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or local people. Regular maintenance of diesel engines will be undertaken to ensure that emissions are minimized, for example by cleaning fuel injectors. Routine	Construction period	Constructing Contractor	MDF CSC

		maintenance will be to a high standard to ensure that vehicles are safe and that emissions and noise are minimized. All plant used on site will be regularly maintained so as to be in good working order at all times to minimize potentially polluting exhaust emissions. Vehicle refueling will 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 stored fuel). If 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: - Damping down using water bowsers with spray bars or other technical means;; - Sheeting of construction materials and storage piles; and - Use of defined haulage routes and reductions in vehicle speed where required. Materials will be transported to site in off peak hours. - Materials transported to site will be covered/ wetted down to reduce dust. The construction site will be watered as appropriate. 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 damaged parts Such measures will be used, in particular, where human or animal receptors lie within 300m of the ROW (v. Sasadilo, Bochorma, Orkhevi)			
Air pollution from asphalt plants.	Plant site	Contract only licensed supplier having all required environmental permits. In case if the Constructing Contractor takes decision to install and operate its own plant, specific IEE	Construction period	Constructing Contractor	MDF CSC

		should be prepared and Environmental Impact Permit obtained			
Noise pollution from vehicle operation during construction in populated areas traversed by the highway, notably metropolitan areas or densely settled rural areas. Local noise.	Right bank - residential area in Mtskheta.	Install and maintain mufflers on equipment. Routine maintenance will be to a high standard to ensure that vehicles are safe and that emissions and noise are minimized. All plant 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	Construction period	Constructing Contractor	MDF CSC
Infrastructure. The main infrastructure element that could be affected are: • optical fibre cable 750 m; • pipe d-1200mm – 600 m; • pipe d-500 mm – 950 m.		**Protection of infrastructure.** Relocate the affected infrastructure elements before construction start up. Permanent monitoring during construction. Full reinstatement in case of damage.	Preparatory works before the construction start up	Constructing Contractor	MDF CSC
Transportation Related Impacts Transportation of construction materials, especially pre-fabricated concretes and steels, through the narrow and busy roads surrounding the town on the right bank could have significant environmental impacts and traffic safety issues on the local community, as well as impacts on residential buildings.	Right bank - residential area in Mtskheta.	The main transportation roads convenient for transportation of construction materials (see fig. 3.1) do not cross historical part of Mtskheta. Thus the mitigation measure, in this case is limited to strict instruction to use only these transportation routes for delivery of construction materials and removal of wastes and to prohibit any construction related transportations through historical part of Mtskheta city. Enforcement of these instructions should be strictly monitored. Dust, emission and noise control measures are addressed in other sections.			MDF CSC
Quarrying Sites: potential impact of the increased quarrying activities on ichthyofauna, groundwater and landscape	presumably, r.Aragvi and Mtkvari floodplain	Control of validity of the quarry and borrow pit licenses. (The license is given with description of exploration limits and reinstatement commitments). Select the suppliers located close to the project site and use access roads not crossing historical part of Mtskheta. Control of vehicle operations. Avoid traverse of	Construction period	Constructing Contractor	MDF CSC Inspectorate of MoE

		watercourse. Exclude leakage of oil or fuel. Check the condition of vehicles.			
Construction Camp and/or equipment yard Site The potential impacts related to the construction and operation of the camp could 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	camp site	- Proper waste management. Detailed waste management plan for the camp operations is given in Annex 2. - Arrange accommodation of personnel in villages. In case if large camp will be constructed for the workers accommodation, organize sewerage according standards. - Pollution prevention strategies: proper organization of fueling, waste management; - Proper storage of topsoil - Reinstatement of topsoil and vegetation cover;	Construction period	Constructing Contractor	MDF CSC Inspectorate of MoE
Health hazards by noise, air emissions and dust raised and blown by vehicles during construction activities.	Right bank of r. Aragvi. Residential area in Mtskheta.	Dust control by application of watering. Use water browsers; Noise control, installation of mufflers on equipment, daytime works;	Construction period	Constructing Contractor	MDF CSC
Cultural heritage protection; Impact on historical part of Mtskheta City (UNESCO zone) Impacts on archaeological sites and remnants	Whole layout,	Transportation of construction materials theoretically may have impact on historical monuments, as well on tourists. It should be stressed, that the main transportation roads convenient for transportation of construction materials (see fig. 3.1) do not cross historical part of Mtskheta. Thus the mitigation measure, in this case is limited to strict instruction to use only these transportation routes for delivery of construction materials and removal of wastes and to prohibit any construction related transportations through Mtskheta city Permanent monitoring during land clearance and excavation activities. Chance Finds Procedure should be implemented, including: stoppage and suspension of construction	Before start up of construction; Construction period	Archaeologist from CAS Constructing Contractor	MDF CSC Archaeologist assigned by the Ministry of Culture

		activities in case of archaeological findings; Completion of required archaeological works before restarting construction activities; Conservation of remnants.			
Hazardous driving conditions where construction interferes with pre- existing roads.	Left bank - at the crossing site with the E-60 highway; Right bank of r. Aragvi. Residential area in Mtskheta.	Provide in design for proper markers and safety signs on roads, including lights. Instruct the drivers	Construction period	Constructing Contractor	MDF
Final Reinstatement and Long-term Anti-erosion Measures	Whole alignment	All the work sites (except permanently occupied by the road and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover). So far as very limited wood cutting and bush clearance is required for the current project, preservation of top-soil is sufficient for reinstating the natural grass vegetation cover .		Constructing Contractor	MDF CSC
Eco-compensation program.	As a result of land clearance, certain amount of sea-buckthorn shrubs on the both sides of the r.Aragvi will be destroyed.	As a result of road widening, sea-buckthorn shrubs on the both sides of the road will be destroyed. Compensatory planting of the species should be facilitated with the proportion of 1:10; Cost of sea-buckthorn seedlings is about 5 Gel and they are available in Sartichala Plant Nursery. Maximum value of compensation planting could be calculated as: 20 cutted bushes x 10 x5Gel + 500Gel for workers = 1500 Gel	Develop before construction start up. Implement before completion	Constructing Contractor	MDF
Accident risks associated with vehicular traffic and transport, that may result in spills of toxic materials, detonation of explosive load, injuries or loss of life(see Accidents due to construction related vehicles and heavy machinery or traffic interference with construction activities.	Left bank - at the crossing site with the E-60 highway; Right bank of r. Aragvi. Residential area in Mtskheta.	- Provide in design for proper markers and safety signs on roads, including lights. Instruct the drivers - Design and implement safety measures and an emergency plan to contain damages from accidental spills. - Designate special routes for hazardous materials transport. - Regulation of construction transport in terms of traffic interference. - Prohibition of toxic waste transport through ecologically sensitive areas and densely populated areas.		Constructing Contractor	MDF CSC

Table 9.2. Operation Phase

Impacts	Sites	Mitigation Measures	Timeframe	Responsibility for Implementation	Responsibility for Monitoring and Enforcement
Erosion from road cuts and fills and sedimentation of natural drainage ways. Erosion of lands below the road bed receiving concentrated outflow from covered or open drains. **Character of impact**: long-term. Change of relief, drainage patterns, land clearance, may cause gradual but stabile intensification of erosion	Whole alignment	Mitigation strategy: long-term – remediation; reinstatement of relief and landscape; 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 number of drain outlets. - Place drain outlets so as to avoid cascade effect. - Line receiving surface with stones, concrete. - Long-term monitoring and maintenance	Construction stage; Maintenance after completion of construction	Constructing contractor RDMRDI in long-term perspective	RDMRDI Inspectorate of MoE
Landscape disfiguration by embankments and deep cuts, fills and quarries. Marred landscape (scars from rod cuts, induced landslides and slumps etc.).	Project sits.	- Maintenance and and/or restoration of roadside vegetation - Use an architectural design to 'blend with the landscape. - Replant disfigured surfaces.	Construction stage; Maintenance after completion of construction	Constructing contractor RDMRDI in long-term perspective	RDMRDI Inspectorate of MoE
Increased suspended sediment in streams affected by erosion at construction sites and fresh road cuts, fills and waste dumps. declined water quality due to increased sedimentation. **Character of impact**: long-term. Change of relief, drainage patterns, land clearance, may cause gradual but stabile intensification of erosion	near the river Aragvi bank slope;,	**Mitigation strategy:** long-term – remediation; Reinstatement of relief and landscape; Long-term monitoring; Installation of long-term drainage systems and anti-erosion structures. Reinstatement of vegetation cover. Establishment of vegetative cover on erodible surfaces as soon as possible		Constructing contractor RDMRDI in long-term perspective	RDMRDI Inspectorate of MoE
Soil and water contamination by oil, grease, fuel and paint	whole alignment	Install oil traps at the bridge; Facilitate installation of standard refueling stations and	after completion of	RDMRDI in long-term	RDMRDI

alongside the highway		repair shops along the highway	construction	perspective	
Air pollution from construction vehicles and equipment during maintenance works.	whole alignment	Install and operate air pollution control equipment.	During Maintenance Works	RDMRDI supervising works and Maintenance Contractor	RDMRDI
Dust and air pollution from vehicle operation, in populated areas traversed by the highway, notably metropolitan areas or densely settled rural areas.	Right bank of r. Aragvi. Residential area in Mtskheta.	- Monitoring of air quality and traffic related emissions (including inspection of vehicle emissions) - Development of policy and regulations limiting traffic related emissions (regulations on fuel quality etc.) - Require adherence to engine maintenance schedules and standards (or use alternative fuels) to reduce air pollution. - Plant trees along the roadside to screen and smoothen emission impacts on the close located villages		MoE Constructing contractor RDMRDI in long-term perspective	MoE
Noise pollution from vehicle operation, in populated areas traversed by the highway, notably metropolitan areas or densely settled rural areas.	Right bank of r. Aragvi. Residential area in Mtskheta.	- High solid walls – wooden or stone/brick - Require adherence to engine maintenance schedules and standards - Plant trees along the roadside to screen and smoothen noise impacts on the close located villages - Enhance public transportation and traffic management capability.		Maintenance contractor RDMRDI in long-term perspective	MoE
Roadside litter.	whole alignment	- Provide for disposal facilities. - Encourage anti-littering laws and regulations.		Local Government authorities and MDF provide facilities and Regional services of MoE tracks compliance with standards	RDMRDI Inspectorate of MoE
Health hazards by dust raised and blown by vehicles.	whole alignment	Impact is minimal on asphalt paved highway. Dust control by application of water.	Operation period	RDMRDI	RDMRDI
Obstruction of routes from homes	Right bank of r. Aragvi.	Design of interchanges (in average each 3 km) have	Design stage	Constructing	RDMRDI

to farms, etc, increasing travel time.	Residential area in Mtskheta	mitigated this potential impact. See in RAP		Contractor	
Accident risks associated with vehicular traffic and transport, that may result in spills of toxic materials injuries or loss of life	whole alignment of the bridge and interchange infrastructure;	Prohibition of toxic waste and materials transport through the project bridge	Operation period	MoE MoI RDMRDI	RDMRDI MoE MoI

9.4 Environmental Monitoring Plan (Matrix)

Table 9.3 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**
Material supply	Possession of official approval or valid operating license	Supplier of materials (asphalt, cement and gravel)	Inspection	Before an agreement for the supply of materials is formalized	Assure compliance with HSE requirements	N/a	Plant operator; Constructing Contractor; MDF CSC
Material transport according to the schedule and routes defined for deliveries	Truck loads covered/ wetted Air pollution due to the dust and fumes related to the Material Transport	Construction site and access road	Supervision	Unannounced inspections during work hours	Assure compliance with HSE requirements. Ensure safety, and minimize traffic disruption.	Minimal Included in supervision contracts	Constructing Contractor; MDF CSC
Top-soil stripping stage. Final reinstatement.	Top-soil storage. Reinstatement. Erosion control. Landscape destruction; Visual impacts;	Construction site	Supervision	Periodic inspections (Unannounced; during work hours); From top-soil stripping – to completion of the works.	Assure compliance with, construction standards, environmental norms and EMP provisions;	Minimal Included in supervision contracts	Constructing Contractor MDF CSC
Construction work	Noise levels; Equipment; (engine maintenance, usage of mufflers, night time work limitations and other provisions of EMP.)	Construction site	Inspection; compliance monitoring noise measuring device	Periodic (average once per month); Only in case of complaints	Assure compliance with HSE requirements. Good condition of standard construction machinery and limiting the works near settlements	Minimal Included in supervision contracts	Constructing Contractor MDF CSC MoE

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**
Construction work	Vibration	Construction site	Supervision	Unannounced inspections; following complaints	Assure compliance with HSE requirements.	Minimal Included in supervision contracts	Constructing Contractor MDF CSC
Construction work	Dust and Air pollution (solid particles, suspended solids, flying heavy metal particles)	At or near construction site	Visually	During material delivery and periodically in dry periods during construction	Assure compliance with HSE requirement, Assure compliance with, environmental norms and EMP provisions.	Minimal Included in supervision contracts	Constructing Contractor MDF CSC
Whole construction period.	Traffic safety/ Vehicle/ pedestrian access Visibility/ appropriate signs	Construction site	Observation	Once per week in the evening	Assure compliance	Included in supervision contracts	Constructing Contractor; MDF SA
Whole construction period.	Material and waste storage, handling, use Water and soil quality (suspended solids, oils, etc)	Material and waste storage sites; Run off from site; material storage areas; wash down areas	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 CSC
Whole construction period.	Waste Management	All construction sites; Camps;	Observation	Once per week	Assure pollution abatement; Assure compliance with, construction standards, environmental norms and EMP	Minimal Included in supervision contracts	Constructing Contractor; MDF CSC

Whole construction period.	Equipment maintenance and fuelling Water and soil quality (suspended solids, oils, fuel, etc)	Refueling and equipment maintenance facilities; Run off from site; material storage areas	Observation	During material delivery and periodically during construction (average 1/week), especially during precipitation (rain/ snow/ etc).	Assure pollution abatement	Minimal Included in supervision contracts	Constructing Contractor; MDF CSC
Whole construction period.	Impacts on archaeological sites and remnants	All earthwork sites	Observation	Permanent/daily	Assure cultural heritage protection	Minimal	CAS represent. Constructing Contractor; SA
Whole construction period.	Protection of infrastructure elements	Crossings of power lines, pipelines;	Observation	During construction activities at the sites of concern	Assure infrastructure protection	Minimal Included in supervision contracts	Constructing Contractor MDF CSC
During Construction period	Eco-compensation Program	Sea-buckthorn replanting Sites	Observation	During Construction period	Assure offset of damage to flora and landscape	Minimal Included in supervision contracts	Constructing Contractor; MDF CSC MoE
During Construction period	Reinstatement of work sites	work sites, road alignment, used quarries, camp sites	Observation	After completion of works at concrete site	Reinstatement of work sites not taken by RoW		Constructing Contractor; MDF CSC
During Construction period	Disposal of construction wastes	work sites, road alignment, used quarries, camp sites	Observation	During and after completion of construction works	Ensure pollution prevention and landscape protection;		Constructing Contractor; MDF CSC
Whole	Personal Protective equipment.	Construction site	Inspection	Unannounced	Assure compliance	Minimal	Constructing

construction period.	HSE issues Organization of traffic by-pass			inspections during works	with HSE requirements	Included in supervision contracts	Contractor; MDF CSC

Table 9.4. Operation 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 operation period	**Lon-term degradation of natural landscape** at land strips and slopes adjacent to highway. erosion, river bank washout and other natural hazardous processes. Visual impacts. Change of drainage patterns, erosion, degradation of vegetation	Whole alignment	Observation	Quarterly	Assure erosion protection, reinstatement and mitigation of visual impacts;	N/a	RDMRDI personal responsible for engineering and environmental monitoring ;
Whole operation period	Increased suspended sediment in streams affected by erosion	Nearthe bridge;	Observation	Quarterly	Assure water protection;	Minimal	RDMRDI Field officer;
During maintenance works	Air pollution from vehicles and equipment during maintenance works.	Whole alignment	Observation; Inspection of equipment;	Once during start up of maintenance works	Pollution abatement;	Minimal	RDMRDI
Whole operation period	Routine waste and pollution management; Roadside litter and minor fuel contaminations;	Whole alignment	Observation	Monthly	Waste management and pollution abatement;	Minimal	RDMRDI Field officer;
Whole operation period	Air pollution from vehicle operation	Mtskheta: residential area on right bank	Observation; Sampling/analysis	Quarterly/Annually	Pollution abatement;	Minimal	MoE
Whole operation period	Noise pollution from vehicle operation	Mtskheta: residential area on right bank		Quarterly/Annually	Noise protection and compliance with HSE requirements;	Minimal	MoE
Whole operation period	Emergency preparedness	Emergency team offices; Simulation trainings;	Emergency team offices; Simulation trainings;	Annually	Emergency preparedness; Rescue and salvage operations; Pollution abatement;	Minimal	MoE; MoI RDMRDI

10. CONCLUSIONS

498. The present IEE reveals that there will be minor negative and tangible positive impacts due to the construction activities and normal operations of the bridge. Recommendations are made to mitigate expected negative environmental impacts. The IEEand included EMP cover all aspects of the Project bridge.

499. The major positive impact of the Project will be safe driving conditions for tourists and local residents and more convenient travel route. Construction of new bridge across the river Aragvi will be the shortest link with the motorway Tbilisi-Senaki-Leselidze and will significantly reduce the distance from Tbilisi to Mtskheta. The travel will become more comfortable and safe and will support increased tourist flow in Mtskheta. The project, in long-term perspective will support tourism development and, as a result of increased tourist flow and improved transportation system, will facilitate also agriculture development. In short term perspective, the project will also have some benefit for local population, providing job opportunities (about 50 new jobs could be available for local residents). The negative impact related to the construction nuisance (dust, emissions, noise) is temporary, insignificant and manageable by application good construction practices.

500. The bridge infrastructure will occupy 21 land plots with total area of 41,621 sq.m. Out of this amount 7 land plots are State owned (2 land plots on the left bank and 5 plots on the right bank of r. Aragvi). Total area of affected State land is 19,513 sq.m. 14 out of 21 affected land plots are private. All affected private land plots are titled and officially registered in NAPR. These registered private land plots are attributed to v. Tsitsamuri, Mtskheta Rayon (District), Mtskheta-Mtianeti Region of Georgia.

501. Within the Preliminary Resettlement Study, it has been concluded that: no crops are cultivated on the affected land plots and accordingly no harvest lost is entailed by the project. The affected private land plots are not fenced. No buildings, structures, trees or other assets are attached to the land.

502. Construction related potential impacts:

- Erosion from road cuts and fills and temporary sedimentation of natural drainage ways.
- Erosion of lands below the road bed receiving concentrated outflow from covered or open drains.

503. These impacts should be mitigated by anti-erosion measures: temporary drainage systems, berms, sediment catchment basins etc

504. No sensitive ecological habitats are represented in the project area. Replanting of some sea-buckthorn seedlings will be required to compensate the impact on individual plants.

505. The waste and hazardous material handling, dust and emission control, traffic management, health and safety procedures and other common construction related activities should be managed according to good international construction practices.

506. All the work sites (except permanently occupied by the road and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover). So far as very limited bush clearance is required for the bridge and interchange construction, preservation of top-soil is sufficient for reinstating the natural grass vegetation cover as well

507. The contractor will prepare a spoil and waste disposal plan in consultation with MoE and local municipality and submit to MDF for approval. Filling materials will be provided from licensed Quarries and borrow pits..

508. Compliance to the environmental management plan during various phases will minimize the negative impacts of the Project to acceptable levels. To ensure that these plans and mitigation measures are implemented and negative impacts avoided, the EMP will be included in the contract documents of the Project with a separate line item on environmental management in the bills-of-quantities.

509. Environmental Consultants of Construction Supervision Consultants are responsible for monitoring of implementation of EMP and ensure compliance. Environmental Division of MDF is also responsible for supervision of construction works and compliance to EMP in coordination with supervision consultants and hiring of external/independent monitoring consultants.

510. The Project will have overall beneficial impact as well as some minor negative impacts that will be carefully monitored and adequately mitigated. Therefore, the completion of this IEE fully meets the MoE and ADB requirements and submitted to MoE to obtain EIP.

Mtskheta Bridge Detailed Design Project

INITIAL ENVIRONMENTAL EXAMINATION

Volume II. Annexes

Draft Final Report

Municipal Development Fund of Georgia

Ministry of Regional Development and Infrastructure

Prepared for Transproject
By Foundation WEG

Tbilisi

June 2012

ADB	Asian Development Bank
CAS	Center of Archaeological Search of the Ministry of Culture and Sports
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
GIS	Geographical Information Systems
GP	Good Practices
GPS	Global Positioning System
HSE	Health, Safety and Environment
IFI	International Financial Institution
IEE	Initial Environmental Examination
LARP	Land Acquisition and Resettlement Plan
MAC	Maximum Admissible Concentrations
MoA	Ministry of Agriculture
MDF	Municipal Development Fund of Georgia
MoE	Ministry of Environmental Protection and Natural Resources
MLHSP	Ministry of Labor, Health and Social Protection
MoI	Ministry of Interior
MoCMP	Ministry of Culture and Monument Protection
MUFSRA	Management Unit for Food Safety and Risk Analyze of the Ministry of the Agriculture
PIU	Project Implementation Unit
PPE	Personal protective equipment
RDMRDI	Road Department of the Ministry of Regional Development and Infrastructure
RAP	Resettlement Action Plan
RoW	Right of Way
SPS	ADB Safeguard Policy Statement 2009
WB	World Bank

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ENVIRONMENTAL LEGISLATION IN GEORGIA

1. Framework Legislation

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

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

3. 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.

4. Legislative execution of constitutional requirements in the sphere of environmental protection is implemented through framework Georgian "Law on Environmental Protection" (1996, as amended) and the set of specific laws developed on its basis. The framework law regulates the legal relationship between the bodies of the state authority and the physical persons or legal entities (without distinction-legal form) in the scope of 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. 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 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. According to the requirements set forth in the framework law, numerous laws and normative–legal documents were adopted to regulate specific environmental issues in Georgia. Further below the environmental regulations most relevant to the project – and first of all, to the permitting process - are described.

2. Legislation Related to Environmental Permitting

5. Legislation Related to Environmental Permitting is described in the chapter 2 of the main body of IEE. and is not repeated here.

3. Other Environmental Laws

6. The Law on Environmental Inspectorate. The Law on Environmental Inspectorate has been adopted in 04.05.2010. This Law has been abolished in 2011, however its provisions are in force until the relevant authorized bodies will issue new regulations. This Law authorized

Environmental Inspectorate to conduct post EIA monitoring on compliance with the Conditions of Environmental Permit and conditions of licenses for exploration of natural resources. For the moment of issuing of this law, the Environmental Inspectorate was under the MoE. Currently, as we have described in p. 2.1, the Environmental Inspectorate has been moved to the Ministry of Energy and Natural Resources. Department of Permits of MoE and Environmental Inspectorate of MoENR are sharing responsibilities for the post EIA monitoring.

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:

7. 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);

8. 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);

The "Georgian Law on Ambient Air Protection" was put into effect from 1 January 2000.

9. 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.

Types of harmful human impact include:

- introduction of pollutants into the ambient air;
- radioactive impact on ambient air;
- ambient air pollution with micro-organisms and microbial toxins;
- physical impact of noise, vibration, electromagnetic field etc on ambient air.

Types of ambient air pollution are specified:

- emission of pollutants into the ambient air from stationary pollution source;
- emission of pollutants into the ambient air from mobile sources of pollution;
- emission of pollutants into the ambient air from non-point sources of pollution;
- emission of pollutants into the ambient air from small-scale sources of pollution.

10. 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.

11. 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.

12. Registration of emissions from stationary pollution sources comprises:

- self-monitoring of emissions;
- state emission registration system.

13. 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:

- emission measurements (assessment)
- registration of emissions
- reporting of emissions

14. 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.

15. 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.

16. 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 such a sensitive ecological areas as Borjomi-Bakuriani.

17. 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:

18. 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.

19. Article 38 of the Forestry Code establishes the modes of protection of the state forest fund:
(1) 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
(2) The mode of protection of the protected territories of Georgia is defined under the Georgian Law 'On the system of protected territories'.

20. Article 41 defines the modes of protection to be used for different categories of the state economic forest funds:
(1) 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.
(2) 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.

21. Article 39 specifies the special limitations to certain types of activity defined by the special mode of protection:
(1) 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).

22. 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:
(a) Disturbance or any other changes of the natural ecosystems
(b) Demolition (destroy), arrest, disturbance, damage (invalidation) of any natural resource with the purpose of its exploitation or any other purpose
(c) Damage of the natural ecosystems or species by reason of the environmental pollution
(d) Bringing and breeding foreign or exotic species of living organisms
(e) Bringing explosives or toxic materials to the area.

23. 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.

24. 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.

25. 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.

26. 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.

27. The Red List of Georgia was approved by the **Presidential Decree No. 303 'On approving the Red List of Georgia' (May 2, 2006)**

28. The water supply and wastewater system rehabilitation project is to be accomplished within the resort zone and 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.

29. 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 we site the clauses, which may be useful to estimate the damage within the limits of the project.

Article 2. The rule to estimate the damage caused by the harmful anthropogenic action on the atmospheric air
Article 3. The rule to estimate the environmental damage caused by the soil pollution
Article 4. The rule to estimate the environmental damage caused by the soil degradation

Article 5. The rule to estimate the environmental damage caused by illegal action with forest resources
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
Article 7. The rule to estimate the damage caused by damaging the fish reserve and other biological forms
Article 8. The rule to estimate the damage caused by illegal acquisition of the animal life objects
Article 9. The rule to estimate the environmental damage during the fossil exploitation
Article 10. The rule to estimate the environmental damage caused by the pollution of water resources.

30. The Law of Georgia on Soil Protection
(1994. Amended in 1997, 2002)
The aim of the Law is to protect the soil from the contamination and sets the limits for the hazardous substances concentration in it.

31. The regulates the usage of fertile soils for non agricultural purposes and strictly prohibits to undertake any kind of activity without removal of the fertile soil layer and makes compulsory to reinstate sites after open mining. It regulates uncontrolled pasturing of animals and protects forest as a mean to maintain the soil in a favourable condition. Prohibits and regulates any kind of activity related to the storage of chemicals and hazardous substances could pollute or damage the soil properties.

32. The Law of Georgia on Water 1998 as amended
This Act governs the legal relations: Between state authorities and natural and legal persons (regardless of the form of ownership and the legal-organizational status) in the sphere of water protection, study and use;

33. In the sphere of water protection, restoration and use on the land, in the continental shelf, territorial waters and in the special economic zone;

34. In the sphere of commercial water production and international trade in water;

35. Under the current law requirements no water discharge or abstraction license is required in case of discharge of the water the developer by Environmental Impact Permit might be required to submit Maximum Permissible Discharge Documents calculating the volumes of the discharge and impact on environment.

36. 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.

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

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

(1) 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.
(2) The construction project of buildings and premises within the zone of coast engineering protection should envisage the compensation amounts for the expected coastal damage.
(3) 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.

4. International Commitments

38. International cooperation is a dominant feature and driving force for environmental reforms in Georgia. Some of the International Treaties and Conventions Ratified or Signed by Georgia are provided in the list below.

Short List of the Ratified or Signed Conventions

N	Title	Year of ratification
1	Ramsar Convention on Wetlands	1996
2	United Nations Framework Convention on Climate Change (UNFCC)	1994
3	Kyoto Protocol	1999
4	Basel Convention on the Control of Transboundary Movement of Hazardous Waste and Their Disposal	1999
5	Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)	1999
6	United Nations Convention to Combat Desertification (UNCCD)	1999
7	Convention on Biological Diversity	1994
8	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1996
9	The Vienna Convention for the Protection of the Ozone Layer	1995
10	Montreal Protocol on Substances that Deplete the Ozone Layer	1995
11	Convention on Long-range Transboundary Air Pollutants	1999
12	Stockholm Convention on Persistent Organic Pollutants	2006
13	Convention on the Conservation of European Wildlife and Natural habitats	2008
14	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	2006

i.

Aarhus Convention June, 1998

39. The Aarhus Convention establishes a number of rights of the public (individuals and their associations) with regard to the environment. The Parties to the Convention are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective. The Convention provides for:

- the right of everyone to receive environmental information that is held by public authorities ("**access to environmental information**"). This can include information on the state of the environment, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. Applicants are entitled to obtain this information within one month of the request and without having to say why they require it. In addition, public authorities are obliged,

under the Convention, to actively disseminate environmental information in their possession;

- the right to participate in environmental decision-making. Arrangements are to be made by public authorities to enable the public affected and environmental non-governmental organisations to comment on, for example, proposals for projects affecting the environment, or plans and programmes relating to the environment, these comments to be taken into due account in decision-making, and information to be provided on the final decisions and the reasons for it **("public participation in environmental decision-making");**
- the right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general **("access to justice")**.

40. Setting the goal to preserve its biological diversity and realising the importance of international cooperation, Georgia signed the Convention on Biological Diversity in 1994, thus accepting responsibility to safeguard the nation's rich diversity and of plant, animal, and microbial life to begin using biological resources in sustainable way, and to ensure equitable sharing of benefits from biodiversity

41. The Convention on Biological Diversity is the first global agreement, which, along with biodiversity conservation, necessitates the sustainable use of biological resources Georgia has been recognised as holding an important reservoir of biodiversity and is very important in the global context – according to the surveys and assessments conducted at an international level Georgia, as a part of the Caucasus, is recognized as:

.

1. One out of 25 biologically richest and endangered land ecosystems (Conservation International);
2. One out of 200 vulnerable ecoregions (WWF);
3. One out of 221 endemic bird habitats (Bird Life International);
4. One of the World Agrobiodiversity Centres.

42. Georgia has implemented a number of measures on fulfillment of the guidelines defined by the International environmental treaties which is party to, in particular:

- The country acceded the most important international treaties on biodiversity, such as Convention on Biological Diversity, Convention on Wetlands of International Importance, Especially as Waterfowl Habitat, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention) and its Agreements;
- A number of national legislative acts has been adopted in the field of conservation and sustainable use of biodiversity since 1996;
- Georgia conducted biodiversity assessment studies (National Biodiversity Assessment Program, UNEP, 1996);
- Strategy and Action Plan on conservation of Georgia's biological diversity was elaborated and approved (2005);
- With the financial support of the German Government and the Global Environment Facility (GEF), the Protected Areas - the Borjomi-Kharagauli and the Kolkheti National Parks were established; with the support of the German Government, new protected areas
- are planned to be established on the Javakheti Plateau in southern Georgia;
- With the support of the Global Environment Facility (GEF), the Project on Development of Protected Areas in Georgia is being implemented. The aim of the project is to elaborate management plans for three protected areas in eastern Georgia (Lagodekhi, Vashlovani and Tusheti), to develop infrastructure necessary for their effective management and to strengthen the State Department for Protected Areas in terms of improving skills for protected areas management;

- With the financial support of the World Bank, the forestry development project is under implementation in Georgia to promote conservation and sustainable use of Georgian forests.
- Though the development of protected areas is the major strategy for protection of biodiversity in Georgia, some other priority directions in this field have emerged:
- conservation – preservation of rare and endangered species in bio-reserves;
- creation of genetic fund of wild nature;
- sustainable use of renewable natural resources;
- reproduction – breeding of rare and endangered species and their introduction in the nature.

The Convention on the Conservation of Migratory Species of Wild Animals

43. The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It has been signed in 1979 in Bonn (Germany.) Georgia ratified the treaty in 2000 together with its three agreements:

- Agreement on "Protection of Populations of European Bats" (EUROBATS);
- Agreement on "Conservation of Cetaceans of the Mediterranean Sea, Black Sea and Contiguous Atlantic Area " (ACCOBAMS);
- Agreement on " Conservation of African-Eurasian Migratory Waterbirds" (AEWA).
- Taking into account, that the Agreements have been initially designed as an instrument for facilitating the implementation of the CMS, the compliance with and enforcement of CMS in Georgia is mostly reflected in implementation of the Agreements.

5. Environmental Standards and Norms

Environmental Quality Regulations and Standards

44. Within the context of the water supply and water drainage project, the environmental quality standards and norms are of primary importance. They define the quality of drinking water, admissible levels of surface waters pollution and measures of their protection including the zones of sanitary protection. The mentioned standards are considered under a separate clause (Clause 2.1.4). The maximum admissible levels of atmospheric air pollution and noise are also of a certain importance to the stage of building. Noise and atmospheric air pollution pose be a certain problem during the building operations (mainly, as the building techniques emissions and welding emissions) and exploitation of the rehabilitated objects (e.g. in case of operation of diesel-generators).

45. 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).

46. 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 A-1. 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	0.2	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

Table A-2. Maximum admissible concentrations of various substances and elements in soils

Heavy Metals

Component	Unit	Level
Arsenic	mg/kg	2-10
Copper	mg/kg	3
Mercury	mg/kg	2.1
Nickel	mg/kg	4
Lead	mg/kg	32
Zinc	mg/kg	23

Mineral Compounds

Cyanide	mg/kg	-
Sulphate	mg/kg	-
Chloride	mg/kg	-
Ammonium Nitrogen	mg/kg	-

Hydrocarbons

Compound Hydrocarbons	mg/kg	0.1
Phenol (Compound)	mg/kg	-

Volatile Organic Compounds

Benzoyl	mg/kg	0.3
Toluol	mg/kg	0.3
Ethylbenzene	mg/kg	-
Compound Xylene (ortho-, meta-, para -)	mg/kg	0.3

Semivolatile Compounds

Benzoapiren	mg/kg	0.02
Izopropilen-benzol	mg/kg	0.5

Pesticides

Atrazin	mg/kg	0.5
Linden	mg/kg	0.1
DDT (and its metabolite)	mg/kg	0.1

47. Noise Standards. The Georgian standards for noise control are approved by the Decree of the Minister for Health, Labour 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 A-3. 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

Table A-4. Georgian General Admissible Vibration Values in Residential Houses, Hospitals and Rest Houses, Sanitary Norms 2001

Average geometric frequencies of octave zones (Hz)	Allowable Values X_0, Y_0, Z_0			
	Vibro-acceleration		Vibro-speed	
	m/sec^2	dB	$m/sec * 10^{-4}$	dB
2	4.0	72	3.2	76
4	4.5	73	1.8	71
8	5.6	75	1.1	67
16	11.0	81	1.1	67
31.5	22.0	87	1.1	67
63	45.0	93	1.1	67
Corrected and equivalent corrected values and their levels	4.0	72	1.1	67

48. It is allowable to exceed vibration normative values during daytime by 5 dB during daytime In this table of inconstant vibrations, a correction for the allowable level values is 10dB, while the absolute values are multiplied by 0.32.
The allowable levels of vibration for hospitals and rest houses have to be reduced by 3dB.

ANNEX 2

DESCRIPTION OF ENVIRONMENTAL SETTINGS WITHIN A BROADER AREA SORROUNDING THE PROJECT SITE

1. General Physical-geographical description of the Project Area

49. The design object is planned to construct over the river Aragvi, at the confluence of the rivers Mtkvari and Aragvi, at 200-250 m up the estuary, against the current and is distanced by about 20 km from Tbilisi. According to climatic zoning (Köppen classification), it is located in the moderately humid subtropical climatic zone and is characterized by moderately humid climate., with moderately cold winter, hot summer and two precipitation minimums during the year (Korzakhia M., 1964).

Fig. A-1. Aero-photo of the city of Mtskheta. The view is photographed from the altitude of 7580 m

50. In a geographic respect, the city of Mtskheta is built over the extreme eastern edge of Shida Kartli plain. It is bordered by Saguramo ridge from the east, with “Saguramo Mta” (Saguramo Mountain) as its highest peak with the absolute height of 1385.5 m. From the west, it is bordered by Trialeti ridge with its eastern piedmonts, with the peak “Gogoti” (the same as Gogoti hillock) as the nearest peak with its absolute altitude of 1095.1 m, with the peak “Didgori” with its absolute altitude of 1274.8 m bordering Mtskheta from south-west. The city of Mtskheta is located at 480 m altitude above sea level.

51. The area to be studied, according to the tectonic zoning by Gamkrelidze P. (1961) (See photo 3), is located in Mukhrani-Tiriponi subzone of eastern subsidence zone of the Georgian block. It is built mostly with Cainozoic deposits and is presented mostly by a tertiary portion. However, the most ancient deposits outcrop on the area adjacent to Mtskheta, south-west of the city, in Mtskheta anticline arch (the right bank of the river Mtkvari). These are Upper Cretaceous

rocks (k_2). The tertiary formations are presented as Paleogenic (Pg) and Neogenic (Ng) age deposits, mostly with Paleocene-Lower Oligocene (Pne_1) and Miocene (Mio) deposits.

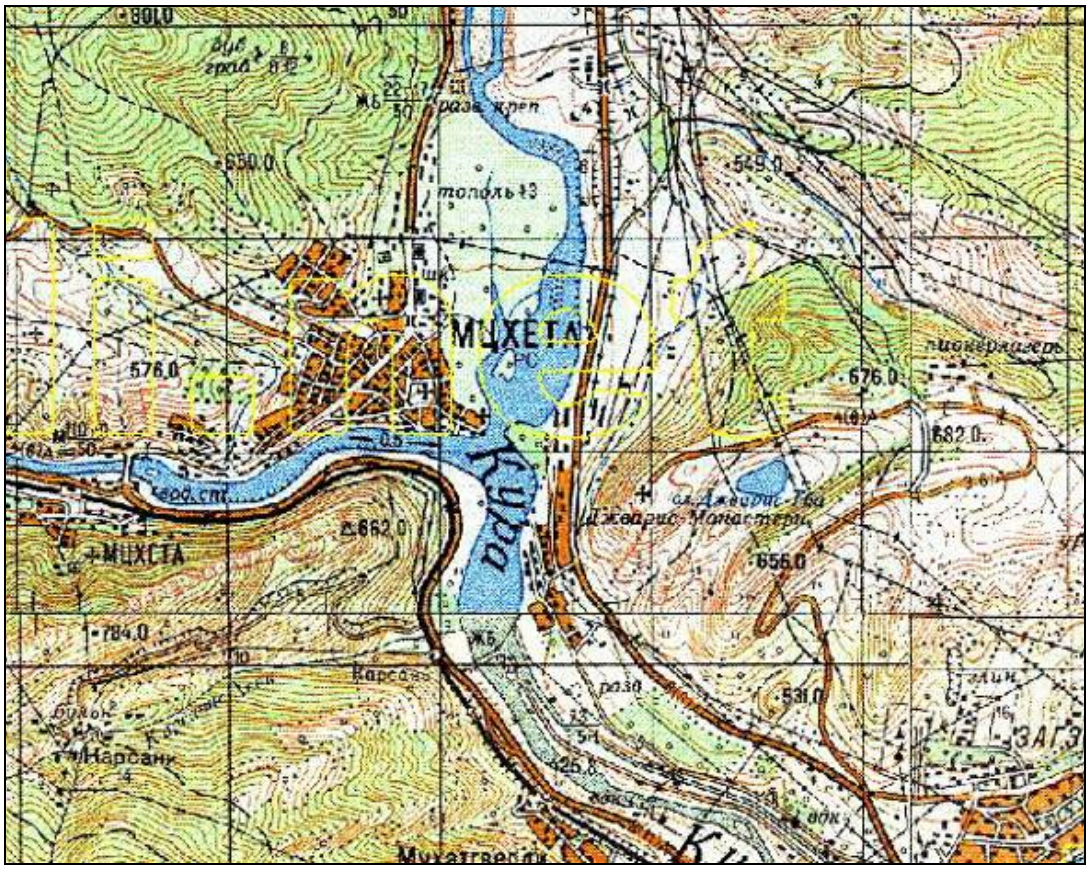


Fig. A-2. Location of the geomorphological elements and hydrographic network in the city of Mtskheta and its adjacent territory (topographic scale 1:50 000)

52. In respect of modern geodynamics (landslides, mudflows), the region is located in the zone of the I category, with zero probability.

Fig. A-3. Tectonic map of Georgia. Scale 1:600 000 (Gamkrelidze P., 1961)

53. The alluvium spread in the gorges of the rivers Mtkvari and Aragvi are also worth attention. They are seen on the map (Photo 3) and we will consider them in details later.

54. According to the immediate seismic hazard map, the city of Mtskheta and its adjacent territories are included in the zone with 8-point micro-seismic intensity what should be necessarily considered when designing any construction object.

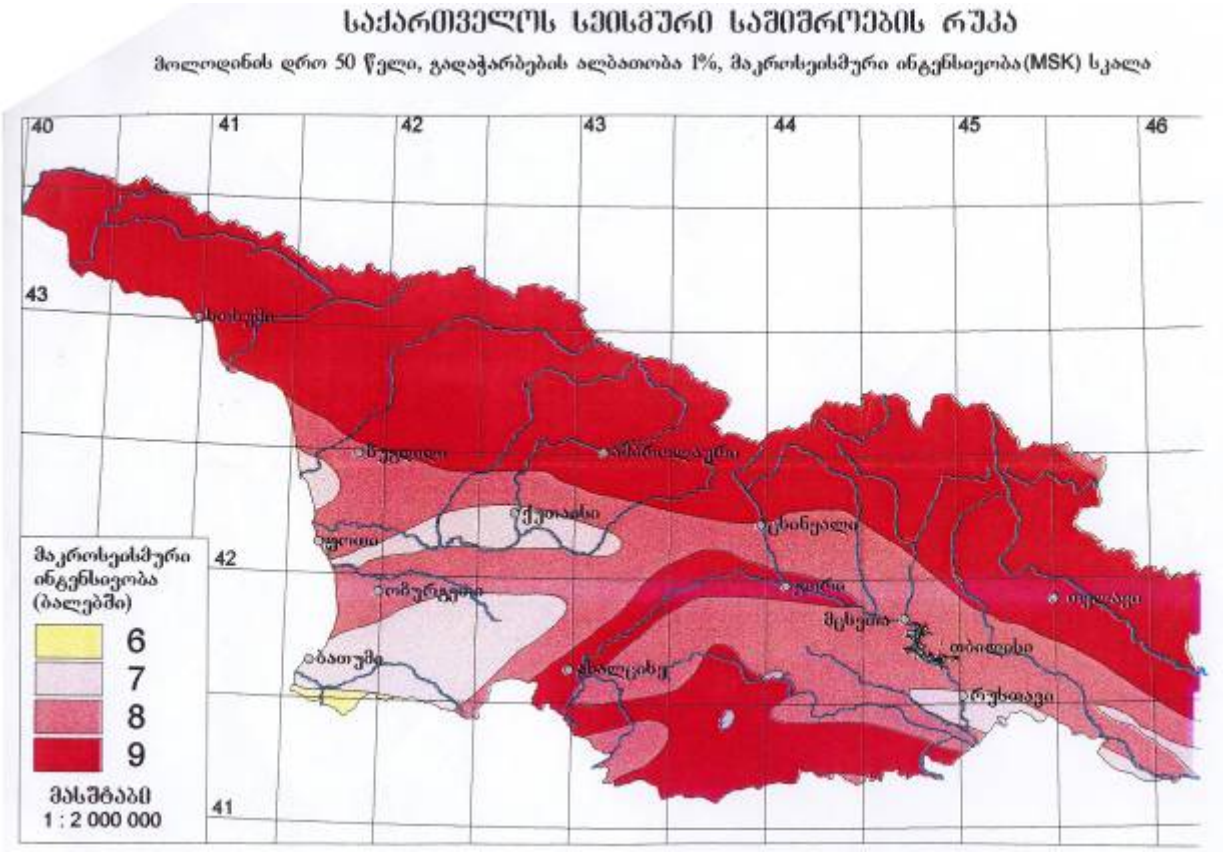
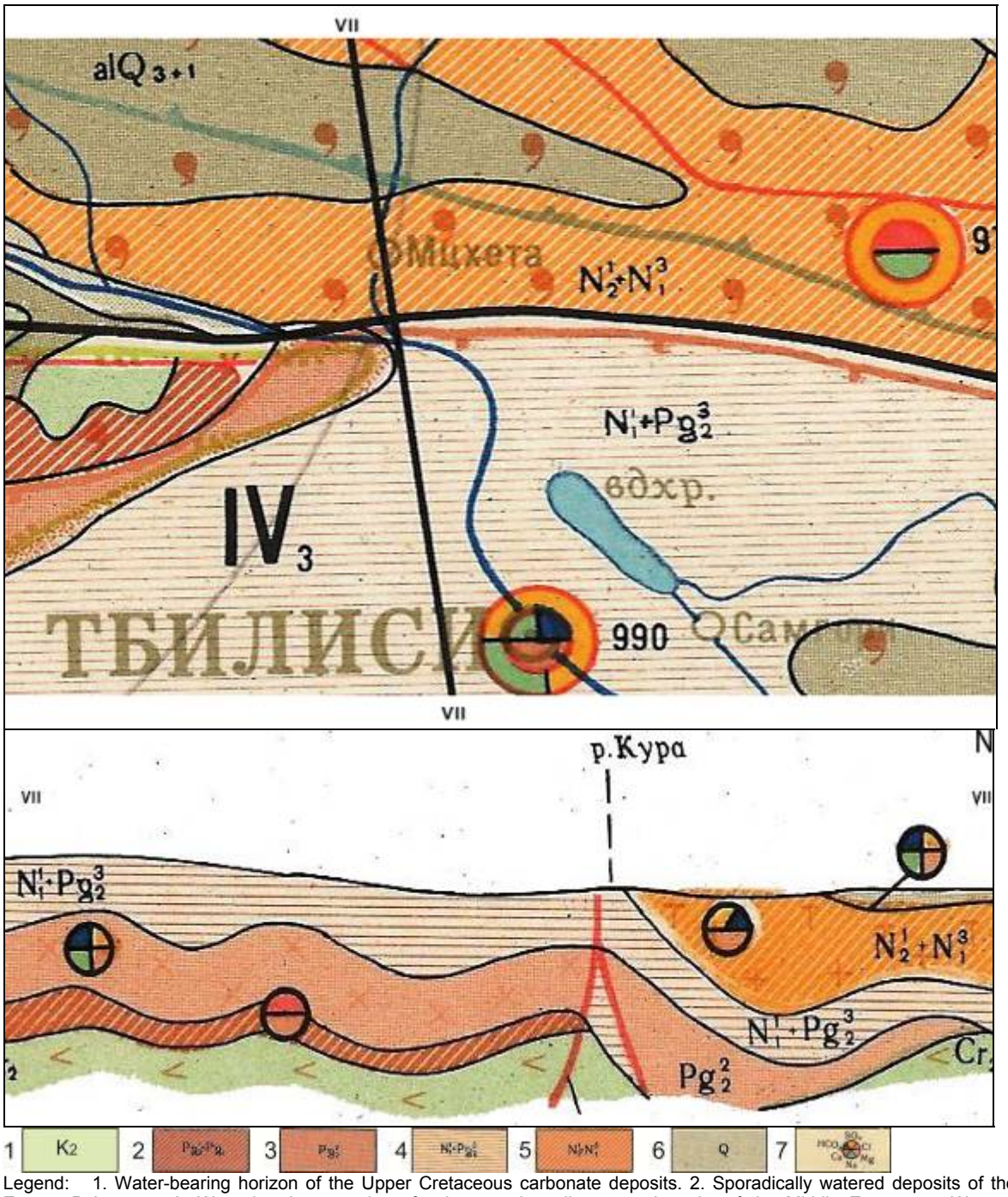


Fig. A-4. Map of Seismic Risks of Georgia

55. In a hydrogeological respect, the given territory is located in the artesian zone of the Georgian block and is the territory in the central part of the hydrogeological region of porous and fissure waters of Kartli artesian basin (Buachidze I., 1970). There are ground waters associated with mother-rocks (deep circulation waters) as well as delluvial and alluvial deposits (waters of no-deep circulation) (i.e. located near the surface). In one of the wells bored on the territory of Mtsketa (well No. 200), the outflow of the water containing Cl, HCO_3, Mg and Na, of deep circulation with little output with the mineralization of 6.2 gr/l was fixed (Buachidze I., Tsertsvadze N. et al, 1970). The terrigenous deposits of Oligocene and Miocene age are water-bearing, and it is Oligocene “Sakaraulo” horizon within the limits of the design zone, with its location elements and lithological content contributing much to the present relief of the southern strip of the given region.

56. The main artery of the hydrographic network of the city of Mtskhet, its adjacent territory and of the given region in general is the river Mtkvari, which is the largest river not only in George, but all over the South Caucasus. The river Mtkvari heads in Turkey, flows over the territory of Georgia and into the Caspian Sea after Azerbaijan. Its total length is 1364 km, with 350 km section flowing across the territory of Georgia. The total area of its catch basin (F) is 188 000 km^2. The river is fed with rain, snow, glacial, ground and underground waters, and its water regime is determined by seasonal snow melting and atmospheric precipitations. The river is maximally water-carrying in spring, with the runoff of 47-58% of the annual flow in the given

period. The summer runoff is more than autumn or winter runoffs and rarely exceeds 27%. The river has maximally low flow in summer and winter. In addition, it should be noted that there was a case of the level of the river Mtkvari raising over the low-water level by 6 m during the spring flood (April 18, 1968).



Legend: 1. Water-bearing horizon of the Upper Cretaceous carbonate deposits. 2. Sporadically watered deposits of the Lower Eocene-Paleocene. 3. Water-bearing complex of volcanogenic-sedimentary deposits of the Middle Eocene. 4. Water-resisting lagoon-marine deposits of the Lower Miocene, Oligocene and Upper Eocene. 5. Sporadically watered lagoon-continental deposits of Miopliocene. 6. Water-bearing horizon of the Quaternary deposits. 7. Chemical content of waters (old indices are used to denote geological age).

Fig. A-5. Hydrogeological structure of the city of Mtskheta and its adjacent territories. A fragment from the hydrogeological map of Georgia. Scale 1:600 000 (Buachidze I., Chumburidze, 1970)

57. The river Aragvi flows along the eastern edge of the city of Mtskheta and it confluences with the river Mtkvari at the given location (Photos 1, 2, 5, 6, 7) forming its left tributary. The river Aragvi heads over the southern slopes of the Caucasioni as Tetri (White) Aragvi and Shavi

(Black) Aragvi. Below, at the altitude of 1040 m above sea level, at settlement Pasanauri, the two rivers merge to form the river Didi Aragvi, which is at present commonly called the Aragvi. The length of the river is 66 km, its mean slope is 9.1‰, the area of its catch basin (F) is 2740 km^2 and its average altitude is 1600 m. The river is fed with melting snow, rain, ground and underground waters. Its water regime is determined by seasonal snow melting and atmospheric precipitations. The river is characterized by spring and summer floods, autumn freshets and winter low-water periods. It should be noted that in 1985, Zhinvali water reservoir was constructed and put into operation, which has regulated the runoff in the lower reaches of the river.

58. In 1927, Avchala hydro-power station was constructed. The headworks of its derivation channel forms a water reservoir with the volume of 800 000 m^3 distanced from the confluence of the rivers Mtkvari and Aragvi by 1 km only. The water reservoir has naturally caused the river flooding, which covers a distance of about 8 km of the length of the river Mtkvari (against the current) and the estuary of the river Agarvi is located within the zone of flooding. The flooding distance of the river Agarvi spreads for about 2 km from the confluence along the current what should be given due consideration, as the construction area of the design object is located within the limits of the given zone.

8	**Brown Forest weakly unsaturated – Eutric cambisoils**
31	**Brown soils**
32	**Cinnamonic Calcareous-Calcaric cambisols and calcic Kastanozems**
33	**Brown light soils**
34	**Meadow cinnamonic-Calcaric cambisols and Calcic Kastanozems**
44	**Alluvial carbonatic soil**

Fig. A-6. Soils spread in the city of Mtskheta and its adjacent territories. A fragment from the "Soils of Georgia". Scale 1:500 000 (Urushadze T. et al, 1999).

59. The surrounding ridges and adjacent territory of the city of Mtskheta, in respect of soil types, according to the ground zoning of Georgia (Sabashvili M., 1965), are included in the "zone of transient forest-and-valley and forest soils eastern Georgia plains" of the "sub-zone of the intermontane plains and plateaus" included in the "soil zone of eastern Georgia", with a "sub-region of brown meadow, alluvial carbonatic and bogged soils of Mukhrani plain" as an

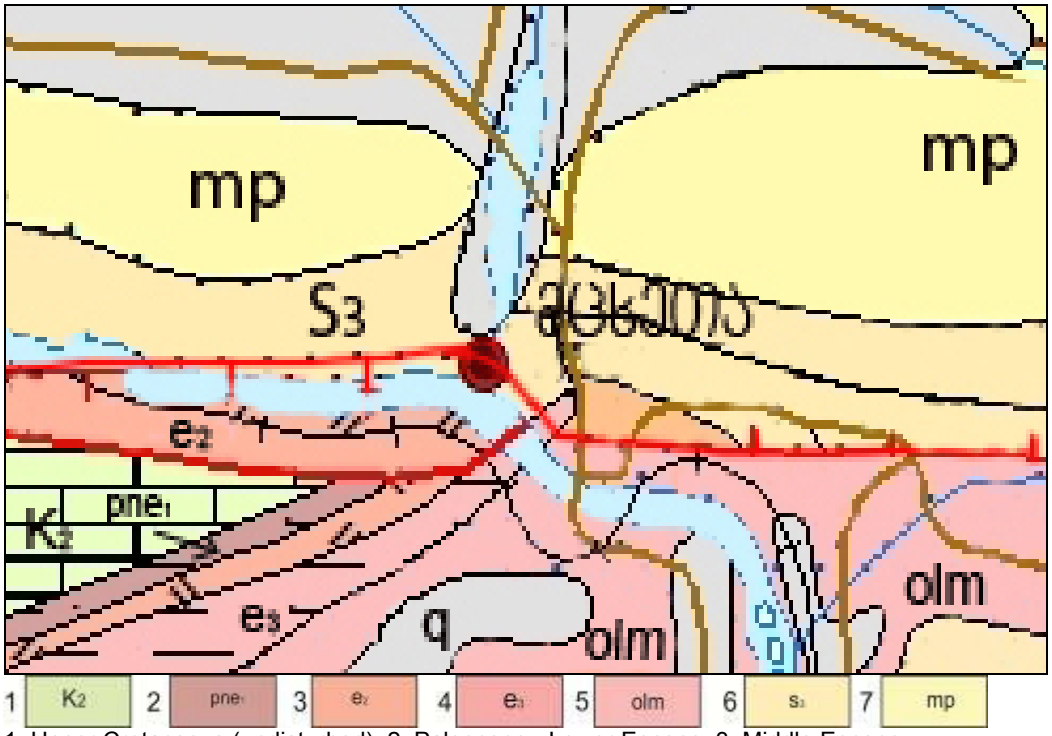
individual unit. The given region is mostly characterized by brown, brown-carbonatic and alluvial-carbonatic soils. However, there are also light brown and brown meadow soils spread on the adjacent territories. As for the design area, the alluvial-carbonatic soil prevails in it. The floodplain vegetation in the vast floodplain forms a peculiar phyto-landscape.

60. The design area is bordered by Saguramo State reserve from the east, which is at present the part of Tbilisi National Park.

2. Geology, Geomorphology, Hydrogeology

Geology of the city of Mtskheta and its adjacent territories

61. Out of the constituent rocks of the city of Mtskheta and its adjacent territories, the most ancient ones are the Upper Cretaceous deposits (K_2) outcropping in Mtskheta anticline arch (some works mention Zenadrisi-Mtskheta anticline) as minor residues, south of Mtskheta, on the right bank of the river Mtkvari and therefore, we will start the characterization of the constituent deposits of the city of Mtskheta and its adjacent territories by describing them.



1. Upper Cretaceous (undisturbed). 2. Paleocene - Lower Eocene. 3. Middle Eocene.
4. Upper Eocene. 5. Oligocene - Lower Miocene. 6. Upper Sarmat. 7. Meotic-Pontic.

Fig. A-7. Geology of the city of Mtskheta and its adjacent territories. A fragment from the geological map of Georgia. Scale 1:500 000 (Adamia Sh., Gujabidze G., 2004).

62. The Upper Cretaceous deposits are presented as grayish and sometimes as white thin-layer (0,4 m) limestones and marl limestones. At some places, they shift to greenish-grey thin-layer limestones with the greenish-grey clay interlayers. In the north, the given deposits are overthrust over the Upper Eocene tufogenic sandstones (with Saskhori fault) and in the south, the Paleocenic deposits continue them in conformity, without an angular unconformity.

63. The Paleocene - Lower Eocene formations are presented by sandy-clay tufogenic rocks of a Flysch nature. The two sub-stages are impossible to isolate from one another because of their identical lithology and absence of fauna. In the city of Mtskheta and on its adjacent territories, they outcrop only on the southern slope of Mtskheta anticline. They are much distanced from

the confluence of the river Mtkvari and river Aragvi and are therefore, of less interest for the given project.

64. The Middle Eocene deposits are spread over the northern wing of Mtskheta anticline. They are thick-layer, coarse-grain tufa-sandstones, tufa-breccias, clays and conglomerates. The total thickness of these deposits exceeds 500 m.

65. The fragment outcrops of the **Upper Eocene** rocks are fixed on the right bank of the river Mtkvari (Karsaniskhevi). The given deposits are presented by alternating layers of dark grey slated clays and yellowish-grey, coarse-grain and sometimes tufogenic sandstones. The given deposits contain buried vegetation remains.

66. The sandstones of the Lower Miocene regional stages, in particular, "Sakaraulo horizon" and "Kotsakhuri horizon", which spread west of the city of Mtskheta, in Gori-Kaspi region **do not spread** at Mtskheta or east of it (i.e. they do not occur within the confluence zone of the Mtkvari and Aragvi) and are facially replaced by clay facies of the Maykop stratum. (Buleishvili D. 1964) (Photo 6).

67. The Maykop stratum (which is considered as the Lower Miocene in the study area) is presented by typical "Maykop", thin-layer, gypsum and jarosite clays with sandstone interlayers. At some places, it contains quartz-containing sandstones packs. Its total thickness exceeds 500 m (Photo 6).

68. The Chokrak deposits outcrop near Mtskheta, in the gorge of the Aragvi, where, with angular unconformity and with conglomerate in their base (2.5 m), they continue the rocks of the Maykop stratum. These are mostly the alternating layers of sandstones and clays (Dzigrashvili A., 1949; Buleshvili D., 1964; Chikovani A., 1964). The thickness of the Chokrak deposits on the given location is 60-65 m.

69. In the same section, the Chokrak deposits are continued by Karagan deposits with full conformity (from bottom upwards in a stratigraphic respect). They are with clay, dark, sometimes with quartz.

70. The Karagan deposits are presented by alternating layers of thin-layer, sometimes carbonatic clays and (thin-layer and average-grained) sandstones (Dzigrashvili A., 1949). The thickness of the Karagan deposits on the given location does not exceed 50-60 m.

71. On the same location, **the Konche** deposits with clear paleontologic dating continue the Caragan layers in conformity. They are mostly alternation of thin-layer clays and sandstones (Photo 5). The total thickness of the given deposits is 35 m only (Dzigrashvili A., 1949; Buleishvili D., 1964).

72. The Sarmat deposits continue the Konche layers lying below them in conformity (Dzigrashvili A., 1949; Buleishvili D., 1964). These are a set of 300-m-thick carbonatic clays, average- and coarse-grain carbonatic sandstones and clay sandstones stacks. The rock made of fossile fauna) is frequent in its lower part. The given deposits are also well dated in a paleontological respect.

73. The Mio-Pliocene deposits in the city of Mtskheta and on its adjacent territories are presented by Dusheti stratum, which never outcrops totally. These are mostly conglomerates made up of well-rounded, quite dense sandstones and stone circles of different volcanogenic rocks, clays and sandy clays. The total thickness of the stratum at some locations exceeds 700 m.

74. Out of **the Quaternary** formations, one should mention the terraces of the river Mtkvari and the river Aragvi. Mtskheta settlement and its environs are located on the II terrace of the Mtkvari. Its height is 25-35 m and is built with alluvial or lacustrine deposits (Tsagareli A., 1964).

These are mainly conglomerates and well-rounded stone circles slightly cemented with the sandy-clay mass. At some locations, the conglomerates (horizontally and vertically) are replaced by clay loams. The same rocks structure the terrace of the river Aragvi, which coincides with the mentioned terrace of the river Mtkvari and is built with similar alluvial deposits (Dzigrashvili A., 1949; Tsagareli A., 1964). The city of Mtsketa and its adjacent territories also have delluvial (slope) and prolluvial (mudflow) deposits.

75. On the southern edge of the territory of the city of Mtsketa, there are two lateral, parallel faults fixed. The first one, so called "Saskhori fault" follows the river Mtkvari, passes the southern-eastern edge of Mtskheta and crosses the river Aragvi (Gamkrelidze, 1961; 1964. Papava I., Ageev V., 1960; Dzigrasjhvili, 1949) - right across the zone of the design area (Photos 3, 5, 7). This significantly increases the degree of geo-hazard. Further in the south, in 0,5-1,5 km only, there is a fault fixed (Dzigrasjhvili, 1949; Papava I., Ageev V., 1960) what even more complicates the existing situation. Nearby, at a great joint of the river Mtkvari (i.e. at the confluence of the river Mtkvari and the river Aragvi), "Saskhori fault" is covered by the Upper Miocene deposits overthrust through "Jachvi-Khashmi" fault from the north (Dzigrasjhvili, 1949) what is an additional risk-factor in respect of the existing geo-hazard.

2. Description of the design area

76. Detailed geotechnical studies of the project site have been completed by Geoengineering Ltd in May 2012 as a part of the Detailed Design works.

77. This report includes the results of geotechnical survey performed by GeoEngineering Ltd for the new road bridge location site in city Mtskheta, near confluence of the rivers Mtkvari and Aragvi, adjacent to Svetitskhoveli. The basis for execution of works is Contract # GC-1213 between TRANSPROJECT Ltd and GEOENGINEERING Ltd of April 24, 2012. The works required for investigation of the area were executed within the period from 25.04.2012 to 18.05.2012, including:
- Field works – from 25.04.2012 to 01.05.2012;
- Laboratory investigation works – from 02.05.2012 to 15.05. 2012;
- Analysis of investigation works results and preparation of technical report – within the period from 15.05.2012 to 18.05.2012.
- Types and scopes of the engineering survey works are given in Table 1.1 below

LOCATION AND RELIEF CONSITIONS

78. Geomorphologically the bridge project area belongs to the Georgian intermount trough area and is located between the eastern end of Mtskheta anticlinal ridge and the western end of the Saguramo range, in the river Aragvi bottom part. Here, the left bank of the river Aragvi represents the II above-flood plain terrace elevated at 16 meters from the rivers current level, while the right bank is a low technogenic terrace. The right terrace formed as a result of sandgravelly sediments accumulation carried by the river to the Zahesi reservoir, on which later on an artificial mound wa sarranged in order to make use of the area no longer good for the reservoir.

79. The artificially plained area is quite wide and in the west it transfers into the Aragvi above-flood plain terrace II on which part of the city and Svetitskhoveli cathedral are located. The right terrace surface, on which Tbilisi-Natakhtari main highway is located, gradually goes up and then transfers into the steep slope of the mountain on which the Jvari monstery is located.

GEOLOGICAL STRUCTURE AND SEISMICITY

80. Stratigraphically this slope of the Mtskheta anticline, which also includes the survey area as weel, is structured with Lower Neogene, specifically, Mid-Eocene (N12) marine-mainland sediments. Lithologically, the sediments are represented by thin and medium-layered argillitelike

clays, thin interlayeres of sandstone and hard sand. In the neighbourhood of Mtskheta, in the suite sometimes are mixed strata and members of marls, chalkstone or conglomerates, including members of massive sandstone layers, though, in the boreholes drilled on the site of the bridge crossing these lithologies have not revealed.

81. In the outcrops on the slopes of the valley, dip azimuth of the strata is northward (from 0 to 10 degrees and within the range from 325 to 360), while dip angle varies from 300 to 800. High dip angle is registered in the cores taken from the boreholes.

82. Within the investigarted bridge crossing site, neogenebasic rocks are overcovered by 2-5 m thick layeres of rounded cobbles and loam soil,as well as delluvial clays and technogenic fill soils.

83. Based on the geological literature and archive materials, near the survey site, south of it lies a regional tectonic fault, which on the east (from Martkopi side) follows along the southern basis of the Saguramo range, goes to the Mtkvari and the Aragvi confluence, and then, in the west follows along the Mtkvari bank.

84. In accordance with the Construction Rules and Regulations currently effective in Georgia, Antiseismic Construction (PN01.01-09), seismicity of the investigated site is intensity 8 by MSK64 scale, with dimensionless seismic coefficient A= 0.16.

ENGINEERING HYDROGEOLOGICAL AND GEODYNAMIC CONDITION

85. Hydrogeologically, the greatest aqueous and water abundant stratum is STRATUM-4 of old alluvial rounded cobbles, which is in direct hydraulic connection with the river, is located on practically impermeable basic rocks – mudstone suite.The filler of the cobbles is various-grained sand, therefore, filtration coefficient of the stratum will presumably be from 50 to 80 in 24 hours. Also aqueous is the cobbles and sandy soils fill, located over STRATUM-4 on the right bank of the river –STRATUM-4. In borehole #1 drilled here, ground water level was registered at 0.9 m depth. High water table (2.5 m) was also registered in borehole #2 drilled on the left bank. As for borehoel #3, drilled on the high terrace, next to the highway, here ground water table was registered relatively deeper – at 5.6 m depth. Ground water here as well is contained in alluvial cobbles stratum. Presumably, being distanced from the river, ground water supply gradually decreases and within the area of Borehole #3, show of water must not be intense. In the excavation pit (if such is arranged based on construction technology) show of water will be active near the river banks.

86. In geodynamiv terms, the only hazard for the bridge abutments and especially bridge access mounds is represented by the deep and lateral erosion processes taking place on the river Aragvi banks and river bed. Deep erosion is practically insignificant, as the river here joins the reservoir and the river bed has insignificant fall. Due to the same reason, lateral erosion is not active either, though, rising water level during floods, or drawdown of the upper (Zhinvali) reservoir creates hazard to the base of the bridge access mound.

SOILS CHEMICAL COMPOSITION AND AGGRESSIVENESS

87. In order to determine aggressiveness of the environment against structural units, soils and ground waters analyses were performed, degree of the environment's aggressiveness was determined. The results of the study are given in Annex-5. Based on the results of the chemical analysis:

 BH#1 – Based on the chemical analysis of soil water extract, (11.8-12.0 m depth) the environment shows strong sulphate aggressiveness against W4 and W6 type water permeability concrete made with portland cement and slag portland cement (State Standard 10178-76), as wll as with sulphate-resistant cement (Sytate Standard 22266-76).

88. It is very aggressive against W8 type concrete made with portland cement and slag portland cement (State Standard 10178-76); and it is moderately aggressive against W8 type concrete made with sulphate-resistant cement.

 BH#1 – Based on the chemical analysis of soil water extract, (14.5-15.0 m depth) the environment shows strong sulphate aggressiveness against W4 type water permeability concrete made with portland cement, slag portland cement and sulphate-resistant cement; it is very aggressive against W6 and W8 type concretes made with portland cement and slag portland cement; it is moderately aggressive against W6 type concrete made with sulphate-resistant cement and slightly aggressive against W8 type concrete made with sulphate-resistant cement.

 BH#1 – Based on the chemical analysis of soil water extract, (19.4-19.7 m depth) the environment shows strong sulphate aggressiveness against W4 type water permeability concrete made with portland cement, slag portland cement and sulphate-resistant cement; it is very aggressive against W6 and W8 type concretes made with portland cement and slag portland cement; it is moderately aggressive against W6 type concrete made with sulphate-resistant cement and slightly aggressive against W8 type concrete made with sulphate-resistant cement. By Chloride component, the soils revealed in BH#1 do not show any aggressiveness.

 Based on the chemical analysis of ground water taken from **BH#2 and BH#3,** the environment shows strong sulphate aggressiveness against W4 and W6 type water permeability concrete made with portland cement and slag portland cement (State Standard 10178-76). Moderate sulphate aggressiveness has revealed against W8 type concrete made with the same cements, and no aggressiveness revealed against any concrete made with sulphate-resistant cement. The environment is slightly or moderately aggressive against concrete reindorcement during its recurrent waterlogging, and is not aggressive during permanent waterlogging.

CONCLUSIONS

89. By climate conditions, the region including the project area is attributed to IIb subdistrict as per Georgian Design Norm – Construction Climatology - PN 01.05-08;

90. Lithologically, the area is represented by Lower Neogene (Mid-Eocene) (N12) marrinesedimented rocks – mudstones and sandstones (STRATUM-5). On the Lower Nreogene sediments suite lie contemporaneous alluvial (STRATUM-4 ans STRATUM-3), delluvial (STRATUM-2) and technogenic (STRATUM-1) clayey and gravelly soils;

91. The project bridge abutments should be based on hard rocks, namely on STRATUM-5. The base of bridge abutments should be deepened into the rock mass to such a level, that its bottom exceeds the elevation of hard rocks surface at not less than 4 meters depth. In calculations for the abutments base, values should be used from Table 3.13 and Table 4.1;

92. In geodynamic terms, slightly expressed deep erosion and relatively more actively expressed lateral erosion of the river Aragvi should be taken into account. The bases of the bridge access mounds also require protection against erosion processes;

93. In terms of hydrogeology, ground waters are contained in alluvial and technogenic soils located on hard rocks. The hard rocks themselves are practically impermeable in the depth. Deeper than the river level, different amount of ground water show is likely at any level;

94. Based on the performed chemical analyses, soil and ground waters reveal different degree of sulphate aggressiveness against concretes. Due to the said, for concretes it is recommended to use sulphate-resistant cement, especially for bridge abutments; the factor of chloride aggressiveness against concrete reinforcement should also be takan into consideration in case of its recurrent waterlogging.

95. Maximum allowable angle of inclination of about 5 m high temporary slope in clayey soils should be 1:075 (530), and in gravelly soils 1:1;

96. In accordance with the Construction Rules and Regulations currently effective in Georgia, Antiseismic Construction (PN01.01-09), seismicity of the investigated site is intensity 8 by MSK64 scale, with dimensionless seismic coefficient A= 0.16.

Standard values of the strata physical-mechanical parameters

Soil stratum / bench #	Soil Description	Density ρ, t/m^3	Voids ratio, e	Consistency index, I_L	Internal friction angle, φ°	Cohesiveness, c, KPa	Deformation Modulus E_D, MPa	Modulus of elasticity, E_{el} MPa	Unconfined compressive strength of rocks, R_c MPa	Design strength R_0 MPa	Soil group as per CHиП-IV-5 -82
1	Clayey sandy GRAVEL with cobbles content, with sand interlayers at some places. Gravel and cobbes are rounded – FILL (Contemporaneous Man-made Deposits)	1.75	-	-	-	-	-	-	-	-	6-a
2	Very stiff, brown, slightly sandy, slightly gravely (5-10%) CLAY. Gravel is angular, the soil is intermediately – Contemporaneous Deluvial Deposits, dQ_{IV}	1.78	0.829	-0.05	22	22	14	-	-	-	33-f
3	Soft, gray, slightly sandy, slightly gravely (5-10%) CLAY with organic content. Gravel is rounded, the soil is intermediately – Contemporaneous Alluvial Deposits, aQ_{IV}	1.90	0.884	0.68	18	22	13	-	-	-	33-f
4	Saturated, dense, slightly sandy GRAVEL with cobbles content. Gravel and cobbles are rounded – Contemporaneous Alluvial Deposits, aQ_{IV}	1.95	-	-	40	1	40	-	-	-	6-f
5	Weak, blackish-gray MUDSTONES (80%) with thin sandstone and dense sand (20%) interlayers. Middle Miocene. Marine sedimentary [N_1^2]	2.21	-	-	-	-	-	-	3.69	-	3-a - 80% 28-b - 20%

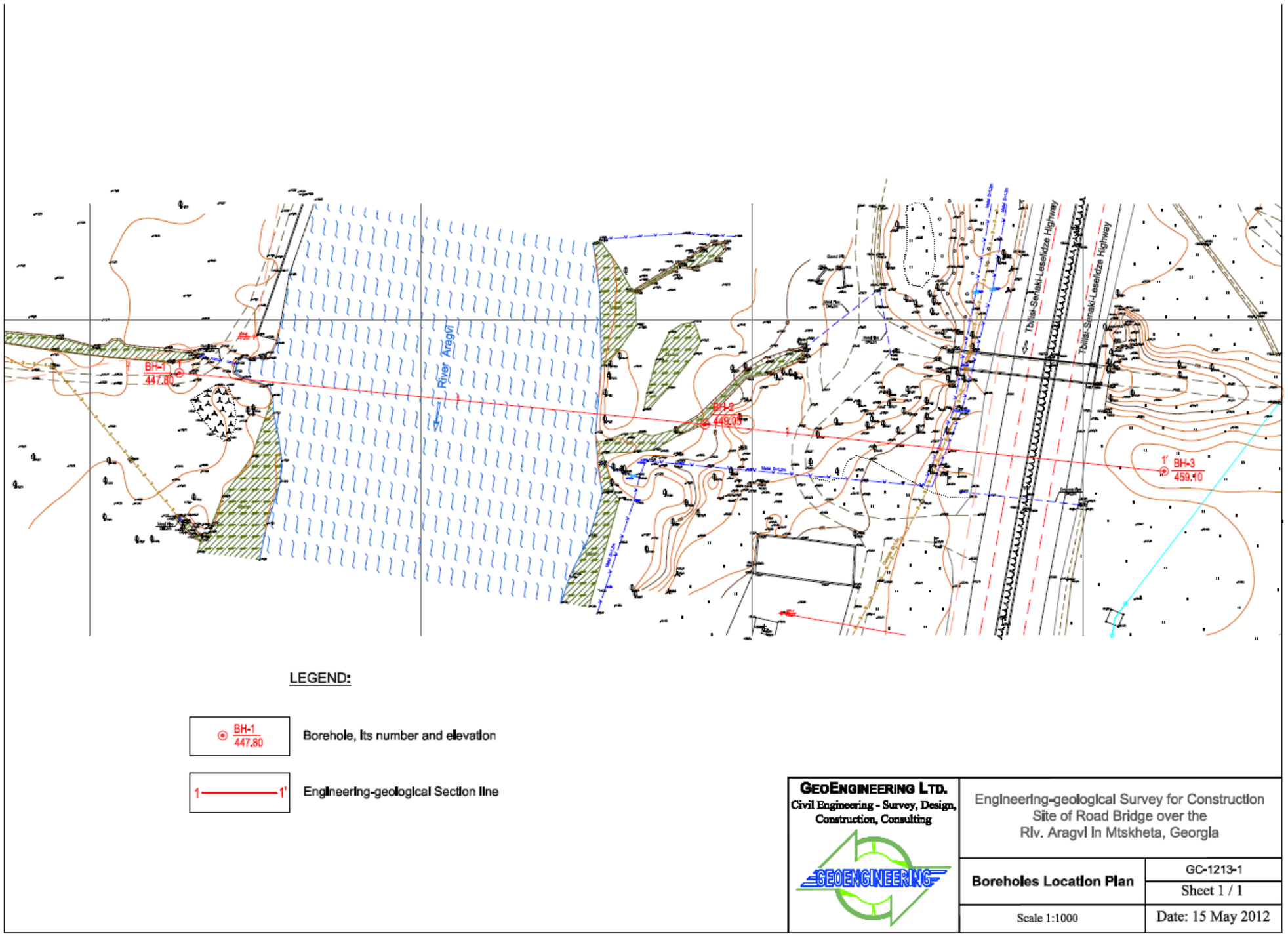


Fig. A-8 Plan of boreholes and cross-section

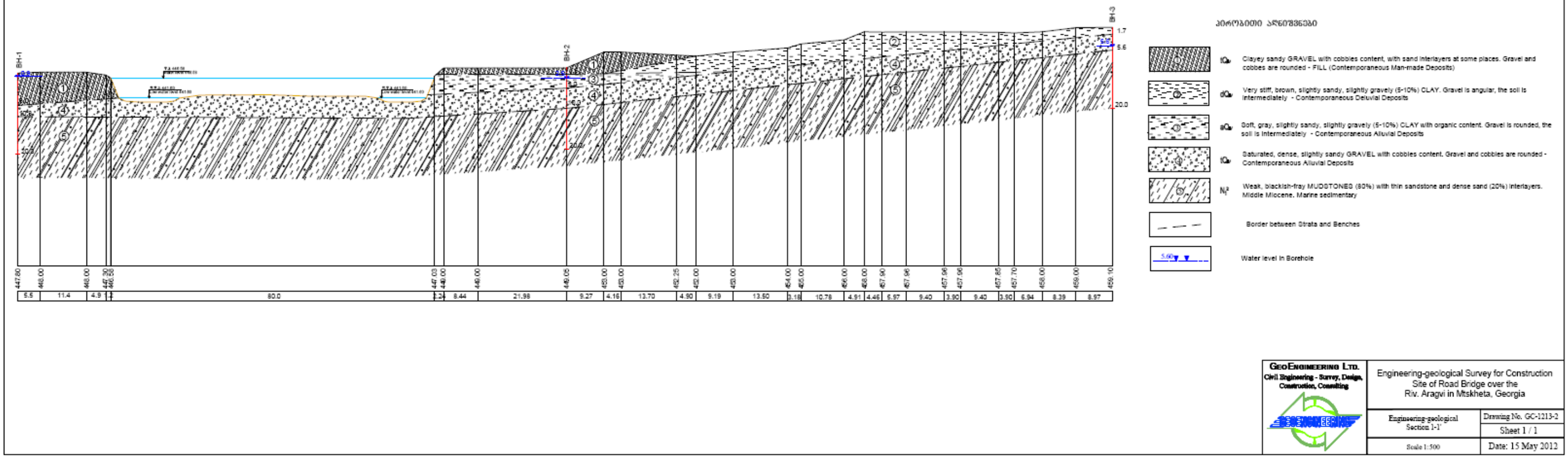


Fig. A-9. Geological Cross-section