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Preparation of Pre-Feasibility Study and Feasibility Study for Samtredia – Zugdidi Bypass Road (including Access Road to Anaklia Deep Sea Port)

Draft Environmental Impact Assessment Report

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1. Introduction

The Government of Georgia is implementing a program to upgrade the major roads of the country, managed by the Roads Department (RD) of the Ministry of Regional Development and Infrastructure (MRDI). The program aims to improve transportation and transit of goods to surrounding countries, which is a significant and growing contributor to GDP.

Transport of goods into and through Georgia has increased over the past 10- 15 years as markets have expanded following the breakup of the Soviet Union, and Georgia is now a major transit country. Almost two-thirds of goods in Georgia are transported by road, and haulage by domestic and international truck companies is very evident on the country's highways. However many roads are poorly equipped to cope with the volume of traffic and the proportion of heavy vehicles, and factors such as insufficient dual carriageways, routing through inhabited areas and inadequate maintenance and repair, hinder throughputs and increase transit times. This creates difficulties for haulage companies and their clients, truck drivers, Georgian motorists and local residents.

This report reflects environmental analysis for Samtredia – Zugdidi Bypass Road (including Access Road to Anaklia Deep Sea Port, which will be jointly financed by the Government of Georgia.

The ToR defines that the report should describe intermediateenvironmental restrictions, preliminary findings / results and recommendations.

The propose of Environmental and Social Assessment prepared for feasibility stage of the project is to determine, which are the most critical issues to study in depth in the detailed EIA. The scope of assessment is based on: the terms of references for the project, the baseline date for the area, results of pre-feasibility study, EIA requirements of the World Bank best practice guidelines..

Objective of this assessment is to:

- identify sensitive environmental, social, and cultural heritage receptors within the project corridor
- examine the project's potential adverse and positive environmental and social impacts and recommend measures needed to prevent, reduce, mitigate, or compensate adverse impacts and to improve environmental and social performance;
- analyse project alternatives in cooperation with the design team to integrate environmental, social aspects into selection of the optimal alignment;
- ensure that affected communities are appropriately engaged on the issues that could potentially affect them; and
- develop Environmental Management Plan (mitigation programme, monitoring plan, allocation of responsibilities for implementation and control) and assessment of institutional capacity for its implementation.

Structure of environmental and social assessment chapter is given below:

- General information and methodology.
- Legal and policy framework, administrative aspects.
- Baseline status of environment (regional and local environmental baseline -physical environment, biological environment and socio-economic conditions.
- Analysis of Alternatives.
- Environmental Impacts and Mitigation Measures.
- Environmental Management Plan – for the pre-construction, construction and operational stages of the Project.

2. Methodology

Environmental and social assessment process was a combination of desktop and field work, comprising literature review, data collection from primate and secondary sources of information, visual observation along the RoW with subsequent analysis of all collected information.

The surveys carried out on feasibility stage of the project included data gathering on –

physical resources: topography, climate and climate change (meteorological data, including atmospheric pressure, air temperature, relative humidity, precipitation, wind speed and direction), air quality, geology, soil , hydrology, natural hazards

biological resources: vegetation/flora and fauna (including IUCN, Georgian red list and other protected species), Protected Areas (Kolkheti National Park), Important Bird Areas and Emerald network nominated site.

socio-economic resources: demography, economic conditions, education and healthcare facilities, landuse, physical cultural resources, available infrastructure and utilities, noise and vibration

For the needs of assessment the following boundaries have been set:

The ToR determines that the assessment process will be implemented in a two measures (phases).

- Measure 1: Feasibility study of the project. Definition possibility of project implementation.
- Measute 2: Detailed engineering project, including detailed environmental impact assessment.

The intermediat stage aims to prepare report that describes the environmental and social limitations, key findings / results and recommendations.

At this stage, an environmental impact assessment team was conducted analyses to detail the positive and adverse effects of the project on the environment, and recommend appropriate solutions to minimize any undesirable effects. The analyses will includethe followings:

- Review necessity of the project and its role and importance for the national and regional level development plans;
- Review relevant policy, legal and administrative frameworks, including pertinent national and international legislation and guidelines; identify gaps between national and international environmental and social laws/guidelines;
- Description of the Environment baseline data;
- Preliminary impact assessment (negative, positive; direct, indirect; short, medium, long-term; reversible, irreversible, etc.) on sensitive receptors;
- Preliminari approaches/strategies and outline of mitigation measures;
- Health and safety issues, including sanitation issues for the road construction labour units, etc.
- Community health and safety issues;
- Gap analysis, ranking the gaps and specification of the scope of works for Environmental and Social Impact Assessment study.

3. Legislative and institutional framework

This chapter reviews the provisions for environmental protection in the laws of Georgia that are relevant to the proposed Project. It also discusses the potential implications of the international treaties to which the Republic of Georgia is a party. Finally, the administrative framework for environmental management is also described.

Legistlative and political framework

The ToR requries implementation of environmental analysis in accordance with Georgian legislation and the Environmental and Social Security Regulations of the World Bank.

This subsection provides a summary of:

- Environmental Legislation of Georgia –laws, regulations, standards;
- International conventions ratified by Georgia;
- The Administrative Framework;
- National Technical Regulations Relevant to the Project;
- Description of Environmental Permitting Procedure;
- Permit and Licenses Required for Off-site Works During Construction;

3.1. Environmental Policies and Laws of Georgia

Georgian legislation comprises the Constitution, environmental laws, international agreements, subordinate legislation, normative acts, presidential orders and governmental decrees, ministerial orders, instructions and

regulations. Along with the national regulations, Georgia is signatory to a number of international conventions, including those related to environmental protection.

The Ministry of Environmental Protection and Agriculture (MoEPA) of the Government of Georgia is responsible for regulating the activities that affect the natural environment.

List of environmental laws and regulations relevant to the project

Year	Law / Regulation	Consolidated version - Last revision	Code
1994	Law on soil protection	07/12/2017	370.010.000.05.001.000.080
1995	Constitution of Georgia	13/10/2017	010.010.000.01.001.000.116
1996	Law on subsoil	07/12/2017	380.000.000.05.001.000.140
1996	Law on environmental protection	07/12/2017	360.000.000.05.001.000.184
1996	On the system of protected areas	07/12/2017	360.050.000.05.001.000.127
1997	Law on wildlife	07/12/2017	410.000.000.05.001.000.186
1997	Law on water	07/12/2017	400.000.000.05.001.000.253
1999	Law on protection of atmospheric air	07/12/2017	420.000.000.05.001.000.595
1999	Forestry code of Georgia	07/12/2017	390.000.000.05.001.000.599
1999	Law on compensation of damage from hazardous substances	07/12/2017	040.160.050.05.001.000.671
2000	Law on regulation and engineering protection of the sea and river banks	05/05/2011	400.010.010.05.001.000.830
2003	Law on Red List and Red Book of Georgia	07/12/2017	360.060.000.05.001.001.297
2005	Law on licences and permits	23/12/2017	300.310.000.05.001.001.914
2003	Law of Georgia on conservation of soil and restoration-amelioration of soil fertility	07/12/2017	370.010.000.05.001.001.274
2014	Waste code	07/12/2017	360160000.05.001.017608
2017	Environmental Assessment Code	07/12/2017	360160000.05.001.018492

Brief summaries of the listed documents are given below:

The Constitution of Georgia 1995 (last amended in 2013)
The Constitution of Georgia is the supreme legal document establishing general principles concerning environmental protection. Article 37 states: "Everyone shall have the right to live in a healthy environment and enjoy natural and cultural surroundings. Everyone shall be obliged to care for the natural and cultural environment." In Constitution are formed the basic requirements about the need of environmental protection and information accessibility for people about environmental conditions.

Also, the Constitution of Georgia states that „the legislation of Georgia shall correspond to universally recognized principles and rules of international law. An international treaty or agreement of Georgia unless it contradicts the Constitution of Georgia, the Constitutional Agreement, shall take precedence over domestic normative acts (change is added by the Constitutional Law of Georgia of 30 March 2001).

Environmental Assessment Code (EAC). The Code establishes a legal basis for regulating issues related to projects and strategic documents, which implementation may have significant impact on the environment, human life and health. It regulates the procedures related to environmental impact assessment, strategic environmental assessment, public participation in decision-making, trans boundary environmental impact assessment; defines rights and obligations of the developer, the planning authority, the public and the competent authorities in the course of decision-making envisaged by this Code; describes procedures of issuing Environmental Decision; exemption rules. The law includes two annexes. Annex I lists activities subject to EIA, Annex II - lists activities/projects that require screening procedure. Screening is responsibility of MoEPA. Under the EAC construction of international and interstate roads; construction and operation of tunnels and/or bridges on the international and interstate roads belongs to activities subject to EIA. According to the document, the main stages of environmental impact assessment include:

(i) Screening;
(ii) Scoping procedure;
(iii) Preparation of the EIA Report by the developer or the consultant;
(iv) Ensuring public participation;
(v) Examination of the information presented in the EIA Report and any supplementary information provided by the developer to the Ministry as well as assessment of the information received through the public participation and consultation processes;
(vi) Expertise procedure;
(vii) Implementation of transboundary environmental impact assessment procedure (weather appropriate);
(viii) Issuance of Environmental Decision or the decision on refusal to implement the project by the Minister.

Law of Georgia on Licenses and Permits
regulates legally organized activities posing certain threats to human life/health, and addresses specific state/public interests, including usage of resources, regulates activities requiring licenses/permits, determines types of licenses/permits required, and defines the procedures for issuing, revising and cancelling of licenses and permits. The law is generic and refers to the Environmental Assessment Code for details of environmental permitting (Environmental Decision) procedures.

Law on Environmental Protection regulates the legal relationship between the bodies of the state authority and the physical persons or legal entities (without distinction-legal form) in the field 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 defines the principles and norms of legal relations, rights and obligations and responsibilities, awareness raising, education and scientific research in the field of

environment, key players and principles of environmental management; describes economical mechanisms and levers; ecological insurance; basics of environmental audit; environmental requirements during privatization; justifies needs of environmental standards and limits (air, water, soil, noise, vibration, fields, radiation) and ecological requirements for production, transportation and storage of goods and food products; ecological requirements applicable to waste; states necessity of environmental impact assessment and related issues (strategic environmental protection and transboundary environment assessment) referring to Environmental Assessment Code; defines general principles of environmental protection; 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. As stated in the law, in order to protect the climate against the global changes, the subject of the business activity is obliged to observe the limits to green-house gas emissions as well as to take measures for mitigating this emission. The emission of the green-house gases is regulated on the basis of integrated control of pollution of environment (Article 51). Besides, the subject of the business activity is obliged to reduce or stop production and use of such chemicals, which are likely to have effects on the ozone, layer of the earth and cause depletion of it (Article 52).

The status, of natural resources, study and usage of mineral resources is regulated by the **Law of Georgia on Subsoil**. The law describes rights and obligations of the users (Including re-cultivation after expiration of the license term), duration of the licenses (for energy resources

– up to 45 years; for metal ores – up to 40 years; up to 30 years for construction materials and other non-ore mineral resources; ground water and gas (except for the natural gas) – up to 25 years); protection of natural resources and safety requirements; termination of license; state supervision and control over the use of mineral resources; general requirements during mining. With regards to the issues related to the licenses for use of the natural resources the law gives reference to the law on Licenses and Permits, Law on Oil and Gas and related regulations. The law states the need for protection of environment and OHS during operation (mining), including requirements for waste (including waste water) management. According to the law extraction and treatment of mineral resources from deposits both of natural and technogenic origin (soil disposal areas) are subject to state supervision and control.

The **Waste Management Code** (2015) provides the legal conditions for implementation of measures aiming at prevention of generation of waste and increased re-use, environmentally- sound treatment of waste (including recycling and extraction of secondary raw materials, energy recovery from waste, as well as safe disposal). The following summarizes the key points of the code.

(i) Article 7 - General waste management requirements

(a) Waste, depending on its type, properties and composition, shall be collected, transported and treated in a manner not impeding its further recovery.

(b) Waste shall be collected, transported and treated in a manner which excludes, to the maximum extent possible, pollution of the environment and risks for human health.

(c) In case of waste pollution caused by waste transport activities, the waste transporter shall be responsible for taking clean up measures.

(d) The producer and holder of waste is obliged to treat their waste

on their own or hand it over for collection, transport and treatment to persons entitled to carry out such operations in accordance with this Law and legislation of Georgia.

(e) Where waste has been submitted for recovery or disposal, the original producer's and/or holder's responsibility shall remain until recovery or disposal iscompleted.

(f) Persons who collect and transport waste shall hand it over for treatment to appropriate facilities, holding the relevant permit or registration.

(g) The burning of waste outside permitted incinerators shall be prohibited.

(ii) Article 14 - Company waste management plan

(a) Legal and natural persons that produce more than 200 tonnes of non-hazardous waste or 1000 tonnes of inert waste or any amount of hazardous waste annually, shall prepare a company waste management plan.

(iii) Article 15 – Environmental Manager

(a) The persons under Article 14 of this Law shall nominate a suitable person as a company environmental manager.

(iv) Article 17 - General obligations for hazardous waste management

(a) The production, collection and transportation of hazardous waste, as well as its storage and treatment, shall be carried out in conditions providing protection for the environment and human health. It shall be prohibited to:
- discard hazardous waste outside waste collection containers;
- discharge it into the sewerage systems or underground or surface waters, including the sea;
- burn it outside waste incinerators permitted for that purpose;
- treat it outside waste treatment facilities permitted to treat such type of waste.

(v) Article 18 - Special obligations for hazardous waste management

(a) Waste producers that produce more than 2 tons of hazardous waste per year shall
- create and implement a suitable separation and collection system for such waste;
- designate an environmental manager, pursuant to Article 15 of this Law, responsible to make arrangements for the safe management of said waste;
- make arrangements for briefing and training for staff handling hazardous waste.

(b) Until the exact content of waste is unknown, the waste shall be regarded as hazardous.

(c) Hazardous waste for which no appropriate treatment techniques and/or technologies are available in accordance with the requirements of this Law within the territory of Georgia shall be exported for treatment. Until the export is carried out, the waste shall be safely stored at temporary storage facilities.

(d) The Ministry may exceptionally once allow for an extended storage period of up to one year if this is justified and does not harm human health or the environment.

(e) Hazardous waste may only be collected and transported by a natural or legal person after its registration pursuant to this Law.

(vi) Article 29 - Obligations for keeping records and reporting on waste

(a) Records on waste shall be kept and waste reports shall be submitted to the Ministry by natural and legal persons:
- dealing professionally with collection, transport and/or treatment of waste;
- which produced more than more than 2 tones non-hazardous (excluding municipal waste) waste or any amount of hazardous waste per year.

Law on Protection of Atmospheric Air. The law regulates protection of atmospheric air from man-caused impact. Pollution of atmospheric air is emission of hazardous substances originating from activities which are able to have negative impact on human health and environment. Four types of pollution are considered (Part II, Chapter IV, Article II.2): Pollution of environment with hazardous matter, Radiation pollution of atmospheric air. Pollution with microorganisms and biologically active matter of microbial origin, Noise, vibration, electromagnetic fields and other physical impact. Maximum permitted limits for concentration of hazardous substances into the atmospheric air are defined for each contaminants and represent maximum concentration of hazardous pollutants, in averaged time span, recurring action of which has not have

negative impact on human health and environment. Maximum permitted levels of emission of hazardous matters into the atmospheric air are defined with allowance of prospective of development of the enterprise, physical. geographical and climatic conditions, dispersion of emitted substances, background concentration of pollutants emitted from other neighboring enterprises, taking into account inter-location of existing or planned dwellings, sanatoria and recreation zones. In compliance with the law (Clause 28), in order to restrict pollution from the stationary sources4 of hazardous emissions the limits of emissions are to be set. The limit of pollution from the stationary source of emission is permitted quantity (mass) of emitted hazardous matters (Clause 29). Maximum annual emission level means the maximum permitted limit of discharge. This is annual permitted quantity of emission predetermined by technology in conditions of standard permitted capacity of discharge. Annual maximum capacity is defined for each hazardous substance and is calculated so that for each stationary source of emission cumulative emission from all registered sources of discharge does not exceed relevant maximum permitted value. Discharge of hazardous emissions from the stationary sources of emission without approved limits of discharge is forbidden. The standards of emissions (Clause 30) are to be worked out by the enterprise itself. According to the law (Clause 38) the enterprise is responsible for conducting self-monitoring which includes measurement of emission (evaluation), recording/registration and accounting. Emission which has not been recorded in self-monitoring record is considered illegal. As mentioned in the Clause 51 results of the monitoring and information on pollution of the air with hazardous substances is transparent and accessible for the public.

Law on Water regulates water use, defines rights and obligations of water users, sets out the types of licenses for the use of water, the rules and conditions of their issuance, considers conditions of suspension, withdrawal and deprivation of license, regulates water flows. The law states liability of all natural and legal persons to prevent pollution of catchment basins, water reservoirs, snow and ice covers, glaciers, permanent snow cover with industrial, household and other wastes and emissions which may cause deterioration of the underground water quality; prohibits piling of industrial and household wastes near the public water headwork's and in their sanitation zones, bans construction of facilities and implementation of any other activity which may cause water pollution; sets requirements for forest use within water protection zones. The state management of water protection and use is exercised through accounting, monitoring, licensing, control and supervision.

State monitoring of water is implemented by the Legal Entity under Public Law - the National Environmental Agency under MoEPA. By virtue of the law when locating/designing/constructing/commissioning of a new or reconstructed enterprise, or other facility, as well as in introducing of new technological process capable to affect the state of water, the rational water use is to be secured. At the same time, attention is to be paid to the measures ensuring due accounting of water abstracted from and returned to water bodies; protection of water from contamination, pollution-and depletion; avoidance of the unfavorable water impact; restriction of land flooding up to minimum necessary level, protection of land from silting, swamping or drying up; as well as environmental protection and landscape preservation.

(i) Under the law required is purification, up to the fixed standard, of the waste water discharged in a water body. In order to protect the quality of water resources, the law requests creation of sanitary protection zone that consists of three belts, each having a special regime. The procedure fixing the water quality standards, the maximum permissible rates of emission of harmful substances (including microorganisms) into ambience, the water abstraction quotas and the temporary rates (limits) of emission of harmful substances (including microorganisms) into water is defined by the Law of Georgia on the Environmental Protection.

(ii) Georgian legislation may provide liability for other violations of law in the water protection and use sphere. Water users shall compensate for damages caused by violation of the law on Water in the amount and under procedure established by legislation of Georgia. Under the Article 17 (Protection

of natural resources of the Black Sea) anadromous fish species (fish species seasonally migrating upstream of a river against the current) within the rivers of Georgia shall be protected by creation of conditions necessary for their reproduction, through conservation of the habitat, determination of procedures for regulating the fishing industry, determination of a total permissible amount of catching these species within the territorial waters, and within and outside special economic zones of Georgia, also through implementation of other measures defined by the legislation of Georgia. Article 20 (River water protection zone) defines protection zone of a river shall be its adjacent territory, where a special regime is established to protect water resources from pollution, littering, fouling, and depletion. This zone may include its dry bed, adjacent terraces, natural elevated and steep riversides, as well as gullies directly adjacent to riversides. The width of a river water protection zone shall be measured in meters from the edge of a riverbed to both sides under the following procedure:

(a) 10 meters - in the case of a river up to 25 kilometers long,
(b) 20 meters - in the case of a river up to 50 kilometers long,
(c) 30 meters - in the case of a river up to 75 kilometers long,
(d) 50 meters - in the case of a river over 75 kilometers long.

(iii) Within this zone, prohibited activities are to: a) construct, expand or reconstruct functioning enterprises, except for cases directly determined by law; b) spray, by air atomisation, perennial plants, sown crops and forest lands with toxic chemicals; c) keep, collect or place toxic chemicals and mineral fertilizers, as well as any other wastes as defined in the legislation of Georgia. It is requested that hydraulic structures located within a water protection zone shall be normally equipped with appropriate technical facilities to completely exclude the possibility of river pollution and littering.

Law on Wildlife. The law regulates wildlife protection and use including hunting and fishing. The main goal of the law is to ensure protection and restoration of wildlife, its habitats, preservation and sustainability of species diversity and genetic resources, creation of conditions for sustainable development, taking into account the interests of present and future generation; legal ensuring of wildlife protection (including in-situ and ex-situ conservation, translocation and reproduction of wildlife) and state-based provision of use of wildlife objects. In addition to this law, Georgian legislation on the wildlife is based on the Constitution of Georgia, Georgia's international agreements and treaties, laws on Environmental Protection and on the System of Protected Areas, law of Georgia on Wildlife and law of Georgia on the "Red List" and "Red Book". It is one of the main goals of the Environmental Protection Law to support the preservation of biodiversity of the country, the preservation of rare, endemic and endangered species, the protection of the marine environment, and the maintenance of the ecological balance (Art. 3.1 (d)). The Law contains regulations on both wild animals and plants which are threatened by extinction and those which are not. Two main legal acts regulating the issues of species protection in Georgia.

Law on Red List and Red Book which gives the legal definitions of Red List and Red Book (relevant recommendations and methodological issues) of endangered species of Georgia. The Red List structure was also legally defined, as well as the relevant procedures for including species in the Red List, procedures for revising, and updating of it. The Law also regulates issues related to planning and financial matters connected with the protection, taking of, rehabilitation and conservation of endangered species. The Red List of Georgia was approved by Order of President of Georgia No. 303 (2006), later - by the Resolution of the Georgian Government No. 190, dated 20-Feb-14. The law defines special cases when removal of individuals of the Georgian Red List species from their habitats is allowed. Decisions are made by the Government of Georgia.

Forest Code regulates relations and state policy in the area of forestry management, use and protection. The code specifies all activities, which may be carried out in Forestry Fund. It allows only those activities, which

are related to forest resource protection or use such as timber logging, collection of non-timber resources, use of area for agriculture or recreation, establishment of hunting farms, etc. State forestry fund may be used for a special purpose in urgent cases. Decisions are made by the Government of Georgia.

Law on Soil Protection. The law provides the policy requirements and principles of the protection and preservation of fertility soil resources against negative impacts. Soil protection is the state problem since correct and rational use of all types of soil, including barren soil, saline soils, swamped soil, alkali soil and aqueous soil are the main reserve of dynamic development of agriculture and of the national economy as a whole. The purpose of the present Law is to establish the rights and the duties of landholders, landowners and the state in the field of soil protect. The law defines soil protection measures and methods and prohibits certain activities, e.g. use of fertile soil for non-agricultural purposes; implementation of non-agricultural activity without topsoil removal and conservation; any activity, which results in deterioration of soil properties, etc. In addition to this law soil protection issues are regulated by order #2-277 (25.11.2005) of the Minister of Agriculture on approving Recommendations for Complex Measures for Soil Protection from the Erosion.

Law of on Conservation of Soil and Restoration-Amelioration of Soil Fertility is to ensure conservation and improvement of soil in the territory of Georgia, define the legal principles, measures, limitations and prohibitions to that end; soil conservation and fertility restoration improvement measures. It prohibits unregulated grazing, removal of windbreaks, application of non-registered fertilizers or other substances, soil contamination and any activity, which results in deterioration of soil properties and facilitates desertification, swamping, salinization, etc. Businesses that use soil or conduct activities upon soil that have the potential to negatively impact soil conservation are required to follow the Law and related normative documents and regulations, including Order #113 (27.05.2005) of the Minister of Environment and Natural Resources' Protection on affirming regulation on "Removal, Storage, Use and Re- cultivation of the Fertile Soil Layer" and 2) Resolution of the GoG #424 (31.12.2013) on affirming technical regulations on "Removal, Storage, Use and Re-cultivation of the Fertile Soil Layer". These documents consider issues of land resources protection and rational use and issues related to removal, storage, use and re-cultivation of the fertile soil layer during different activates. According to the regulation, restoration of degraded soil fertility must be implemented using re-cultivation (technical and biological) methods.

Law on System of Protected Areas. Forms a legal basis for planning, establishment and maintenance and assignment of categories of protected areas, described funding issues for each category. It specifies ownership forms of land and other natural resources in protected areas, allowed and prohibited activities.

Law on Regulation and Engineering Protection of Seacoast and Riverbanks of Georgia provides general principles and requirements for protection of coastal areas and riverbanks from negative environmental impacts.

Law on Compensation for Damage Caused By Hazardous Substances Includes principles and procedures for compensating the negative impacts caused by discharge of hazardous substances into environment.

The Georgian Red List and Red Book - The Red List of Georgia was adopted in 2006 based on work conducted by the Commission of Georgian Scientific Academy working in Endangered Species and updated in 2014. It now includes some 56 plant and 139 animal species, including 33 mammals, 35 birds, 11 reptiles, 2 amphibians, and 11 fish (including all sturgeon). Of these, 20 plant and 43 animal species are categorized as critically endangered (CR) or endangered (EN)5, and 4 mammals may be extinct.

The "Red Book" of critically endangered species includes information on the status, habitat, home range, quantity, reproduction areas and conditions, protection measures and risk factors for species listed in the Red List. In terms of plants, some 275 species of vascular plants are considered endemic to Georgia, of which approximately 60% (152 species) are considered endangered, although there is insufficient information form them all to be included in the Red List[6]. Further details on Red List species within the project AoI are included within **Section E**.

Laws and regulations related to social aspects and land ownership applicable to the project are presented

in in Table

List of social and land ownership related laws relevant to the project

Year	Law / Regulation	Last revision	Code
1996	Law on agricultural land ownership	16/06/2017	370.030.000.05.001.000.132
1997	Civil code of Georgia	23/12/2017	040.000.000.05.001.000.223
1997	Law on compensation of land substitute costs and damages due to allocating agricultural land for non-agricultural purposes	25/12/2014	370.020.000.05.001.000.244
1999	Law on rules for expropriation of property for public needs	06/09/2013	020.060.040.05.001.000.670
2007	Law on cultural heritage	07/12/2017	450.030.000.05.001.002.815
2007	Law on public health	07/12/2017	470.000.000.05.001.002.920
2010	Law on state property	07/12/2017	040.110.030.05.01.004.174
2010	Labour Code	04/05/2017	270000000.04.001.016012

Brief summaries of the listed documents are given below.

Civil Code regulates contractual relations, describes the rights and responsibilities of natural and legal persons, defines the penalties in the case of violations of the requirements set out in the document. The Civil Code differentiates between movable and immovable property and provides rules for acquiring title over property, as well as any proprietary or obligatory rights thereto. This piece of legislation must be taken into account when entering into contracts in Georgia.

Labour Code regulates employment relations, unless such relations are otherwise regulated by international treaties that have been implemented in Georgia. Employers are obliged to comply with requirements and clauses of the document for the purpose of ensuring that the rights of employees are protected.

Law on Public Health regulates legal relations for ensuring a safe environment for human health. It indicates quality norms of for air, soil and water pollution and restrictions related to ionized radiation, noise and vibration. The limits must be complied with. Section 7 of the law is dedicated to safety of technological processes.

Law on Compensation of Land Substitute Costs and Damages due to Allocating Agricultural Land for Non-agricultural Purposes defines compensation amounts, required at the time of allocation, use or disposal of agricultural land parcel for non-agricultural purpose; the payment procedure and the procedure for changing the agricultural land category, including payment of losses to landowners or land users, as a result of restricting their rights or reducing the quality of their land.

Law on Agricultural Land Ownership. Objective of the law is to ensure improvement of the structure of agricultural land based on rational use of resources, avoidance of splitting and unsustainable use of the land plots. The law defined the rules for acquisition and selling the land, participation of the state in agricultural land related relations. The law deals with land ownership issues, restrictions of land alienation in case of co-ownership, sets priority of the state in buying out the agricultural land plots.

Law on rules for expropriation of property for public needs outlines respective procedures and conditions for expropriation of private property as well as procedures for compensation payment for expropriated

property or the transfer of other property with the same market value.

Law on State Property regulates relationships on state property management and transfer for use by others, defines special requirements and procedures for transfers. The Ministry of Economy and Sustainable Development is the state authority in charge of the property.

Law on Labour Safety defined general requirements and preventive measures related to safety on worksites; avoidance of existing and potential hazards, accidents/incidents and professional diseases; training, awareness raising, communication and consultations with equal involvement/participation of employees. The law regulates rights, obligations and responsibilities of state institutions, employers, employees and employees respresentatives in providing safe and healthy environment. The law applies to dangerous, hazardous, heavy and works with/in dangerous working conditions. The list of high risk works is defined by the government in consultations with social partnership.

Law on cultural heritage sets out procedures for protection of cultural heritage and permitting arrangements for archaeological investigations.

The Constitutional Agreement between the State of Georgia and the Apostolic Autocephalous Orthodox Church (2002) regulates the relationship between the state and the Church. Its provisions (art. 7, 8 and 9) have a major impact on the management of cultural heritage in the country. By this agreement all the religious buildings and related structures on the territory of the country, in use or without function, standing or in ruins, together with their parcels and also all the immovable ecclesiastic treasures protected in museums and archives are handed down in the ownership of the Church of Georgia (art.7 and 8). The MoCMP must agree with the Church of Georgia in the process of adopting protection zones, rules and methodologies, planning and approving rehabilitation projects or scientific research of movable and immovable religious monuments. Together with the state, the Church is responsible for maintenance and care of the monuments in its ownership (art.7 and 9). The property of the Church is exempt from the state taxes (art. 5). According to the Concordat the church is the owner of the majority of immovable listed properties in the country, most of which, at the same time, are living heritage sites, with the religious function being restored and enhanced after the fall of Soviet regime. Because of this special circumstance, the specific rules for maintenance and exploitation of these properties need to be elaborated.

3.2. Administrative Framework

Ministry of Environment Protection and Agriculture (MoEPA) - In December 2017, MoEPA had its responsibilities split between the ministries of agriculture and economy, with the latter also taking over the Ministry of Energy.

MoEPA is responsible for all environmental protection issues and agriculture in Georgia. The responsibilities of the Ministry as the competent authority are: a) to intermit, limit, or stop any activity having or likely to have adverse impact on the environment, b) to carry our screening of planned development, c) to implement scoping, d) to issue environmental decision for project subject to EIA procedure (ref. Environmental Assessment Code), c) to control the execution of mitigation measures by the developer, d) to organize public meetings and discussion of an estimation of influence on environment and prepares the documentation (the project of the order of the minister) to let out the permission to influence to environment.

Ministry of Economy and Sustainable Development (MoESD) - MoESD is responsible for carrying out the review of technical documentation (including conclusion of independent experts) and issuing Construction Permits, as well as for supervision over construction and for arranging Acceptance Commission after completion of construction. State supervision of construction and compliance monitoring is provided by the Main Architecture and Construction Inspection (MACI), which is operating under the MoESD. The MoESD also took up function of the Ministry of Energy upon recent merget of these two entities. Reorganization of MoESD included creation of the National Agency of Mines under it, which took over the function of licensing mineral extraction from the National Environment Agency under the MoEPA.. The MoESD is a responsible

institution for developing and administrating Local Market Information System (LMIS). The LMIS information providers include: Ministry of Economy and Sustainable Development of Georgia, Enterprise Georgia, Georgia's Innovation and Technology Agency, National Agency of State Property, National Statistics Office of Georgia, Ministry of Education and Science of Georgia, Education Management Information System, National Center for Educational Quality Enhancement, Ministry of Environment Protection and Agriculture of Georgia, Agricultural Projects' Management Agency and Ministry of Labour, Health and Social Affairs of Georgia.

The Roads Department - The Roads Department of the Ministry of Regional Development and Infrastructure (RD) is responsible for elaboration of policy and strategic plans related to developing motor roads, management of road and traffic related issues and construction, rehabilitation, reconstruction and maintenance of the roads of public use of international and national significance, utilizing funds from the state budget, lawns, grants and other financial sources. Thus, the RD is responsible for the procurement of design and EIA studies, as well as works on construction and rehabilitation of roads and is responsible for ensuring compliance with the Georgian legislation and environmental and social requirements of the relevant donor organizations. Control of implementation of the Environmental Management Plan (EMP) is direct responsibility of the Roads Department. Within the RD there is Environmental Division dealing with the environmental issues. This division is supposed to review the EIAs and EMPs related to the Roads Department projects and perform monitoring of compliance of the contractor's performance with the approved EMPs, EIAs, environmental standards and other environmental commitments of the contractor.

The Ministry of Culture, Monument Protection and Sports - 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.

The "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of Environmental Protection and Agriculture - responsible for implementation of complex sanitary protection measures in case of identification 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 MoEPA by the Construction Contactor (field environmental officer) and RD field officer.

Ministry of Labour, Health and Social Affairs (MoLHSA), together with other ministries, institutions and social partnerships defines the state policy on labour safety; supports awareness raising and training sessions, develops proposals and recommendations related on labour safety programs. MoLHSA is represented in Trilateral Commission of Social Partnership together with the Ministry of Justice (MoJ), MoESD, MoRDI and Ministry of Education and Sport (MoES). MoLHSA defines the scope, qualification requirements, condition and rules for accreditation of labour safety officers; elaborates incident evidence gathering and keeping procedures as well as reporting rules and terms; together with Social Partnership acts and mediator in collective labour disputes, monitors implementation of OHS conventions, recommendations and agreements, develops reports on the subject, ensures cooperation with ILO and other international and governmental institutions, carried out labour market studies and analysis.

Service for the Protection of Labour Safety Regulations under the MoLHSA monitors and implements supervision over compliance with the labour safety rules, investigates incidents and professional deceases cases and registration.

Trilateral Commission of Social Partnership (TCSP). Parties to the Partnership are the government of Georgia, employers associations and employees associations. The term of office of the TCSP members is 1 year. Each member has 6 members in the commission. Objective of the TCSP is improvement of labour safety through supporting dialogue between the GoG, employers and employees.

3.3 Gap analysis between the National Environmental and Social legislation and the Requirements of International Financal Institutions

On January 1, 2018, a new Environment Assessment Code was enforced in Georgia. The requirements of this Code are based on the requirements of the EU Environment legislative base and consequently, most of the gaps existing between the environmental requirements of the international financial institutions (IFIs) and Georgian legislation have been filled.

Present environmental analysis was carried out in agreement with the policies of the World Bank and The European Investment Bank. Environmental and social requirements of these international financial institutions (IFIs) as well as any others who may finance further preparation and implementation of this project will be applicable. National legislation of Georgia shall be followed throughout as well. In case of differences between the two, more stringent requirements have to be applied.

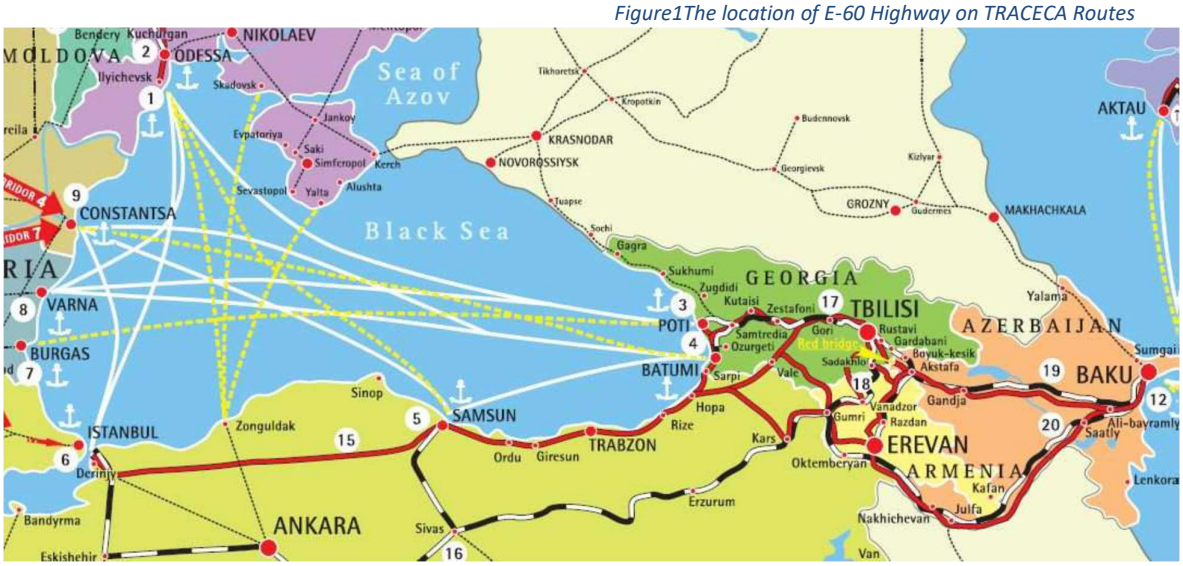
Georgia has adopted Environmental Assessment Code (January 2018), which introduces screening and scoping procedures to the environmental assessment, which is fully in line with the international good standard. IFIs expect that social aspects of the proposed investment are covered to full estent in the ESIA process, and that measures for mitigation of social impacts are integral part of Environmental and Social Management Plans (ESMPs). National legislation requires coverage of public health implications of the proposed activities, while aspects of social equity, inclusion, vulnerability, etc. are not expected to be fully explored and addressed through the ESIA.

Resolution No. 242 of the Government of Georgia dated August 20, 2010 on the Rules of Forest Use dated August 20, 2010 states that in case clearance of forest vegetation is required to construct new infrastructure in the area designated for special use within the boundaries of the State Forest Fund, the developer/project proponent is obligated to pay a single compensation fee in the amount set forth in Table 1, Annex 7 of the above-referenced Resolution. The fee is paid to the State budget and accumulated funds are intended for afforestation / reforestation purposes. However, the paid amount is not earmarked for forest restoration in the specific area of impact and its timing is not defined either. After having paid the fee, project proponent has no further obligation to undertake compensatory tree planting. In difference from the above approach, IFIs expect that ecological loss incurred by clearing of vegetation for the purposes of a given investment project is thoroughly assessed and in case compensation is deemed necessary and feasible, it is undertaken to make up for the specific impacts caused by the given project.

4. Project Description

The E-60 highway is the most important component of the South Caucasus road system. The highway, within territory of Georgia passes from the Red Bridge (Azerbaijan border) to Poti (Black sea coast). The length of the road within the country is about 388 km. Competitiveness of Georgia as a transit country depends on the efficiency of its transport network. The main component of this network is essentially the E-60 highway and its improvement / modernization is a prerequisite for full realization of the global transport potential of the country. Due to above mentioned, the Government of Georgia is implementing measures under which construction of the four-lane highway is currently underway on certain sections of the E-60 highway.

Figure1The location of E-60 Highway on TRACECA Routes



The Samtredia – Zugdidi road section is part of the Georgian route S1, also known as Tbilisi – Senaki – Leselidze Highway, and is a major trunk road that runs from Tbilisi through Senaki before reaching the border with Russia near Leselidze (Abkhazia). It's connecting Samegrelo-Zemo Svaneti region and new Anaklia Deep Sea Port with E-60 core network. Length of theSamdredia – Zugdidi section is around 90 km including the access road to Anaklia Port.

The new Port of Anaklia sits on the shortest route from China to Europe, a route that has become a major focal point of Chinese investments in infrastructure. As such, the port will attract high-value cargos seeking the fastest travel between Chinese and European Markets. It is envisaged that the first phase of the port will go in operation in year 2020 which comprise the container terminal. At later stages facilities for liquid bulk and dry bulk goods will be implemented.

The Anaklia Port will be a developed as a greenfield port located on the Black Sea just south of the Enguri River and the village of Anaklia on the Black Sea, and just north of Kolkheti National Park in the Samegrelo-Zemo Svaneti Region of the Republic of Georgia (42°23′ N, 41°43′ E).

Road Infrastructure is needed by the Port for two main reasons: (i) to provide connectivity for inflow and outflow of goods and, (ii) to provide connectivity for labour. Therefore timely implementation of the access road to the new Anaklia port and connection to Georgia's main road network is essential for the regional economic development.

The development objectives of the Project for Georgia to contribute to the gradual reduction of road transport costs and to improve road safety along the section upgraded under the project.

5. Project area

The Samtredia – Zugdidi road section is part of the S1 Highway Tbilisi - Senaki – Leselidze and forms part of Georgia's trunk road network. It's connecting Samegrelo-Zemo Svaneti region with E-60 core network, the main East-West Highway, and will provide a future transport connection to Abkhazia. The existing Samtredia – Zugdidi road section is generally a two-lane carriageway road with a paved width of 9.00 m and an unpaved shoulder width varying between 1.0 and 3.0 m. The road complies mainly with category II road design standard in accordance to the former Soviet Union Standard SNIP 2.05.02-85.

The existing pavement is in good to fair condition and the road surface shows no major damages. The existing road passes through following settlements:

Settlement Name		Settlement Start (km)	Settlement End (km)
Samtredia City		266.8	270.2
Marani		272.8	276.2
Abasha City		276.2	280.2
Norio		280.2	282.9
Tskemi		285.2	286.0
Nosiri		286.8	291.1
Senaki City		291.1	296.0
Teklati		296.0	301.9
Kemo Kvaloni		301.9	306.6
Nojikhevi		306.6	308.4
Khobi City		308.4	313.3
Pirveli Maisi		313.3	316.0

Kheta		316.1	320.3
Khamiskuri		320.3	322.0
Tsaishi		324.4	331.0
Chitatskari		331.0	335.0
Zugdidi City		335.0	341.8
Rukhi		341.8	344.4

The densely concentrated development of the settlements along the existing Samtredia - Zugdidi road sections, creates road safety problems, reduce travel speeds, and hampering road improvements to increase capacity and road safety.

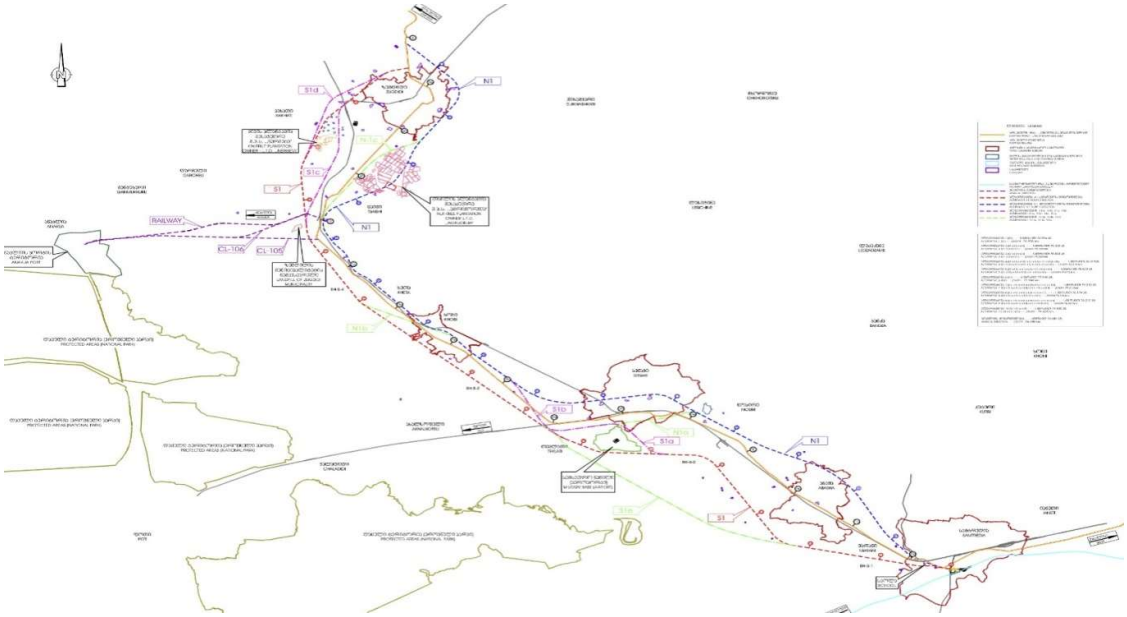
5.1. Alternatives of the project

During the pre-feasibility stage different alignment alternatives were evaluated and assessed. This chapter summarise the initial assessment of alignment alternatives.

Following the development of constraint mapping and viable corridor options, further work will be undertaken to develop viable route corridor options. The viable corridors must be able to fit a road with an alignment suitable for minimum 80 km/h travel speed, as required by the Anaklia Port Development.

5.2. Description of the alignment

The initial concepts were developed based on field visits and desk studies.



Besides the do-nothing case, generally there are two alternative alignments with sub alternatives. The main alternatives are the North alternative (N) and the south alternative (S) running mainly north respectively south of the existing road.

Alignment alternative North

This alternative alignment is running mostly north of the existing road. This is a complete new alignment starting at Samtredia in northern direction. The proposed alignment alternative is avoiding the avoiding settled areas and passing north of villages and towns of Senaki and Zugdidi. Between Senaki and Zugdidi the proposed alignment is running in a short distance nearly parallel to the existing road.

The two sub alternatives of the North alignment N1a and N1b are connecting to the south alternative. Alternative N1a crossing the existing road east of Senaki and passing south of the town, but north of the airport and connects to the south alignment alternative S1a. West of the village Khobi the sub alternative N1b crosses the existing road and joins the south alignment alternative.

South alternative

The alternative alignment is running mostly south of the existing road. This is a complete new alignment with four sub alternatives. Starting at Samtredia the proposed alignments runs in western direction south ot the existing road. The main alternative passes south of the military airport at Senaki and runs then in a distance of about 1km parallel to the existing road until passing south-west the town of Zugdidi, joining the existing road north of Zugdidi.

The sub alternative S1a passes north of the military airport near Senaki, sub alternative S1b leaves the main south alignment at Senaki and joins the north alternative. Sub-alternative S1c and S1d are running west if Zugdidi west or east of the main alternative.

The south alternative goes past a military airport between km 25 and km 30. To ensure safety and security, the Ministry of Defence requires a minimum distance of approximately 1000 m between the firing range of the base and the new road. The initial south alignment alternative was revised to consider this requirement.

Alternatives for the access road to Anaklia Deep Sea Port

The proposed alignment alternatives for the access to Anaklia Port pass trough a level and rural area. The initial alignment alternative for the access road to the Anaklia Port based on preliminary design of the road and railway connection developed by ILF Consulting Engineers1. The access road to Anaklia port will be located parallel to the new railway line and following the proposed alignment as set out in the existing preliminary design. The access road will divert from the Samtredia – Zugdidi road near the village Tsatskhvivi and heads to the east until the new seaport. The length of the access road developed by ILF is 17km. This initial alignment is shown on the location map below as purple line and called CL-107 (railway).

In order to minimize the resettlement impact a sub-alternative was developed (red line) for the road alignment, which will deviate from the initial alignment and bypass the elongated settlements in the project area. This alternative considers a separate railway and road alignment for about 8 km and is called CL-106 alternative.

[1] Initial Design of Black Sea Port Road and Railway Connection, August 2012, ILF Consulting Engineers, Report D073L11RRD0901

Since a combined road/railway corridor is desired this alternative has been developed further and continues in west-east direction in a straight line till crossing with the Samtredia – Lezelidze Road (alternative CL-105).

6. Basline iformation

Social-Economic Baseline

The existing road sections passes through following municipalities: Samtredia, Abasha, Senaki, Khobi, Zugdidi and following cities: Samtredia, Abasha, Senaki, Khobi and Zugdidi.

Samtredia municipality (with the area of 364 km2) is located in the west of Georgia, it is part of Imereti District. The number of population in Samtredia municipality is 48 562 (Census 2014). . The distance from Tbilisi to Samtredia is 268 km. The number of villages in Samtredia municipality is 14.

Abasha municipality (with the area of 320, 5 km2) is located in the west of Georgia, it is part of Samegrelo Zemo-Svaneti District. The number of population in Abasha municipality is 22 341 (Census 2014). The distance from Tbilisi to Abasha is 274 km. The number of villages in Abasha municipality is 40.

Senaki municipality (with the area of 520, 7 km2) is located in the west of Georgia, it is part of Samegrelo Zemo-Svaneti District. The number of population in Senaki municipality is 39 652 (Census 2014). The distance from Tbilisi to Senaki is 291.5 km. The number of villages in Senaki municipality is 14.

Khobi municipality (with the area of 659, 2 km2) is located in the west of Georgia, it is part of Samegrelo Zemo-Svaneti District. The number of population in Khobi municipality is 41 338 (Census 2014). The distance from Tbilisi to Khobi is 305.5 km. The number of villages in khobi municipality is 56.

Zugdidi municipality (with the area of 668 km2) is located in the west of Georgia, it is part of Samegrelo Zemo-Svaneti District. The number of population in Zugdidi municipality is 62 511 (Census 2014). The distance from Tbilisi to Zugdidi is 333 km. The number of villages in Zugdidi municipality is 58.

Ethnicity

Ethnicity %	Samtredia	Abasha	Senaki	Khobi	Zugdidi
Georgian	99.2	99.2	99.4	99.3	99.3
Armenian	-	-	-	-	
Abkhazian	0.1	0.1	0.1	0.1	0.1
Russian	0.5	0.4	0.4	0.5	0.5
Ukrainian	-	0.1	-	-	-
Moldavian	0.1	0.1	-	-	-

Local population under the project impact:

The road sections passes through following settlements:

Settlement Name	Total Population (Census 2014)	women	Men
Samtredia City	25 318	13 076	12 242
Marani	1 153	613	540
Abasha City	4 941	2 681	2 260
Norio	614	325	286
Tskemi	575	301	274
Nosiri	796	415	381
Senaki City	21 596	11 544	10 052
Teklati	444	223	221
Kvemo Kvaloni	3 240	1662	1578
Nojikhevi	996	515	481
Khobi City	4 242	2 289	1 953
Pirveli Maisi	661	345	316
Kheta	364	188	176
Khamiskuri	443	228	215
Tsaishi	1 526	806	720
Chitatskari	3 293	1706	1587
Zugdidi City	64 400	30 927	31473
Rukhi	2 784	1 438	1 346

Employment

The specific weight of the self-employed in the total number of the employed in Imereti and Samegrelo- Zemo Svaneti regions is high constituting mainly the rural population with one ha or more land plot area. As per the official statistics (source: National Statistics Office of Georgia), by 2017, the number of the active population (labor force) in Imereti region was 307.5 and in Samegrelo-Zemo Svaneti 191.7 thousand people, including 264.5 and 175.1 thousand employed. The unemployment level is in Imereti 14.% and in Samegrelo-Zemo Svaneti 8.6%.

The economically active population of Samtredia, Abasha, Senaki, Khobi, Zugdidi municipalities is mainly employed at public bodies, in education, timber industry, production, sales and processing of agricultural products and tourism.

The number of active population in Imereti is 307.5 and in Samegrelo-Zemo Svaneti is 191.7 thousand people.
As for the residents of the villages near the project highways, their absolute majority is self-employed and the unemployment level is high. The main source of income is agriculture (cattle breeding, citrus/fruits producing, corn growing and bee raising). The population sells the agricultural products at the municipal centers. It should also be noted that a certain proportion of the rural residents takes the agricultural products (fruits, citrus, maize, honey, etc.) at the roadsides to sell them. In addition, there are some public outlets located along the roads.

Industry and Business

During the Soviet times, industry was well developed in Samtredia, Abasha, Senaki, Khobi, Zugdidi municipalities, with food enterprises, mining industry and timber plants, citrus, fruit, wine, milk tee, furniture,porcelain, cellulose, cement and other complexes of enterprises.
.
According to available statistics, the number of acting businesses in Imereti and Samegrelo-Zemo Svaneti regions ranks 2th and 4th after Tbilisi (2014 data)

Businesses

	units	%
Total		100
Tbilisi	257084	43.7
Imereti	81195	13.8
Adjara	47812	8.1
Samegrelo-Zemo Svaneti	47221	8.0
Kvemo Kartli	44042	7.5
Kakheti	35986	6.1
Shida Kartli	26241	4.5
Samtskhe-Javakheti	15844	2.7
Guria	14636	2.5
Mtskheta-Mtianeti	10898	1.9
Racha Lechkhumi-Kvemo Svaneti	4531	0.8
Abkhazeti	3292	0.6

Source: National Statistics Office of Georgia

Agriculture

The major branch of economic activity for all municipalities in the study area is agriculture. For example, 340 km2 of the total area of Zugdidi municipality is used for agricultural purposes. Pastures occupy 55% of this territory and 15% is used for tee and citrus production. Out of agricultural branches, cattle breeding and bee raising are also developed. Zugdidi municipality is one of the leading municipality for citrus production of in Georgia. The branches of specialization are vine growing, fruit growing, maize growing, tee and citrus producing and cattle breeding.

The qualitative properties of agricultural production are quite high in the municipalities. The both regions- Imereti and Samegrelo-Zemo Svaneti have very high basic indicators in the qualitative and ecological respects of the agricultural production.

As mentioned above, the main source of income of the population on the villages adjacent to the study area is the sales of agricultural products.

Tourism

Tourism plays an important role in the economics of the municipality, with Anaklia resort on the territory of the Zugdidi municipality being major destinations promoting the development of tourism there. The project area, in tourism respect, is rather valuable. There are several tourist routes (For example Nokalakevi in Senaki municipality), important historical-cultural monuments, or tourist facilities (hotels) in the municipalities.

Heath services

Public health services in the region are provided by hospitals, dispensaries, ambulances. Along with the public health establishments, private medical hospitals and clinics also exist. Hospitals are located in towns Samtredia, Abasha, Senaki, Khobi and Zugdidi. In number of villages is also Ambulance Service.

Education

In municipalities under project impact, there are more than 100 schools. There are Universities in city Senaki and Zugdidi.

Migration

Statistical data on migration from the region are not available. Migration includes economical migration to other regions/towns and abroad, migration of youth for education. Main destinations for migrants are Turkey, Greece, Spain, etc. Some seasonal migration is also observed.

Main Social impacts

Resettlement Issues

According the feasibility study it is expected that Samtredia-Zugdidi Road Section and Access Road to Anaklia Deep Sea port project will have the following kind of potential impacts on private land:

Access Road to Anaklia Deep Sea port

a. This part of the project has impact on 418 land plots- 128 privately registered and 290 legalizalbe. The impact on land under annual crops is 127.1. Ha., on land under fruit trees is 24.3 Ha., on land under pasture 4.2 Ha., on residential area 12.6 Ha. And on commercial 0.42 Ha.

b. 22 Houses, 3 commercial and 9 supplementary buildings are under impact;

c. Allowances will be provided for business and HH relocation; HH with severe impact, vulnerable groups;

d. Compensation for businesses owners, workers and employees, as well as for agricultural land leaseholders and workers will be provided.

e. Land registration fees will be also paid.

Samtredia-Zugdidi Road Section and Access Road

f. This part of the project has impact on 1525 land plots- 838 privately registered and 687 legalizalbe. The impact on land under annual crops is 179.5 Ha., on trees is 19.5 Ha., on land under pasture 61.7 Ha., on residential area 53.5 Ha. And on commercial 0.2 Ha.

g. 117 Houses, 3 commercial, 131 supplementary buildings and 6 common buildings are under impact;

h. Allowances will be provided for business and HH relocation; HH with severe impact, vulnerable groups;

i. Compensation for businesses owners, workers and employees, as well as for agricultural land leaseholders and workers will be provided.

j. Land registration fees will be also paid.

k. Appropriate RAPs will be prepared to address all project related types of impact and suggests detailed description of actions to be undertaken during RAPs implementation to ensure that each and every project affected person is cash compensated. Those in need will also be provided within additional rehabilitation measures as stipulated in the Entitlement Matrix of the RPF, and to foresee that all these actions are undertaken in accordance to the entitlements agreed under the RPF.

Labor

The project is unlikely to generate very significant permanent or temporary local employment. The construction works will mostly require skilled labor from outside the area (Tbilisi). There may be a need for short-term unskilled labor to assist with the digging works and preference for unskilled jobs should be given to local residents. No new permanent employment is envisaged. The project will not cause a reduction of permanent employment in the project area.

Communicable Diseases, other H&S risks

Community Health & Safety

The risk of communicable disease e.g. HIV/Aids transmission through construction workers is assessed to be very limited due to the short construction time and limited number of workers. No impact expected.

6.1. Climate

Climate features are provided in the tables below tables 6-11

Table1General Climate Features

Climatic Distric	Climatic sub-district	AveragetemperatureinJanuary, °C	Averagewindspeedof 3wintermonths,m/sec	AveragetemperatureinJuly,° C
III	IIIð	From +2 to+6	-	From +22 to+28

Table2Air Temperature and Humidity

№	Climate Features	Metoo station	Bymonth												Yearlu
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1	Average MonthlyandYearlyAirTemperature, ^0C	Senaki	5.2	5.8	8.4	12.9	17.9	21.0	23.2	23.6	20.5	16.4	11.5	7.5	14.5
		Samtredia	4.7	5.6	8.8	3.0	8.0	1.0	3.2	3.5	0.4	6.2	1.2	.0	4.4
2	Absolute Minimum AirTemperature, ^0C	Senaki	-	-	-										.7
		Samtredia	-	-	-										.7
3	Absolute MaximumAirTemperature, ^0C	Senaki	-	-	-										2
		Samtredia	-	-	-										1
4	Mean Maximumof the hottest month, ^0C	Senaki	-	-	-					8.9					
		Samtredia	-	-	-					8.8					
5	Range of ambient temperature, ^0C	Senaki	6.5	7.1	8.5	0.5	0.9	0.5	.2	.4	.7	.4	.7	.8	
		Samtredia	9.4	10.1	10.3	.6	0.3	1.7	2.4	3.0	2.7	1.6	.9	.2	
6	Relative airhumidity, %	Senaki	68	68	68	5	9	2	6	5	4	1	4	3	0
		Samtredia	76	75	73	2	3	5	8	0	1	9	2	2	6

Table 3Amount of Precipitation and Snow Cover

#	Amount ofprecipitationin ayear,mm	Amount ofprecipitationin24hours,mm	Weight of snowcover,KPa	Numberof dayswithsnowco
1	1386	166	0.50	26

Tabele4Standard Values of Wind Pressure

W_0	W_0
0.73	0.85

Table5 Greatest wind velocity with probability, m/sonce in 1,5,10,15,20 years

In 1year	In 5years	In 10years	In 15years	In 20years
31	35	37	38	39

Teble 6Recurrence/Frequency of Wind Directions

Windproperties		Direction								Calm
		N	NE	E	SE	S	SW	W	NW	
Frequencyofwinddirections(%)	January	1	4	75	1	0	2	16	1	-
	July	2	1	24	1	1	5	62	4	
Winddirectionandcalm frequency(%)inayear		1	3	53	2	1	3	35	2	27

Seasonal freezing depth for any soil is 0 cm along the alignment, which means that soil does not freeze

6.2. Geomorphology and Geology

The location of the project road segment territory stratigraphically is represented by Cretaceous (Cr), Paleogenous (Pg) and Neogenous (N) rocky complex and Quaternary soils resting on them as a stratum of variable depth. Rocks are widespread on the undulating territory north of the project road, where they outcrop on the ground surface.

In various periods geological structure of the region was studied by few authors; most part of the investigation territory is represented by Jurassic deposits.

S. Bukia (1970) studied the region geological structure. Bukia called Bajocian porphyritic series - Khodjali formation in Eastern Abkhazia, which he divided into three members by lithological-petrographic and chemical characters; besides, middle member is divided into two horizons. The author remarks, that they are distributed into small distance, but borders between member do not always combinate with each other in adjacent sections; therefore, the author thinks that this kind of distribution is very conditional and it has got local significance.

By Sh. Geguchadze's (1976) data volcanogenic-sedimentary deposits of Khodjali formation are distributed further more to South and are pushed into the river valleys of Enguri, Magana, Khobistskali, Tekhuri, Tskhenistskali and Rioni by continuous line. Analysis of Bajocian Khodjali formation structure gave opportunity to the author to divide it into four members (from below upwards) at the investigation territory.

To East to Abkhazia, in interfluve of the rivers Enguri – Liakhvi, within Gagra-Java zone areas, volcanogenic-sedimentary series was studied by Z. Pailodze (1986), who divided Bajocian series into three horizons of some material contents by lithological-petrographic characters; they are: spilitic augite-labradoric, hornblende, hypersthene and biotite basalts, also andesite basalts and their volcanoclastoliths. The author also remarks, that the most abrupt border is pushed between earl Bajocian basalt-andesite-basalt and late Bajocian andesite-antesite-dacite volcanism on the background of sharp changeability of content and volcanism character.

The study area (alpine Samegrelo) is located in peripheral part of Southern slope of central Caucasus and is orographically represented by one of longitudinal ridges – Egrisi (Samegrelo) ridge. Valleys of the rivers Magana, Khobistskali, Tekhuri and others are cut into Southern slopes of the ridge. The river Khobistskali mouth is on Southern slope of Egrisi ridge, on 2326m elevation, within the areas of mountains Chitagvala and Lakumurashdudi.

The area geologically represents fold region, which is almost totally structured by Bajocian volcanogenic deposits and partially by lagoonal-continental deposits of upper Jurassic Akarmari

(particolored) formation; to its north – lower and middle Jurassic clays and sandstones are developed, but to the South – Cretaceous carbonaceous creatures. This kind (sub-latitudinal) of distribution of lithofacieses played important part in relief establishment and its development.

According to tectonic regionalization scheme of Georgia (E. Gamkrelidze, 2000), the study area is entirely distributed within fold-porphyritic Jurassic subzone areas of Gagra-Java zone of Caucasus fold (fold-overthrust) system. The mentioned subzone is bordered by Laila (scaly-anticlinal) subzone of Chkhalta-Laila (fold-scaly) zone from North, but from South – by Amzara-Mukhuri (extreme dislocations) subzone of Gagra-Java zone.

From geomorphologic viewpoint, the study area is located in Northern and central part of Kolkheti lowland, on accumulative seaside ending and terraces of rivers (Rioni, Tskhenistskali, Abashistskali, Khobistskali, etc.) down flow from Caucasus main ridge. The surface is plain, almost planar, slightly bending to sea, partially marshy. In the central part of the area small size lakes with quite rich flora and fauna are observed on the right bank of the river Rioni.

The territory is basically structured by recent (Q4) – new black marine, old black marine (Holocene) and Upper Quaternary Q3 – new Euxine, beach and deltaic loose Quaternary deposits. In the mentioned region, gathering deposits are connected to transgressions and regressions. Gathering deposits from about 30m to 100m are connected to new Euxine regression, but gathering younger deposits (from 15m to 30m) is connected to Pontic and Kolkhian regressions; as for the uppers layer gathering deposits to 15.m depth is connected to Lazian transgression.

Within the study areas, covering soils are structured by Quaternary deposits thickness of which is more than 100m by fundamental data. Holocene deposits genetically represent marine and fluvial deposits, lithological – gravelly, sandy and clayey materials.

At the study area boundaries groundwater outlets are observed in boreholes from 0.5m to 3.5m depth.

Geomorphologic structure of Kolkheti is formed during the recent stage of geological development, which composed a two-part terrain. Part of lowland adjacent to the seashore has an ideally flat surface with maximum absolute elevations not above 20-25 m. Here the terrain is fully free from erosion effects. The morphology structure may be fully explained by accumulation processes. The rivers running through this area have elevated beds. Coastal dunes impeding to entering the river waters into sea, are developed in intertidal zones of the coastal strip.

The inner part of Kolkheti Lowland is of relatively recent Quaternary origin. The absolute elevations in this area vary in 20-130 m range. The area is sloped down foothill from the north to the south and from the east to the west. The wide terrace steps of rivers Rioni, Tskhenistskali and Kvirila are evident over the plain terrain.

Study area belongs to 7 and 8 scale (MSK64) seismic regions according to the seismic regionalization scheme of Georgia (Construction Norms and Rules “Seismic Resistance Construction” – pn 01.01-09). From Samtredia into Zugdidi direction, up to Abasha, the region belongs to 7 scale region, but from Abasha to Zugdidi – 8 scale region (#2634 Abasha-8 scale, A=0.12; #2909 Senaki-8 scale, A=0.17; #2675 Zugdidi-8 scale, A=0.21).

Geohazards

The significant geohazards of the Kolkheti plain lowland are composed by riverbank erosion and flooding. In this regard particularly hazardous are rivers Rioni and Tskhenistskali with extensive bank

washout processes occurring almost at each meandering bend. Based on results of the geomonitoring surveys carried out by Geology Division of the National Environmental Agency, the total length of sections with riverbank erosion in Samtredia and Lanchkhuti Districts is 58 km, and total flood exposed area is 150 Ha.

The coastal zone of Kolkheti Lowland includes numerous wetlands and seashore erosion areas. Earthquake risks within Lanchkhuti and Samtredia Districts are estimated as of intensity Grade 8 (in accordance with adjusted temporary seismic zoning established by the Order No.42 of the Ministry of Architecture and Construction of Georgia dated 7 June 1991).

The new road alignment to the seaport of Anaklia passes central seaside peripheric part of Kolkheti lowland. Relief is accumulative, horizontal and almost flat. Riverbed cutting depth is insignificant here. Riverbeds are precinct by natural accumulative dams. Big part of the surface is marshy. Lithologically the territory is structured by marine and river loose and cohesive sandy,clayey and marshy gleizated deposits. At extreme West part of Kolkheti lowland, which borders to Black Sea coastline – here soils are lithological represented by glaciated clays containing very weak peat; they turn into very soft consistence by treatment. As for bogging up process, it is caused by total sinking of Kolkheti at Holocene period.

This territory belongs to 7 scale seismic region according to the scheme of seismic regionalization of Georgia, Samegrelo region, Zugdidi region, Anaklia community 2678) (Construction Norms and Rules “Seismic Resistant Construction” – pn 01.01-09).

With regard to the information about the ground structure and soil characteristics a liquefaction potential cannot be excluded. Liquefaction can occur in moderate to major earthquakes resulting in severe damages to structures.Liquefaction susceptibility is a measure of soils inherent resistance to liquefaction, and can range from not susceptible, regardless of seismic loading, to highly susceptible, which means that very little seismic energy is required to induce liquefaction. Liquefaction susceptibility is evaluated based on the primary relevant soil properties such as grain size, fine content, plasticity and density.

The liquefaction hazards are commonly associated with saturated sandy and silty soils having low plasticity and density. Where these type of soils are encountered during the investigations the liquefaction potential will be assessed.

6.3. Hydrology and hysrogeology

The Samtredia-Rukhi main road runs across the territories of Kvemo Imereti and Kolkheti Lowland, across administrative regions of Samtredia, Abasha, Senaki and Zugdidi. It crosses 116 watercourses, including 17 big and small rivers, 32 nameless brooks and gullies and 67 drying large and small channels. Out of big rivers, the Tskhenistskali, Noghela, Abasha, Tekhuri, Tsivi, Ochkhomuri, Khobi, Jumi and Chkhoushi are worthwhile. Most of the small rivers and nameless brooks are the tributaries of big rivers and have the same water regime as the big rivers.

Samtredia-Rukhi planned road crosses two small rivers and 16 dry channels.

Below, there is a brief hydrographical description of the big rivers, which are crossing the design main road.

The Contractor shall consult with the local Concerned Agencies to establish the fish spawning period in relation to the bridge construction works

6.4. Soils

In mosty of the Project área meadow wetland, subtropic, organic, alluvial soils. Average humisity - 35 %. the concentrations of the majority of contaminants are typically below the applicable Georgian MPCs and international Target and Intervention values. Agricultural land: The agricultural land consists of overgrazed pastures, maize fields and plantations (e.g. maize, filbert and other fruit trees) that are waterlogged for much of the year due to the high water table.

6.5. Biodiversity

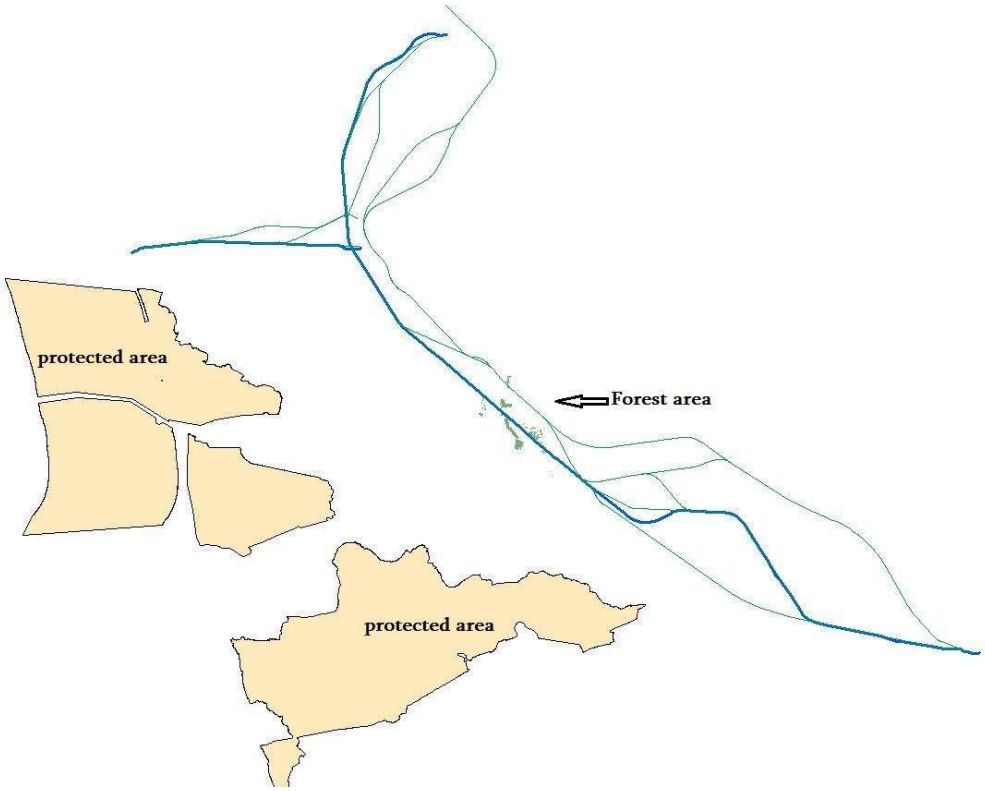
Characterization of floristic environment of the project road corridor is based on field survey, carried out within the area. The aim of the survey was to study vegetation and animal species within the corridor. Detailed survey of the flora and fauna of the territory was conducted by a team of biodiversity experts.

The main objective of the floristic surveys was identification of plant species, sensitive habitats and communities; determination of age and density groups of ligneous species of the forest.

Botanical survey was carried out along All sections the right of way in order to register species of conservative valuesin the project impact zone. The survey revealed that project implementation will have insignificant impact on flora during construction phase.

It should be noted that species composition of flora and fauna are almost similar on each alternative of distribution area.

Impact on Forest Find and risk of impact on protected áreas must be mentioned. As mentioned above the forest covers significant part of the project área. State forest authorities must be actively consulted and involved in the process in order to minimize adverse impact. Prior to tree felling the relevant sections of the forest must be de-listed from the forest fund. Possible consequences of tree felling on soil stability must be carefully assessed, relevant protection measures – included in the design.
Recommended Mitigation Measures is The Contractor should plan to avoid loss of trees where possible and should employ techniques such as asymmetrical widening. Where trees must be felled, the Contractor shall ensure that each one removed should be replaced by at least two new saplings of the same species or other at suitable locations, all as designated by the tree owner,



Latin names of species, mentioned in the text, are taken from the second edition of Georgian Flora (Book I –XIV 1987-1996; N. Ketskhoveli, A. Kharadze, R. Gagnidze); according to botanical dictionary (1991- A. Makashvili), and vulnerability categories – according to the Red List of Georgia (2008-2009).

Floristic Description and Characterisation of the Study Area

From orographic point of view Kutaisi-Samtredia road section is located on Kolkheti Lowland and belongs to slightly inclined accumulated plain-lowland landscape; absolute elevation is 20 - 60 m asl and in some places even more. Drainage is good; groundwater aquifers are deeper compared to the other areas of the lowland; rivers flow in deeply cut riverbes, therefore the area is not waterlogged.

The area is basically under anthropogenic load, in some sections altered natural landscapes with lowland meadows, in some places – marches are preserved.

The road alignment area is transformed, vast areas are used for agricultural purposes. Almost all forms of the relief (floodplains, above floodplain terraces, plains and elevated areas) are exposed to the impact of agricultural activities.

In historical past, the natural vegetation in the corridor and adjacent area was dominated by Imeretian oak and Zelkova forests with relicts of Colchic forest; nowadays due to anthropogenic load vegetation in major part of the area is altered. Only few standalone Imeretian Oak (*Quercus imeretina*), Zelkova Tree (*Zelkova carpinifolia*) and Hybrid poplar (*Populus hybrida*) have surviced. In most cases the forest cover is totally destructed, the areas overown with sparce shrubbery are developed. Species composition is rather poor.

Within the project corridor, small fragments of forest are preserved along the riverbeds and in relatively humid areas.

All sections except for **NORTHERN ALIGNMENT ALTERNATIVE**Due to the absence of shallow aquifers hygophilous and marsh vegetation is less developed. Weeds dominate in herbaceous cover; typologically similar trees and shrubs (mainly invasive species): Black locust (*Robinia fseudoacacia*), Honey locust (*Gleditschia triacanthos*), False indigo bush (*Amorpha fruticosa*), Oriental hornbeam (*Carpinus orientalis*), and weed herbaceous plants, such as - Canadian goldenrod (*Solidago Canadensis*), which are wide-spread on the major part of the area and pastures are wide-spread. On plains and meadows Johnson grass (*Sorghum halepanse*), annual Ragweed (*Ambrosia artemisiafolia*), Mugwort (*Artemisia vulgaris*), etc, unusable for cattle are met in large amount.

In overgrazed areas forestation process with high productivity trees and shrubs is impeded; this promotes degradation of the ecosystem, which is finally results in deforestation and domination of weed and meadow elements in herbaceous cover.

Environs of the study area and adjacent floodplain are used as maize fields and pastures; in most cases meadows are overgrazed, stony-detritus ground layer is visible. Such meadows are so called involuntary pastures for the cattle.

Considering aforementioned, the project corridor has been devided into section (by habitat type). All sections except for **SOUTHERN ALIGNMENT ALTERNATIVE**are considered as land plots of low conservative value (see **Error! Reference source not found.**).

forest fragment, medium age group, belongs to the medium to high conservation value habitat.

Types and Conservative Values of Plant Communities (Habitats) Studied within the Project Area

Section	Habitat	Conservation value
I	Agrarian landscape (maize fields)	Low
II	Standing water ecosystems- marshlands, lakes	Low
III	Meadows, weeded by black locust and false indigo bush	Low
V	Overgrazed stony-detritus meadow	Low

SOUTHERN ALIGNMENT ALTERNATIVE-(S1) - LENGTH 74.956 km

Agro-landscape (maize fields).

Stand alone Poplar (*Populus gracilis*), Oriental plane (*Platanus orientalis*), Black locust (*Robinia pseudoacacia*), Honey locust (*Gleditsia triacanthos*) are found in the cornfields. In the area not used as an arable small patches overgrown with weeds: Johnson grass (*Sorghum halepanse*), annual ragweed (*Ambrosia artemisiafolia*), Mugwort (*Artemisia vulgaris*) are met.

Sensitivity of habitat - low.

NORTHERN ALIGNMENT ALTERNATIVE (N1) - LENGTH 77.946 km.

Pastures with dense weed growth.

Such pastures are often met in the project corridor.

Sensitivity of habitat - low.

ACCESS ROAD TO ANAKLIA PORT

Meadow with bushes of Black locust (*Robinia fseudoacacia*), Honey locust (*Gleditschia triacanthos*) and False indigo bush (*Amorpha truticosa*).

Distributed invasive vegetation is uniform and poor from the view of species composition. Canadian goldenrod (*Solidago Canadensis*), Common ragweed (*Ambrosia artemisiafolia*) and Johnson grass (*Sorghum halepanse*) should be mentioned. These weeds cover not only the project corridor, but also significant part of Kolkheti Lowland making areas unusable as a pastures.

Sensitivity of habitat - low.

Fauna

Following basic types of ecosystems are represented within the project corridor:

Riverine ecosystems. Generally, such areas differ from neighboring landscapes with increased humidity, underdeveloped soil cover, but sometimes with density of shelters, more developed shrubbery and less utilized areas (for agricultural purposes). However lowlands of riverს floodplain are used for maize fields or pastures. Natural riverine ecosystems as a rule run along the river in the form of narrow lines and their width does not exceed several dozen meters. They are singled out with diversity of flora and fauna species composition and are very significant as shelters and feeding areas for species.

Standing water ecosystems – marshes, lakes (meanders, flooded meadows) are met on several sections of the project. In general, any wetland may contain some rare and endemic vertebrate and invertebrate species and extremely vulnerable animal groups live here. These areas are very significant for many species as shelters, feeding area, places to rest during migration and winter season. Fish species, invertebrates and amphibians should be highlighted. Such ecosystem is vulnerable toward construction and operation impact.

Impact can be resulted by fuel leakage during construction works and increased turbidity due to crossing floodplain and river by trucks during work implementation.

Residential, village and industrial areas– Industrial, urban type ecosystems and agrocenosis are met in manmade changed landscapes; arable lands, orchards, vegetable gardens, pastures, mowing lands, wind-belts, embankments of channels and ditches and other ecotone ecosystems between agrocenosis and road. Part of the route goes along less cultivated lands Large part of the animals, existing in this landscape comes from neighboring ecosystems. At the same time arable land are

feeding areas for many animals. This refers especially to bats and birds, inhabiting in forest or migrating. Several permanent complexes of animals can be observed here. Wild animals, existing on pastures and mowing lands, are given significance to some extent. Basically this is related to specie complexes from nearby natural landscapes, the quantity of which are reduced.

The road project impact zone mainly covers agricultural lands and settlements. Small sites of semi-natural biotypes are observed in anthropogenic landscape – forests and meadows. Common garden birds (sinanthropic), mammals, reptiles and invertebrates are represented on the area. The mentioned area is important for migratory birds and bats. Sometimes bird nests and bat colonies can be observed in old industrial buildings – mainly in abandoned storage areas, basements, lofts, etc. In this case it is necessary to take special measures in order to avoid massive destruction of them, especially when the species are protected under Law (e.g.: included in the Red List of Georgia). During short field survey, such nests and colonies of the protected species were not observed near the project corridor. Several abandoned buildings should be observed prior to construction.

Bats

All bats in Georgia are protected by law, according to agreement of EUROBATS. Bats are highly depended on shelters. Shelters like tree hollows, caves and abounded buildings are essential for their vitality. Wintering and newly reproduced colonies may destructed during cleaning works, during cutting hollow trees or construction of bridges, as well as during improperly selected period for dismantling of buildings during construction of the alignment.

There is only one specie verified on Samtredia site, and two species are assumed. None of them are protected by law.

Mammals

Besides the above mentioned issues, it should be noted that the construction area is located on the territory that is interesting for the society in terms of existing of certain species. There are species interesting for hunters and tourists, as well as for observers on the birds.

These species are less expected to be impacted, because number of their population is small and this territory has been experiences the anthropogenic pressure for a long time.

According to the implemented field works, no mammals were detected along the linear transects, so we based on the literary sources about this area. Indirect impact or permanent impact is expected on the given species. Indirect impact means damage that part of the ecosystem, from where animals receive food, as well as shifting of migration corridors that will intensify the background pressure on the fauna representatives inhabiting nearby the study area. From the listed animals, Otter (Lutra lutra) is the species inhabiting along the rivers of the project area and experiences the considerable impact. But there is no information about precise location or community structure and number of this species in the mentioned area.

As a general, Otter is a species of river habitat and inhabits on the ground substrate at the slow streams of rivers.

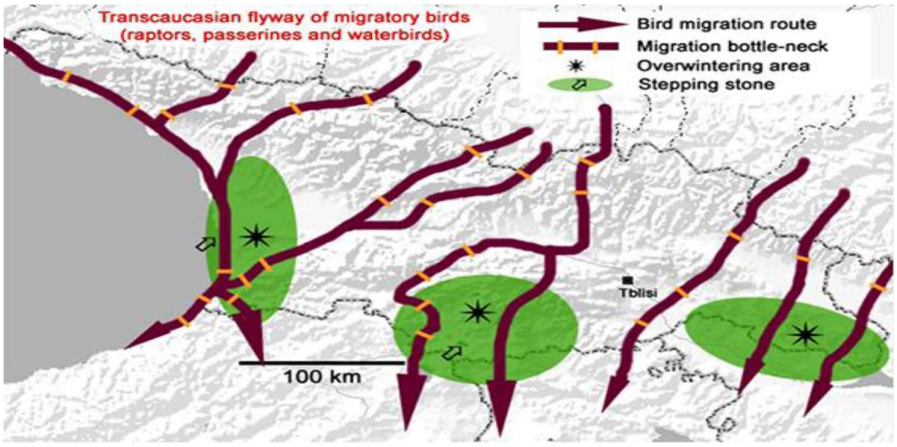
In terms of terrestrial mammals inhabiting on the study area, bats (order Chiroptera) are vulnerable group. They are extremely limited to provide shelters for their nestling colonies. Favourable shelters are hollow trees, caves and abandoned buildings, which are extremely important for bats. All species of bats observed in Georgia are included in the Annex II of Bonn Convention and protected by the

agreement of EUROBATS. Based on this agreement, Georgia is mandatory to protect all bats inhabiting within the project area and in its vicinities.

Birds

Majority of birds found on the study area are mainly presented by forest, shrubbery and other species, water birds are also observed there . The territory is not significant habitat for birds; there are no migration routes on the territory of the projectcorridor .

Figure 1 Migration corriodr



Birds were observed during the field survey, relevant information is given in the Table

Birdsfound during the field surveys within the project area

№	Latin name	English name	Georgian name	Red List	Season	IUCN
1.	*Motacilla alba*	White Wagtail	თეთრიბოლოქანქარა		YR-R, M	LC
2.	*Apus apus*	Common Swift	ნამგალა		BB, M	LC
3.	*Merops apiaster*	European Bee-eater	ოქროსფერიკვირიონი		BB, M	LC
4.	*Charadrius dubius*	Little Ringed Plover	მცირეწინტალა		YR-R, M	LC
5.	*Larus ridibundus*	Black-headed Gull	ტბისთოლია		YR-R, M	LC
6.	*Corvus cornix*	Hooded Crow	რუხიყვავი		YR-R	LC
7.	*Garrulus glandarius*	Eurasian Jay	ჩხიკვი		YR-R	LC
8.	*Turdus merula*	Eurasian Blackbird	შაშვი		YR-R	LC

9.	*Delichon urbicum*	Hause-Martin	ქალაქისმერცხალი		BB, M	LC
10.	*Upupa epops*	Common Hoopoe	ოფოფი		BB, M	LC
11.	*Turdus viscivorus*	Mistle Thrush	ჩხართვი		YR-R, M	LC
12.	*Erithacus rubecula*	European Robin	გულწითელა		YR-R	LC
13.	*Fringilla coelebs*	Chaffinch	სკვინჩა		YR-R, M	LC
14.	*Phoenicurus phoenicurus*	Common Redstart	ჩვეულებრივიბოლოცეცხლა		BB, M	LC
15.	*Passer domesticus*	Hause Sparrow	სახლისბეღურა		YR-R	LC
16.	*Carduelis carduelis*	European Goldfinch	ჩიტბატონა		YR-R, M	LC
17.	*Parus major*	Great Tit	დიდიწივწივა (წიწკანა)		YR-R	LC
18.	*Lanius collurio*	Red-backed Shrike	ჩვეულებრივიღაჟო		BB, M	LC
19.	*Turdus philomelos*	Song Thrush	წრიპა		YR-R, M	LC

YR-R = It stays in Georgia throughout the year, nestling and breeding here;

YR-V = Visitor of these territories; it doesn't breed but stays here throughout the year;

BB = Visits the territory only for breeding;

M = migrant; can occur on this territory during migration(autumn and spring)

EN = endangered; VU = Vulnerable; NT = Near threatened and LC = Least-concern.

Reptiles (class: Reptilia)

As to the literary sources, 8 species of reptiles are known on all sites of the study area, out of which 2 are lizards, 2 – turtles and 4 – snakes.

Amphibians (Class: Amphibia)

According to the literary sources, the study area is mainly characterized by existing the following species: marsh frog (Pelophylax ridibundus) and long-legged wood frog (Rana macrocnemis), European tree frog (Hyla orientalis).

Insects

Survey methodology of invertebrates:

Recording of adult phase of large invertebrates is visually carried out on transects. They are butterflies, bugs, dragonflies, bees, grasshoppers, spiders, mollusks. Research methodology comprises the following activities:

- Catching and identification of insects;
- Turning over the stones and soil layer;

- Checking of plants and plant residues;
- Photographing;
- Beating the insects on an awning with a stick;
- Checking the pond bottom by sand screening

6.6 Protected Areas

The protected area is relatively far from the highway corridor (3 km and more from Kolkheti National Park).

6.7 Sources of Natural Construction Material

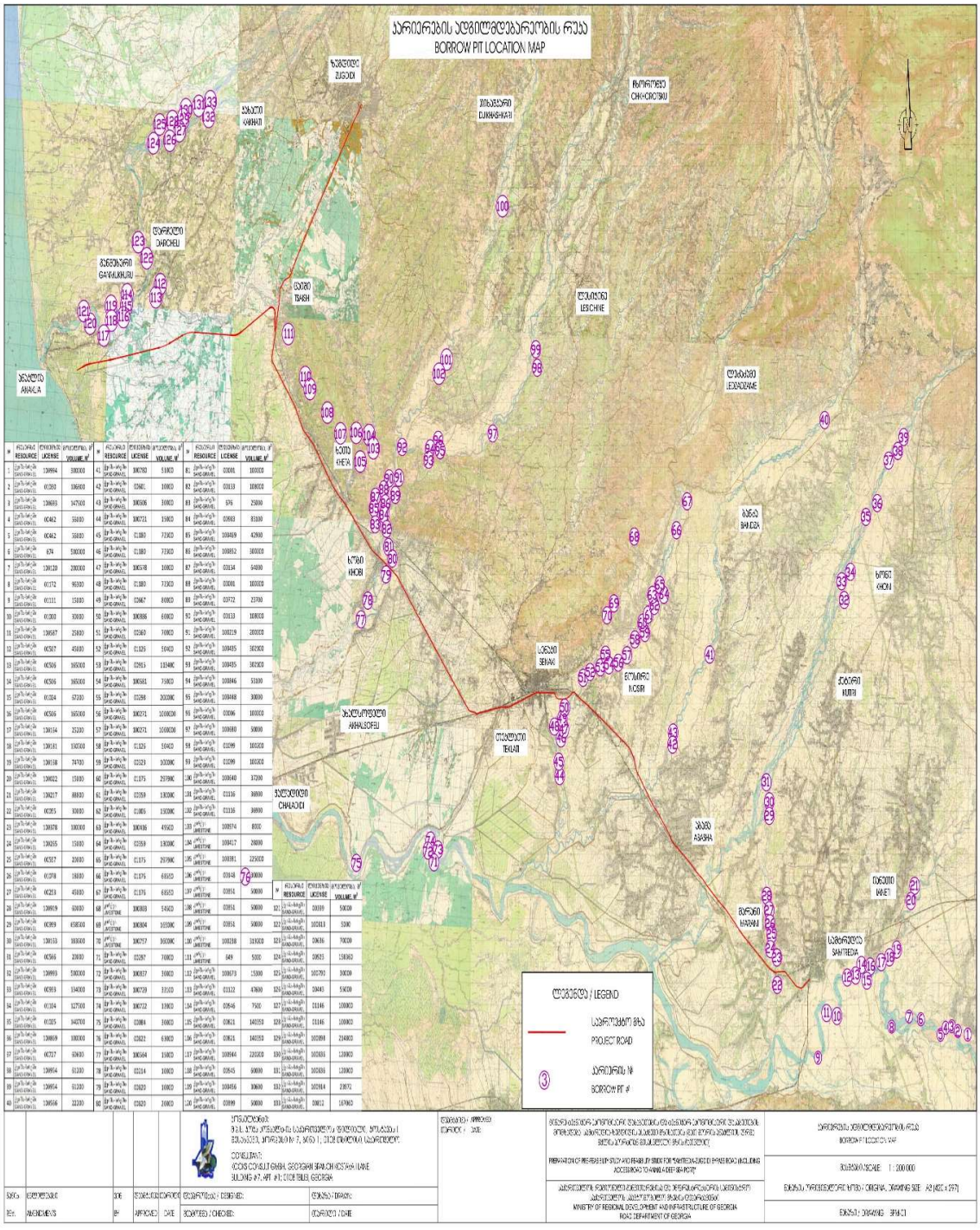
The feasibility study of the project has identified scope of earth works. A significant amount of natural constrction material of acceptable quality is required for the project implementation. It is very important to assure that the quarries used for the project are properly operated and reinstated after the construction works are finished.

The international best practice provisions recommend use of quarry and borrow material from mountain sources, however, in Georgia, such quarries are rare and most of the material is obtained from quarries based on river gravel.

The quarries and borrow pits used for the project should be reinstated at the end of the project when the need for the inert material disappears. National regulations manage the operation of quarries and borrow pits through the licensing process. Geological plan for mine operation is to be developed and strictkly followed. The plan usually defines the process of quarry operation; i.e. opening of the quarry, excavation of the material, dimensions of operation face, internal roads, access, health and safety requirements etc. Finally, the document provides information on how the quarry should be suspended or closed. Methodology for quarry operation is part of the licensing documentation. Otherwise, applicants need to prepare the licencing documents and should submit to the authorities for no objection.

Usually, construction companies claim that a quarry will be used in the future and so does not want to close and reinstate it. The requirement for full or partial closure should be a strict and not subject to discussion. The construction company should be responsible for full or partial close down and reinstatement of the quarry.

For minimizing environmental footprint of the extraction of natural construction material, works contractor should be encouraged to abstain from opening a new quarry if the material of requires specifications can be purchased at a reasonable cost from the existing licensed quarries located in proximity to the project site. The below map provides locations of such operating quarries.


ქარიერების ადმილმდებარეობის რუკა
BORROW PIT LOCATION MAP
ზესტაფონი ZESTAFONI
ხაშური KASHURI
ჭიათურა CHIATURA
ზესტაფონის ტყიანები ZESTAFONI FOREST
ცხრაწყარო TSKHRAWYARO
ლეჩხუმი LECHKHUMI
ტყიბული TKIBULI
ლენტეხი LENTEKHI
ბარისახო BARISAKHO
ჭიათურა CHIATURA
ხონი KHONI
ბაღდათი BAGDATI
ვანი VANI
სამტრედია SAMTREDIA
ნინოწმინდა NINOTSMINDA
ასპინძა ASPINDZA
ახალციხე AKHALTSIKHE
ადიგენი ADIGENI
ბორჯომი BORJOMI
ახალქალაქი AKHALKALAKI
ნინოწმინდა NINOTSMINDA
ნინოწმინდა NINOTSMINDA
ნინოწმინდა NINOTSMINDA

7. Possible impacts on the environment and corresponding Mitigation Measures

Environmental impacts of the the road Project have been identified and evaluated for pre-construction, construction and operation stages of the project. On each stage both negative and positive impact on environment along the new alignment and next to it will occur. The list of expected impact by the stage of the project is given in Table below.

Planned Operations	Environmental Impact
Pre-construction: • Obtaining all clearance and permits related to the project; • Development and approval of plans (such as waste management, traffic management, erosion management); • Identification of sources /suppliers of materials identified; • Selection of sites for temporary camps, material, topsoil, spoil and waste with consideration of environmental and safety requirements.	These activities are not related to impact on environment
• Preparation of worksites, sites for vehicles and construction machinery, arrangement of temporary facilities and camp site (in case arrangement of construction camp is considered by contractor advisable) – this includes removql of road pavement and certain amount of demolition works; removal of vegetation (whether absolutely necessary); stripping and removal of topsoil to temporary storage,;grading of the work areas; • Clearing the RoW strip - removal of vegetation, stripping and removal of topsoil to temporary storage area; • Onsite and offsite works.	• Air emission of inorganic dust and combustion products; • Propagation of noise and vibration; • Impacto n ground wáter during tunelling; • Generation of waste, littering; • Accidental oil spills - risk of soil and water pollution; • Soil erosion, ramming; • Impact on flora and fauna; • Visual impact; • Increase of traffic; • Impact on infrastructure – potential temporary disruption of services provided to population; • Resettlement/land acquisition of permanenent use agreement needs; • Health and safety risks – community (road accidents), workforce (work at hight, work in wáter, works in confined spaces);

	• Temporary employment (Note: positive impact).
Construction works: • Importation of inert material for arrangement of embankment; • Storage of material in specially allocated area (if deemed advisable); • Arrangement of embankment – forming embankment, ramming; • Arranging drainage system; • Installation of sheet piles in water crossing bridge construction area; • Bridge construction - arrangement of foundation; pile cap; bridge column, bearing, bridge deck – works include excavation, concrete works, assembling pre-cast elements on the site; • Paving of the deck and the carriageway, including shoulders; • Road marking and installation of road signs; • Onsite and offsite traffic.	• Air emission – dust, exhaust emissions and welding aerosols; • Propagation of noise and vibration; • Deterioration of water quality – pollution with oil products and increased turbidity during works close/in the riverbed; • Risk of flow blockage; • Possible impact of ground wáter during tunelling; • Accidental oil spills – soil /wáter pollution; • Soil erosion, ramming; • Waste generation, littering; • Impact on terrestrial fauna; • Impact on aquatic fauna (in river crossings); • Risk of impact on vegetation; • Increase of traffic; • Impact on road infrastructure; • Risk of accidental undeliberate impact on private properties; • Safety risks – community, workforce; • Temporary employment in construction (Note: positive impact); • Promotion of satellite businesses (positive impact).
Demobilisation • Dismounting of temporary structures; • Removal of machinery and waste from the area; • Recultivation of site disturbed during construction (based on recultivation plan, tailored to the site).	• Air emission – dust, exhaust emissions; • Propagation of noise and vibration; • Waste generation, littering; • Risk of soil and water pollution; • Impact on baseline traffic; • Safety – community, workforce.
Operation: • Traffic along the new alignment; • Maintenance of roads, bridges.	• Air emissions (dust, combustion emissions); • Noise and vibration; • Safety risks;

Decommissioning; Must be considered separately (whether required).	Will depend on planned works.

7.1. Impact on water resources

Assessment of Impact: pre-construction and construction stages

Preparation works and works during construction of the road, bridges may have impacts on water environment. These are:

- Potential contamination of surface and ground waters, which can be caused by:
  - Accidental leakages of fuel/oil/ lubricants from cars and machinery (including emergency situations);
  - Pollution caused by improper management of construction materials and waste;
  - Increase of turbidity caused by earthworks and construction activities near and/or in the riverbed;
  - Possible pollution with runoff from contaminated areas;
  - Contamination of ground waters by infiltrated contaminated surface water.
  - Possible pollution of ground water (shallow horisons) during earthworks and construction activities;
  - Impact on groundwater flow during tunelling;

During earthworks certain risk of impact on shallow aquifers which are more vulnerable - exists. The impact probability in the bridge construction areas, where extensive excavation is needed, is higher.
Pollution of water may be observed during construction works near rivers and small stream crossings. During construction, qualitative parameters of these surface water bodies may be affected by accidentally spilled fuel/oil or contaminated surface runoff. Increase of turbidity caused by the lack of erosion control, and pollution with poorly managed solid construction waste may also occur.
Impact on ground wáter hydrology may happen during tunelling works.
Direct discharge of potentially contaminated waste water is another potential cause of wáter pollution.
The ranking of project impact on water flow and quality for considered alternatives is as follows:

- Sensitivity of receptor – high,
- Likelihood of impact – medium to high, with consideration of location,

Major possible impacts on water during operation of the highway will be:

- Sedimentation and pollution of waters with heavy metals and petroleum hydrocarbons (runoff, emergency);
- Pollution with waste;
- Cross contamination of ground water in case of surface water pollution;
- Pollution during winter maintenance (application of salt, sand and other products posing water quality under threat);
- Pollution in case of emergency;
- Pollution of water during maintenance works.

Some of the listed impact are described in more details below.

Surface/ground water pollution during operation of the highway may occur from regular operational and maintenance, as well as from traffic accidents involving cargo vehicles transporting hazardous substances.

During operation of the road pollution of surface/ground water may occur through direct release of drainage carrying heavy metals, oil products from the road surface. The list of typical pollutants washed off from the road surface/bridge deck is as follows:

Pollutant	**Source**
Particulate matter	Pavement wear, vehicles, 'natural' dust, maintenance activities
Rubber	Tire wear
Asbestos	Clutch and brake lining wear
Nitrogen and phosphorus	Air, roadside fertilizer application and sediments
Lead	Leaded gasoline from auto exhaust, tire wear, lubricating oil and grease, bearing wear and atmospheric fallout
Zinc	Tire wear, motor oil and grease
Iron	Auto body rust, steel highway structures such as bridges and guardrails and moving engine parts
Copper	Metal plating, bearing wear, moving engine parts, brake lining wear
Cadmium	Tire wear
Chromium	Metal plating, moving engine parts and brake lining wear
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear and asphalt paving
Manganese	Moving engine parts
Sulphur	Roadway beds, fuel
Bromide	Exhaust
Petroleum	Spills, leaks, antifreeze and hydraulic fluids, asphalt surface leachate and blow-by motor lubricants
PCB	PCB catalyst in synthetic tires
Pathogen bacteria	Soil litter, bird droppings and trucks hauling livestock/stockyard waste

The Table shows that the lower is the traffic flow the lower are concentrations of main pollutants in the runoff.

Concentration of contaminants in the runoff cannot be reduced on source and depend on the status of technical maintenance of cars, traffic speed, quality of petrol, etc. Curbs and gutters can trap particulate matter on the highway. Impact caused by the runoff on surface water can be somehow reduced by vegetation along the highway, availability of infiltration trenches, general roadway maintenance and clean-up activities. The baseline quality of water, size and characteristics of receiving stream, potential for dilution, ability of self-cleaning are the critical factors in determining the magnitude of highway runoff on surface water

To avoid direct discharge of runoff and/or spills from the bridges prevention measures are to be considered for recipient water bodies in particular for those of zero tolerance (drinking water reservoir, protected area, etc.). Designs will ensure that drainage from bridge decks over 50 meters does not discharge directly to the watercourses beneath the bridges. The bridge run-off waters will lead to an interceptor tank, or filter pond adjacent to the bridge in order to trap oil and grease run-off.

In a longer-term perspective, as the country progresses in the implementation of recommendation for EU approximation, regulations of the age and technical condition of vehicles will considerably stiffen and control over the quality of fuel will enhance, leading to the decrease of impact from the movement of vehicles.
Worth to mention is impact of road salt or sand for improvement of traffic safety in winter. The road salt (sodium chloride), is composed of 40% of sodium ions (Na+) and 60% of chloride ions (Cl-). Other components and impurities account for 5% of the total weight. The salt components make their way into environment through the runoff (rain, melting snow and ice), as well as through splash and spray by vehicles and/or by wind causing impact on environment. Chloride ion is completely soluble and very mobile, toxic to aquatic life and capable to impacts vegetation and wildlife. There is no natural process by which chlorides are broken down, metabolized, taken up, or removed from the environment. The transport of sodium (Na+) in environment is less prominent due to ion exchange. With consideration of the climate excessive use of ice breakers in the project area uses to be required. Other posible impacts woth to mention are: pollution from road maintenance works in case of careless handling of construction materials and wastes, failure to adhere to good construction practice.
By the risk of impact on surface water quality and littering all alternatives are similar.
The ranking of project impact on water flow and quality for considered alternatives is as follows:

- Sensitivity of receptor – high (all sections and alternatives),
- Likelihood of impact – medium to high Magnitude of impact - low to médium, depending on location.

Mitigation measures

Pre-construction and construction stages.
In order to avoid or mitigate impact works should be performed with due consideration of environmental safety measures:

- Should any temporary fuel tank be available, it must be located within at least 100m from the riverbed. The tank must be placed in covered areas with berms or dikes installed to intercept spills, if any. Any spill should be immediately localized and cleaned up with absorbent materials.
- Onsite repairs /maintenance and fuelling activities should be limited. Priority should be given to offsite commercial facilities. If impossible, a designated area with secondary containment for possible spills for on-site repair or maintenance activities must be provided. These areas shall be located away from drainage channels and surface water bodies. (distance between the maintenance site and the river should be at least 100m).
- On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site.
- Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing oils from vehicles or equipment. For small spills, absorbent materials must be used.
- Discharge of any untreated water into the surface water body must be strictly prohibited.
- Discharge of cement contaminated water must be avoided as cement pollution results in high alkalinity and raises the pH, which can be toxic to aquatic life.
- Materials and waste must be stockpiled so as to avoid erosion and washing off into the river. Drainage trenches must be established to divert surface runoff from the site. Waste management strictly follow best practice requirements. Good houskeeping practices kept to.

- Runoff control measures can be installed at the time of road/highway and bridge construction to reduce runoff pollution.
- To prevent runoff contamination, paving should be performed only in dry weather.
- In disturbed soil areas silt fence, fibber rolls, gravel bags, or other approved sediment control must be ensured. At a minimum, bare soil (whether it is an abutment slope or a stockpile) must be protected before it rains. Soil stabilization BMPs such as mulch, soil binders, plastic sheeting or erosion control blankets must be used to protect bare soil;
- Place generators must be place at more than 20 meters from the river. No hazardous liquids should be places within 10m from the riverbed.
- Staff must be trained and aware of best practice requirements.

During construction of the crossing sheet piles/cofferdams must be used to avoid operation in water. Use of machinery in the riverbed will be prohibited. Works will be implemented in 'dry' environment. Construction company selected through bidding will specify location of construction camp (if deemed advisable). With consideration of vicinity of worksites to the residential areas contractor may decide to use existing facilities (hire accommodation in the nearest village) rather than run his own camp. This will allow to resolve (avoid) the issue of domestic waste water and alleviate the impact on environment. On worksite portable toilets will be installed[2].

Machinery stationing and material/topsoil storage sites should be located away from the watercourses/canals. Impact on surface water from these areas will not happen.

Use of commercial car service facilities will be encouraged. Along with reduction of the risk of spills and pollution of water with spilled/washed off lubricants/fuel, impacts related to presence and management of fuel stock on site will be avoided.

Responsibility for mitigation measures rests with the contractor.

Under condition that mitigation measures listed above are implemented the magnitude of residual impact for considered alternative alignments will be low.

Operation stage

Most mitigation measures suggested for construction phase shall be applied to maintenance works. The measures required for each specific site will be specified with consideration of the scope/scale and type of maintenance and location of the site. Proper planning of rehabilitation works in the sections close/in the riverbed can be an effective measure for protection of the water environment during maintenance works. In addition to that, to reduce impact on the water environment while maintenance

- Proper staging techniques should be used to reduce the spread of paving materials during the repair of potholes and worn pavement. These may include covering storm drain inlets and manholes during paving operations, using erosion and sediment controls to decrease runoff from repair sites, and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines;
- Good waste management practices must be kept to. Regular clean up along the roads – provided.

According to preliminary estimate, under condition that mitigation measures are implemented, the magnitude of residual impact will be low.

[2] According to the experience 1 toilet per 10 individuals is required. Capacity of a standard toilet tank is 225-227 litres. Capacity of water reservoir is 19 litres. The tank should be cleaned maximum once in 4 weeks. Odour problem can be avoided through use of deodorants.

7.2. Waste Management

Waste: pre-construction and road construction stages

Waste streams generated during construction include inert and hazardous waste.
Inert waste (earth, soil) do not decompose or produce leachate or other products harmful to the environment. Recyclable materials include but are not limited to cardboard, gravel, excavated soil (uncontaminated), green waste, wood/lumber, limited amount of scrap metal.
To prevent the impact of the waste generated during construction on environment it must be collected and temporarily placed in the selected area with consideration of requirements applicable to each waste stream. The inert waste must be placed so as not to interfere with free movement of machinery and staff, away from surface water (within at least 100m).
All waste must be source-separated in order to ensure proper management and enable reuse. Until removal from the site, domestic waste (food waste, plastic bottles, packaging) must be collected in containers with fitted lid to avoid attraction of scavengers, emanation of odour and scattering by wind. The lids also protect waste from rain and snow.
Assuming that the quantity of domestic waste generated per capita per year totals 0.7m^3 , the approximate total amount of the above-mentioned waste produced during the construction will equate 200x0.7=140 m^3/year.
In Georgia municipalities are responsible for the collection and transportation of household waste. However, regular waste collection service is only available in some of the central settlements. The household waste generated during construction will be collected and delivered to the nearest landfill under the contract with the Solid Waste Management Company of Georgia.
Contractor (construction company) will be obliges to provide waste management plan tailored to the work schedule and waste streams.

#	Waste Type	Hazardous	Estimated Volume
1	Concrete	No	200 m^3
2	Asphalt	No	Currently unknown
3	Bituminous Mixtures	Yes	1 t
4	Wood	No	1 t
5	Uncontaminated Metal	No	5 t
6	Uncontaminated Plastic	No	1 t
7	Contaminated metal (paint tins, etc.)	Yes	2 t
8	Contaminated plastic (oil containers)	Yes	3 t
9	Domestic Waste (non-foodstuff)	No	40 t
10	Sewage Water	Yes	150 m^3
11	Used tyres	Yes	150 t
12	Hazardous liquid waste	Yes	20 m^3
13	Hazardous solid waste	Yes	10 t

Waste: road operation stage

During operation of the highway, roadside litter may accumulate (unfortunate practice). It is predominantly food waste, plastic and paper that people fly tip. The roadside litter is extremely unsightly. Uncollected litter may attract vermin. It can impact animals that may get trapped or poisoned with litter in their habitats. Cigarette butts and filters threaten wildlife, as fish and birds often mistake this waste for food. Litter may end up in rivers and canals, and the last but not the least, the litter is also a road hazard that may occasionally contribute to accidents.
Management of waste during operation will be responsibility of the contractor identified by the Roads Department.
The ranking of project impact related to generation of waste is as follows:

- Likelihood of impact – low to medium, depending on location.
- Magnitude of impact - low to medium, depending on location.

Pre-construction and construction stages
Impact of waste generation on environment during construction can be mitigated by proper storage, maximum reuse and timely removal of unusable waste to agreed location.
Staff must be trained in safe waste management practices.
Handling/utilization of hazardous waste will be done by authorized contractor only.
Until removal from the site, waste will be stored with consideration of requirements listed above.
The main principles can be summarized as follows:

- Waste must be stored in specially allocated are away from watercourses (not closer tan 100m);
- The storage must not hinder traffic (vehicles, people);
- Waste must be separated to enable reuse;
- Inert and hazardous waste must be stored separately, is adequately markers/labelled relevant containers;
- Domestic waste must be collected in conainers equipped with lids to avoid attraction of scavengers, spreading of odour, scattering by wind and to protect from atmosphetic wáter;
- Hazardous waste must be stored in containers relevant to the type pf waste. Containers must not be damaged. Integrity of containers must be checked regularly. Containers must be marked and equippedwit secondary containment (whether appropriate).

Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low.

Operation stage

- Educate community that littering is illegal, fines apply and behaviours are monitored, inform the community of the level of fines that littering incurs;
- Install banners with the message that littering is not acceptable action. The signs may be suitable for placement in a series of two to four signs at 10 km intervals to repeat the message in different ways.
- Provide clean up.

Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low.

7.3. Impacts on the Air quality (air pollution)

Assessment of impact: pre-construction and construction stages

Deterioration of air quality pre-construction and construction works can be due to the following:

- Dust emissions during earthwork and stockpiles;
- Dust from loading, transportation and unloading of soil and friable materials;
- Emissions from operation of construction machinery, asphalt/concrete plant;
- Dust and emissions from onsite and offsite traffic, vehicles moving across unpaved or dusty surfaces;

It is very difficult to accurately quantify dust emissions arising from construction activities. It is thus not possible to easily predict changes to dust soiling rates or PM10 concentrations. Amounts of vehicle-emitted pollutants will mainly depend on technical condition of the vehicles, fuel quality and speed. Older vehicles usually have lower fuel consumption efficiency and cause higher emissions of combustion by-products. Increasing speed of the vehicle demands higher fuel supply and therefore results in larger amounts of emitted pollutants. Keeping that in mind attention should be paid to the age and status of technical maintenance of vehicles/machinery used during construction.

Alignment alternatives in some sections run close to the residential area. The sites suggested for stationing of machinery and storage of materials (including topsoil) must be at some distance from the settlements.

Dust and emissions during operation of machinery along alignments is inevitable. However, the impact will depend on the season. The impact can be managed to some extend though implementation of mitigation measures and good organisation of works.

Duration of impact will be proportional to the length of considered alternatives. Since alternatives for sections 1 and 3 of the new alignment does not differ a lot. The impact will be almost similar. Dust and exhaust emissions for all alternatives will be of the same range. The issue must be considered in more details during preparation of ESIA on detailed design development stage of the project.

The impact of considered alternatives can be described as follows:

- Likelihood of impact – medium to high, depending on location
- Magnitude of impact – medium to high, depending on location.

Assessment of impact – road operation stage

Impact during operation will be related to dust and exhaust emissions from the vehicles using the highway. Amounts of vehicle-emitted pollutants mainly depend on technical condition of the vehicles, fuel quality and speed. As already mentioned above, older vehicles usually have lower fuel consumption efficiency and cause higher emissions of combustion by-products. Expected increas in number of vehicles using the road enables to assume higher exhaust emission levels. Traffic emissions will mostly depend on speed, technical condition of the vehicles and percentage of Heavy Goods Vehicles (HGV) in the traffic flow.

Increased traffic flows will inevitably result in higher CO2 emissions. Very low average speeds generally represent stop-and-go driving, and vehicles do not travel far. Therefore, the emission rates per kilometre are quite high (when a car's engine is running, but it is not moving, its emission rate per distance unit reaches the maximum). Conversely, when vehicles travel at much higher speeds, they demand very high engine loads, which require more fuel, and therefore lead to high CO2 emission rates. Low emission rates are obtained at moderate speeds of about 65-95 km/h.

Modernization/optimisation of the road will help to avoid emissions due to vehicles travelling at very low speed or queuing.

One of the measures for CO2 emissions reduction is proper management of vehicle speed. To reduce CO2 emissions from the transportation sector, attention should be given to more efficient vehicles, alternative fuels. In terms of the perspective of the new road section upgrading, all factors influencing CO2 emissions are hard to foresee. For example, it is possible that in 2050 the consumption of low-carbon fuel (such as biofuel and synthetic fuel) will considerably increase resulting in lower emissions than predicted. However, consistent policy on the topic should be obtained considering all the influencing factors and development of the state.

Despite of a certain growth in the traffic flow in 2020-2050 period, in a longer term perspective, as the country progresses in the implementation of recommendation for EU approximation, regulations of the age and technical condition of vehicles will considerably stiffen and control over the quality of fuel will enhance, leading to the decrease of impact from the movement of vehicles.

Preliminary ranking of project impact on air quality for considered alternatives is as follows:

- Likelihood of impact – high,
- Magnitude of impact - medium to low, depending on location.

Mitigation measures

Pre-construction and construction stages.

In order to avoid or mitigate impact works will be performed with due consideration of environmental safety measures:

- Spraying all unpaved roads and significant areas of uncovered soil with water every four hours (or more frequently, depending on the needs) on working days, during dry and/or windy weather;
- Covering all loose material with tarpaulins when transported off-site on trucks;
- Good selection of layout of the stockpiles to avoid aeolean erosion;
- Ensuring proper maintenance of vehicles and machinery;
- Setting optimum speed while moving through the residential area to reduce dust emissions;
- Prohibition of idling with switched gear;
- Prohibition of dumping of material from high to avoid dust related nuisance;
- Keeping at least 300 m distance from residences windward to reinforced concrete production plants (if planned to run);
- Obtaining environmental impact permit for asphalt plant (if planned to run own facility);
- Training staff in construction best practice.

To asvoid emissions from construction camps hiring accommodation in the nearest villages can be considered as an option.

Contractor must be responsible for preparation of a Health and Safety Plan (component of Site Specific Environmental Management Plan (SSEMP)) to deal with contingencies for accidental reléase of air pollutants.

Under condition that mitigation measures are implemented the magnitude of residual impact will be medium to low, depending on location.

Operation stage

The only measure for reduction of emissions related nuisance during operation is arrangement and maintenance of vegetation barrier along the road (in particular in the sensitive areas such as settlements).

Mitigation measures suggested for construction stage should apply to road maintenance works (the measures should be relevant to the type of activity and the scale of impact).

Under condition that mitigation measures are implemented the magnitude of residual impact will be medium to low, depending on location.

7.4. Vulnerability to Climate Change and Carbon Footprint of Road Operation

Approximately 40% of CO_2 emissions in Georgia come from transport and the other 60% of CO_2 emissions comes from other sources. Existing tranpsot traffic will use 4-line highway, which will lead to increase traffic safety and will alloy traffic to keep constant speed. This factor may affect todays CO_2 emissions positively and will reduse amount of CO_2.

The transport sector is vulnerable to changes in climate variables, expected changes in the frequency and intensity of extreme weather events, and increased sea level. The following are a few examples of the potential effects:

• Changes in temperature—both a gradual increase in temperature and an increase in extreme temperatures—are likely to impact road pavements (for example, heatinduced heaving and buckling of joints).

• Changes in precipitation and water levels will impact road foundations.

• Extreme weather events such as stronger and/or more frequent storms will affect the capacity of drainage and overflow systems to deal with stronger or faster velocity of water flows.

• Stronger or faster velocity of water flows will also impact bridge foundations.

• Increased wind loads and storm strengths will impact long span bridges.

• High levels of precipitation may threaten embankment stability.

• Increase in scouring of roads, bridges, and support structures.

Most climate change impacts are projected to occur slowly over a long period of time and as such providing mitigation measure for topics such climate change impacts on pavement design need to be taken over time and cannot be determined in a study like this. Notwithstanding the above a number of simple measures can be taken to ensure that in the short term that extreme precipitation events do not result in significant impacts to the Project, they include:

• Increase ditch and culvert capacity;

• Maintain positive cross slope to facilitate flow of water from surface;

• Increase resistance to rutting;

• More frequent use of elevated pavement section;

• Improve visibility and pavement marking demarcation; and

• Ensure that all embankments are seeded to help increase stability.

Pre-construction and construction stages.

Residual Impact Significance-MINOR

Operation stage

Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted, more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road.

7.5. Noise and Vibration

Assessment impact on background noise and vibration: pre-construction and construction stages

Road construction will introduce additional noise sources to the local area. Road construction noise is caused by construction equipment and operations. There are two main sources of noise during the construction: noise resulting from road upgrading works, and noise from additional activities, such as transport of materials by HGV along the route. Noise and vibrations will be inevitable from such activities as digging trenches, soil compaction, tunnelling, onsite and off-site traffic.
The dominant source of noise from most construction equipment is the engine, usually a diesel, without sufficient muffling. Only in a few cases noise generated by the process dominates (for example, impact pile driving, pavement breaking – where required). Noise levels during the construction vary depending on the construction activity and schedule.
Noise limits for various working environments are estimated in General EHS Guidelines "Occupational health and safety" (issued by International Finance Corporation, 2007), which is the main document to rely on for noise and vibration issues in this phase. Noise levels induced by the main road construction equipment are presented in Table given below (Note: the values indicated in the table may differ depending on the brand of machinery provided/used by construction company).

Comparing alternatives in terms of sound and vibration

Alternatives of the sound are transported in the same corridor and the difference between them from the standpoint of voice and vibration impacts is insignificant. Detalied evaluation of alternatives must be performed during the detailed projection and complete analyses of environemtnal impacts.

If the detailed project will decide to postpone arrangement of noise barriers till road is operation and noise impacts materialize, the road corridor should still have space to place barriers at that later stage.

Equipment	Typical noise level (dBA), in appr. 15 m from source
Backhoe	80
Compactor	80
Roller	85
Concrete mixer truck	85
Concrete pump truck	82
Bulldozers	85
Front loader	80
Grader	85
Paver	85
Dump Truck	84
Clamshell	93

Equipment	Typical noise level (dBA), in appr. 15 m from source
Angle dozers	85
Front loader	85
Shovel loaders	85
Excavators	85
Drilling Machines	85
Ditcher/Trencher	85
Scrapers	85
Tractor	84

Noise impact assessment was performed identifying sensitive receptors (settlements, dwellings) within minimum distances from alignment boundaries.

Noise level for the worst possible scenario – all machinery operating simultaneously- was assessed. Octave levels of the sound pressure in the reference point are calculated using the following equation:

$$L = L_p - 15 \lg r + 10 \lg \Phi - \frac{\beta_a r}{1000} - 10 \lg \Omega$$

Where,

L_p – Octave level of the noise source capacity;

Φ – noise source direction factor, non-dimensional, is determined through trial and changes from 1 to 8 and depends on spatial angle of sound radiation;

r – Distance from the source of the noise to the reference point;

Ω – Spatial angle of sound radiation, which will be: $\Omega = 4\pi$- when located in the space; $\Omega = 2\pi$- when located on the surface of the area; $\Omega = \pi$ - double ribbed angle; $\Omega = \pi/2$ – triple ribbed angle;

β_a – Sound damping in the air (dBA/km) tabular description.

Table 1. Average geometric frequencies of octave band

Average geometric frequencies of the octave band, Hz	63	125	250	500	1000	2000	4000	8000
β_a dBA/km	0	0.3	1.1	2.8	5.2	9.6	25	83

Summary noise level on the site is calculated according as:

$$L_p = 10 \lg \sum_{i=1}^{n} 10^{0,1 L pi}$$

Where,

L_{pi} –is i-type source noise capacity.

For simplicity, calculations are performed for the sound equivalent levels (dBA) and average value of its octave indicator is taken as sound reduction coefficient β_{ave}=10.5 dBA/km;

The summary noise level generated during simultaneous operation of all machinery from the source of noise propagation:

$$10\lg\sum_{i=1}^{n}10^{0,1Lpi} = 10\lg (3*10^{0,1x80}+ 12*10^{0,1x85}+2*10^{0,1x84} +2*10^{0,1x93}+10^{0,1x82})= 99.4 \text{ dBA}$$

The maximum noise level at recipient located in 80m from the source will be as follows:

$$L = L_p - 15\lg r + 10\lg\Phi - \frac{\beta_a r}{1000} - 10\lg\Omega = 99.4 - 15\lg 80 + 10\lg 2 - 10.5*80/1000 - 10\lg 2 =$$

=59.3dBA

Results of calculation, provided in Table 2 below, show that the noise level in case of simultaneously operation all types of machinery is slightly above the day-time limit (Georgian regulations). Keeping in mind that this is the worst case scenario which is not likely to happen we can assume that acceptable noise level will not be exceeded. Construction during night hours is not planned.

Construction noise impact will be temporary and of medium significance, if environmental and safety requirements are followed.

Table 2. Noise propagation calculation results with indication of allowable limits

Noise equiv. level at source,	Distance to nearest receptor	Noise equivalent level at the closest receptor	Norm[3]			
			Georgian		Good international practice and standards (European)	
			Daytime	Night time	Daytime	Night time
99.4 dBA	80 m	59.3 dBA	55 dBA	45 dBA	65 dBA	55 dBA

According to conventional practice, minimum distances for various construction related activities from sensitive recipients, to protect human health from the impacts of emissions, noise and vibration should be kept:

- Borrow pits > 100 m;
- Asphalt plants > 500 m;
- Reinforced concrete production > 300 m;

The mentioned requirements will be observed.
It should be considered that construction activities at up to 50 meters of sensitive receptors will result in elevated noise levels. At a distance greater than 100 meters all construction noise will be below the daytime limits, but still higher than the nighttime limits. At a distance of more than 250 meters construction noise levels are below allowable daytime and nighttime values.
Effect of vibration varies and depends on the magnitude of the source, ground conditions between the source and receiver, presence of rocks or other large structures in the area. Intensity, duration,

[3] Sanitary norms "the noise on the workplaces, residential, in public building housing and on the residential development territory".

frequency and number of occurrences of a vibration play an important role in annoyance levels caused and the strains induced in structures.

Assessment of Impact on background noise and vibration: road operation

There are two types of road-related noise:

- noise generated by vehicle engines and
- noise generated by tyre-road friction.

Noise levels increases with the speed. It should be taken into account that use of asphalt pavement is planned, in similar conditions, this, compared to concrete paving may result in noise level lower by approximately 3 dBA.

In order to assess possible increase of noise level during operation modelling must be done,

According to good international practice and standards commonly used in European Union countries, the maximum noise level for residential areas, mainly influenced by traffic noise, is 65 dBA during the day and 55 dBA at night. National regulations (Noise at workplaces, in rooms of residential and public buildings, and on a territory of residential área, Approved by Order 297/n of the Minister of Labour, Health and Social Affairs, dated 16.07.2001) set maximum indoor day-time and night-time noise limits as 55 dBA and 45 dBA respectively. On the other hand, for the areas adjacent to residential houses, outpatient buildings, dispensaries, rest houses, elderly and disabled living facilities, preschool, school and other education facilities, library buildings, sanatoria and hotels, the mentioned regulation allows +10 dBA amendement to noise levels generated by road and railway traffic for the areas in 2 metres from the first row of buildings (outer building envelope) facing the main road. For the needs of this ESIA the Georgian limits with this last remark, which comply with the standards accepted in EU states, have been used.

The ranking of project impact for considered alternatives differs by location. Expected impacts can be described as follows:

- Likelihood of impact – medium to high, depending on location;
- Magnitude of impact – medium-high to medium, depending on location.

Mitigation measures

Pre-construction and construction stages

- Maintain the distance to the nearest residence building or inhabited area;
- Keep restrictions on working hours on week days, weekends or public holidays, no night-time working;
- Ensure proper state of maintenance of machinery and vehicles;
- Develop and keep to the traffic schedule;
- Set optimum travel speed during offsite travel;
- Install temporary noise barriers whether appropriate;
- Preserve vegetation that can act as a natural noise barrier;
- Prohibit idling with switched gear;
- Design and construction of noise barrier - a wall, an earthen berm, or a combination of wall and berm, use of green barrier (tree planting);
- Adherence to no horn policy;
- Train staff in construction best practice.

Under condition that mitigation measures are implemented the magnitude of residual impact can be reduced. Assessment of the magnitude and significance of impact will be posible after implementation of modelling.

Responsibility for implementation of mitigation measures rests with construction company.

Operation stage

Installation of noise barriers and vegetation barriers can be used to reduce the noise impact. The artificial barrier can achieve a 10dBA noise level reduction, when it is tall enough to break the line-of-sight from the highway to the house or receiver, approximately 1.5 decibels of additional noise level reduction for each meter of barrier height. To effectively reduce the noise coming around its ends, a barrier should be at least eight times as long as the distance from the receiver to the barrier. This is just a simple orientative rule.

The need of noise barriers and their parameters will be extimated base don modelling results.

7.6. Impacts on the geological activity

Impacts

Cosntruction Phase

The road construction is related to certain amount of earthworks for installation of structures, sach as road, bridge, overpass, junctions and etc. During the construction risks of landslides and erosion must be considred especially on the perimeter of eartworks and roads, sedimentation of natural drenage channels and surface water. Sepcial attention should be paid to bridges crossing the rivers.

Natural process of geological erosion may affect road projects by temporary floods of water and land slides over the de-structured land. The change of exposition and topography causes erosion and sedimentation.

Installation of road or a bridge can cause an erosion of a terrain and the riverbed that will seriously affect the environment including:

- The contamination of surface waters;
- Demage of the adjacent agricultural lands;
- Degradation of water habitats.

Mitigation Measures

Construction Phase

The erosion process during the construction process can be mitigated by implementing following measures:

- Choosing a proper elevation for the road and stabilization of slopes;
- Arranging temporary gabions, slope drenage, temporary tubes, conture drenage channels, and other precipitation measures.

Installation of ditch, bridges and gabions prevent flooding and scouring of roads, decrease erosion. The stabilization of cut slopes is also possible by vegetation.

Maintennance Phase

In order to avoid the impact during rhe operation stage, it is important to carry out the detailed geotechnical and geological survey and consider the results of surveys during the construction stage.

7.7. Impacts on the soil /land

Assessment of Impact: pre-construction and construction stages

The primary effect of the new road sections is that on the topsoil. The topsoil can be lost/degraded if not stripped prior to the construction, or if mixed with subsoil. Impact on soil productivity outside the RoW may result from excessive ramming. The impact on soil will be commensurate to the length of alignment.
The road construction impact on the soil will be the case during organization and operation of the camps/machinery stationing and operation grounds; fuel/oil spills from vehicles and/or fuel storage (if available on the camp site/building ground) and erosion due to modification of the natural conditions.
Other sources of impact on soil quality are poorly managed waste (both solid and liquid), spilled fuel/oil.
Location of the sites must be carefully selected, dumping of spoil – done according to the Soil Management Plan developed by construction company.
The ranking of project impact on soil/land for considered alternatives, depending on the section of alignment is as follows:

- Sensitivity of receptor – medium,
- Likelihood of impact – medium,
- Magnitude of impact – médium.

Assessment of impact: road operation stage

The road operation is usually related to soil pollution by heavy metals in a narrow band on either side of the road. Pollutants settling in soil within the RoW may impair vegetation growth and increase the risk of erosion. Impact on soil may result from blockage of the drainage system which may cause flooding and/or erosion of soil.
Use of ice-breaking salts may cause increase of sodium and chlorine content in soil. This can change ion-exchange processes in soil, reduce water permeability and aeration ability, as well as increase alkalinity.

Another impact is the pollution with litter. The impact on soil during operation is more difficult to manage as the sources of impact in this stage are the “users” of the highway.
The ranking of project impact on soil/land for considered alternatives, depending on the section of alignment is as follows:

- Sensitivity of receptor – medium,
- Likelihood of impact – medium,
- Magnitude of impact – low to médium, depending on characteristics of the site for spoil disposal.

Mitigation measures

Pre-construction and construction stages
In order to avoid or mitigate impact on topsoil and other impacts caused by accidental fuel/oil spills, poor management of waste and/or polluted runoff, the operation ground must be established with consideration of environmental safety measures, as presented below:

- Ground clearance must be minimized;
- Topsoil must be removed from all areas required for permanent and temporary needs of the project;
- To avoid loss of the productive soil layer, all suitable topsoil and other material shall be saved and stockpiled separately for the future recultivation of the disturbed area;
- Stockpiles of removed topsoil must be properly designed/shaped and managed[4] – stability of the stockpile will be achieved through preservation of 'safe' slope inclination and diversion of runoff from the area;
- SIte for temporary storage of topsoil and subsoil must be selected so to avoild loss/damage - the are must be flat, located away from the riverbed, must be protected deom washing away by runodd or scattering by wind;
- Topsoil and subsoil must be stored separately until reuse;
- To ensure stability, the soil piles shall not be higher than 2 metres. The piles must be placed and managed so as to avoid erosion and washing off. Drainage trenches around the piles must be provided.
- Soil compaction may be reduced by strict keeping to temporary roads, camp/operation ground boundaries;
- Disturbed vegetation must be replanted immediately after the construction/disturbance stops;
- Any temporary fuel tank (if contractor decided to have small stock of fuel on the site) shall be placed in a covered area with berms or dikes to contain any spills. Any spill shall be immediately contained and cleaned up with absorbent material;
- Onsite repairs /maintenance/fuelling activities shall be limited. Priority shall be given to offsite commercial facilities. If impossible, a designated area and/or secondary containment for the on-site repair or maintenance activities must be provided;
- On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site;
- Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing fluids from vehicles or equipment. Drip pans or absorbent materials shall be provided. On small spills absorbent materials shall be used;
- The site will be cleaned regularly, littering will be prohibited;
- Waste collection area will be sited so as to avoid receiving a substantial amount of runoff from upland areas and draining directly to a water body;
- In case of the fuel/oil spills risk, an oil trap shall be additionally provided;
- Discharge of effluents into the water bodies is not planned. Only wastewater cleaned up to the established norms (TPH 0.3 mg/l and suspended particles 30 mg/l) may be discharged to the relief. Receiving area must not be prone to erosion or waterlogging. It is advisable not to drain water to the area where crops are cultivated.
- Adequate training on environmental protection and safety shall be provided to the staff;
- Impacts may be partly mitigated by awareness rising and education of the community. The latter may contribute to the reduction of soil pollution with waste.

[4] Topsoil management must comply with requirements set in the Government regulations (#424, dated 31 December, 2013) on topsoil removal, storage, use and recultivation. Good management practice experience must be also taken into account. Subsoil pile must have a natural angle of slope of up to 40° depending on texture and moisture content but, if stable stockpiles are to be formed, slope angles will normally need to be smaller. For stockpiles that are to be grass seeded and maintained, a maximum side slope of 1 in 2 (25°) is appropriate. If the soil is to be stockpiled for more than six months, the surface of the stockpiles should be seeded with a grass/clover mix to minimise soil erosion and to help reduce infestation by nuisance weeds that might spread seed onto adjacent land. Sites of temporary storage of excess material will be agreed with the local municipalities.

To prevent impact on erosive sliding of the soil or flooding, blockage of the drainage system will be avoided. Phytoremediation may be considered as a measure for reduction of soil contamination.

Under condition that mitigation measures are implemented the magnitude of residual impact is expected to be low.

Operation stage

- Awareness raising and education of community on waste management (no fly tipping);
- Maintenance and clean up the drainage system to prevent impact on erosive sliding of the soil or flooding;
- Use of phytoremediation may be considered as a measure for reduction of soil contamination.

Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

7.8 Impact on Biological Environment

Assessment of Impact: pre-construction and road construction stages

Vegetation/Flora

General impacts of roads and other linear structures on flora include the following:

- Removal of roadside vegetation and vegetation within the RoW;
- Soil compaction and pollution;
- Indirect impact from dust, particles; oil/fuel;
- Introduction of invasive species;
- Soil erosion triggered by removal of vegetation in road cuts that may lead to additional impact/loss of vegetation in adjacent to the cut areas;
- Sealing of soil surface reducing 'availability' of land for vegetation.

Alignment alternatives cross forested areas, meadows and cultivated land.
Impact on vegetation is expected in the spoil disposal áreas. These sites must be carefully selected by contractor and agreed with localand environmental authorities to minimize impact and avoid disposal of material in sensitive área.

Impact on the State Forest Find and risk of impact on protected áreas must be mentioned. As mentioned above the forest covers significant part of the project área. State forest authorities must be actively consulted and involved in the process in order to minimize adverse impact. Prior to tree felling the relevant sections of the forest must be de-listed from the forest fund. Possible consequences of tree felling on soil stability must be carefully assessed, relevant protection measures – included in the design.

Fauna

Construction and operation of highway in those sections which pass through transformed landscapes and cultivated lands will not cause significant impacts on animal life, as such areas do not support important animal species due to human presence and consequent significant permanent disturbance. Hence, impacts on fauna are expected rather in the construction stage and will be considerably lesser in the operation stage. Expected impacts from the construction works are as follows:

- Loss of shelter due to removal of vegetation;
- Barrier effect - reduced connectivity;
- Soil compaction, sealing of soil surface – potential impact on worms;
- Light pollution,
- Death of animals caused by road mortality;
- Risk of intrapment and injury in night hours – in open trenches/excavation areas;
- Higher levels of disturbance and stress, including that related to noise;
- Indirect impact from exhaust emissions and dust,
- Impact of on aquatic life because increased water turbidity (river crossings)
- Impact due to soil and/or water pollution with spilled fuel/oil, poorly managed waste.

Dust deposited on the plants in the road impact zone may affect food base of the vertebrate and invertebrate species.

The roads and excavated sites are considered as a barrier for mammals, reptiles and amphibians that might occur in the project area, both during pre-construction, construction and operation.
Noise from construction machinery and heavy traffic on construction and operation stages will have immediate impact on animal world in the area. Animals respond to noise pollution by altering activity patterns, and with an increase in heartbeat and production of stress hormones. Birds and other wildlife that communicate by auditory signals may be confused near the road and construction sites.
On construction stage the magnitude of noise and vibration is expected to be in the range from detection to avoidance level. Besides, because of the presence of people on the ground animals will try to avoid the project areas anyway.

Erosion during and after construction of roads, highways and bridges can cause siltation and increase water turbidity, which in its turn may lead to impact on macroinvertebrates and fish, affecting quality of habitat and availability of food base for ichthyofauna. Heavy metals, oils, other toxic substances, spilles and debris from project related traffic can be absorbed by soil at the project sites and carried by runoff to the river.

Prior to commencement of works in the riverbed, the sheet piles will be installed to allow dewatering of the pier construction grounds. In this process works will inevitably result in temporary increase of water turbidity – leading to impact on aquatic biodiversity. Since construction works will be carried out in dry environment impact on fish will be minimal. The flow in the riverbed will not be blocked. Fish migration/movement will not be hindered.

The scale of impact during construction will depend of the level of observance and implementation of water impact related mitigation measures and schedule of works.

The survey carried out on feasibility stage of the project has not revealed any protected animal species/traces of the presence of protected animal species in the direct impact zone of the project alignment. Additional survey will be required after the road buffer is specified to identidy any protected species within the buffer zone of alignment, to ensure avoidance/reduction or compensation of posible impact through site and species specific mitigation measures. Particulat attention is to be paid to the new sections where probability of the presence of wildlife is higher.

Preliminary ranking of project impact on fauna in the project area for considered alternatives is as follows:
For aquatic fauna

- Sensitivity of receptor – medium,
- Likelihood of impact –medium to high (depending on location),
- Magnitude of impact - medium.

For terrestrial fauna

- Sensitivity of receptor – médium to high (depending on the species and location),
- Likelihood of impact –medium to high, depending of the section
- Magnitude of impact – must be specified during detailed survey following to identification of exact buffer of alignments.

Assessment of Impacto n flora and fauna: road operation stage

No direct impact on flora is expected during operation of the highway. Indirect impact can be related to dust and exhaust emissions from traffic and pollution with contaminated runoff from the road. Pollutants washed off from the road can impair growth of vegetation and affect soil organisms.
Main impacts on fauna during operation in general may include:

- Death of animals caused by road mortality;
- Barrier effect (reduced connectivity) ;
- Higher levels of disturbance and stress, including that related to noise;
- Modification of light conditions;
- Modification of humidity conditions (e.g. lower moisture content in the air due to higher solar radiation, stagnant moisture on road shoulders due to soil compaction);
- Indirect impact from dust, particles (abrasion from tyres and brake linings); oil, fuel (e.g. in case of traffic accidents), including chronic contamination due to bioaccumulation.

As mentioned above, immediate impact related to the road operation is noise from heavy traffic. This may affect communication of the species (birds, other wildlife) by interference of traffic noise with auditory communication signals in particular near the road alignments.

Pollutants, such as heavy metals, carbon dioxide, and carbon monoxide, emitted by vehicles, may all have serious cumulative effects. Combustion of petrol containing tetraethyl lead, and wear of tyres containing lead oxide, result in lead contamination of roadsides. Many studies documented increasing levels of lead in plants with proximity to roads, and with increases in traffic volume. Plant roots take up lead from the soil, and leaves take it up from contaminated air or from particulate matter on the leaf surface. The lead then moves up the food chain, with sometimes toxic effects on animals, including reproductive impairment, renal abnormalities, and increased mortality rates.

The impacts of other heavy metals, such as zinc, cadmium, and nickel are less known. Motor oil and tyres contain zinc and cadmium; motor oil and gasoline contain nickel. These metals, like lead, were found to increase with proximity to roads, with increasing traffic volume and decreasing soil depth.

Earthworms were found to accumulate all these metals, in concentrations high enough to kill earthworm-eating animals.

Impact of ice-breaking salt and/or sand on vegetation and fauna, including aquatic, is not assumed to be high.

Impact of roadside litter is also to be mentioned. Poorly managed waste may attract and entrap small animals, while cigarette butts and filters are often mistaken for food by fish and birds.
Change of land use form will reduce availability of land used as pastures.
The ranking of project impact on vegetation for considered alternatives is as follows:
For aquatic fauna

- Sensitivity of receptor – high,
- Likelihood of impact– low,
- Magnitude of impact – low.

For terrestrial fauna:

- Sensitivity of receptor– médium to high, depending on the species and location,
- Likelihood of impact– low to médium, depending on location,
- Magnitude of impact - medium to low, depending on location.

Mitigation measures

Pre-construction and construction stages
On pre-construction and construction stages the following measures for impact mitigation on the vegetation/flora are suggested:

- Strict keeping to the boundaries of RoW and operation areas,
- Prohibition of shortcuts to avoid impact on the adjacent vegetation;
- Preservation of vegetation as much as feasible, fencing the sensitive areas;
- Fencing critical root zone of the trees at the boundary with the project area;
- Management of protected species, in case encountered in the direct impact zone, in accordance to the applicable regulations (Law on Red Book and Red List of Georgia).
- Implementation of dust, water, soil, waste-related impact mitigation measures;
- Selection of tunelling spoil disposal área with consideration and ranking of the risks of impacto n biodiversity. (Note: Disposal must follow Spoil Disposal Plan developed by construction company);
- Waste management – regular clean up of the área, management/removal of waste in accordance to the type;
- Recultivation of disturbed sites after completion of Works (based on Recultivation Plan developed by construction company);
- Liason and coordination of activities with National Forestry Agency; Agency of Protected Areas, environmental authorities and local municipal administration;
- Training staff in construction best practice.

Measures for mitigation of impact on fauna include:

- Preservation of vefetation as far as feasible;
- Adherence to no horn policy to avoid disturbance of wildlife;
- Trenches or pits, should be fenced or protected to avoid entrapping and injuries of the fauna species. Bright coloured ribbons may be used for big animals (e.g. cattle), while metal plastic and other shields/fences may be used for small animals. As a pracaution, upon completion of the shift, planks or medium size twigs must be made available for small animals to escape from the pits/trenches in case entrapped. Pits and trenches must be checked prior to filling up.

- Scheduling works to the season less sensitive for fauna. Special attention should be given to the avian fauna in the spring-summer (April to July). Tree cutting in the season most sensitive for birds (nesting/hatching) must be avoided;
- Avoidance of construction in/near the riverbed in the fish spawning season (June-September);
- Implementation of control on compliance with mitigation measures and monitoring of vegetation/fauna status in the direct impact zone of the project. In case required – additional mitigation measures – developed and introduced;
- Implementation of measures set for mitigation of impact related to noise, air, water, soil and waste generation;
- Prohibition of poaching;
- Training staff in construction best practice.

Note: while planting along the highway, safety requirements must be taken into account while planting, so that the trees do not block the view, have acceptable diameter when mature while they are planted in certain locations and their canopies do not reach over the road. In addition to monetary compensation for removed plants, requested under the law, 'replacing' of lost vegetation by compensation planting or restoration of any damaged forest áreas is advisable) with subsequent monitoring and maintenance of vegetation for 2 years mínimum. Priority should be given to planting on the slopes (whether feasible) to reduce a risk of erosion.

Spoil Disposal Plan must be developed by construction company prior to commencement of works. The plan will indicate:

- Location of disposal area (layout, coordinates etc).
- Profile drawings of the spoil area.
- Agreement with the land owner.
- Category of the land.
- Distance from the surface water source.
- Information on rout of spoil transportation and means of transport.
- Disposal scheme (scheme of dumping).
- Maximum height of disposed soil and anti erosion measures.
- Description of re-cultivation activities.
- Time stamped photographs of the pre-disposal site conditions.

The Plan will be provided to the RD and the Engineer as part of his SSEMP.
Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low to medium, depending on location.

Operation stage

Impacts on flora and fauna during operation are reduced by

- Arrangement of barriers preventing cattle and animals from death caused by road mortality (measure included in design);
- Monitoring of road mortality in order to identify additional protection measures;
- Arrangement of passages to improve connectivity (measure included in design);
- Prohibition of direct discharge of untreated runoff into the river;
- Roadside waste collection and regular clean up (sweeping) of the road;
- Preservation of roadside vegetation.

During maintenance of the road cover, mitigation measures set for construction stage must apply.
Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

7.8 Visual Impacts

Impacts

Visual impact during construction will be related to machinery and people operating on the ground, onsite and offsite traffic as well as the temporary facilities (car stationing, material and waste storage areas, camp (if available), borrow pits and quarry sites), built sections of the road and bridges. Most of activities will be implemented away from the residential areas.

As the road is a linear structure, construction works will not be always 'concentrated' in one location. So, the source of visual disturbance will be 'moving'.

Landscape visual impact will also be due to topsoil/material storage areas. By the end of works it is assumed that surplus material (if any) and topsoil are fully removed from the area.
Special attention must be paid to the need for recultivation of all disturbed areas (including borrow pits/quarries in case contractor obtains a short-term licence) after completion of works. Adherence to the terms of licenses for resource extraction will be tracked by RD through technical supervisor or works and overseen by the Department of Environment Protection Oversight of MENRP.
The impact during pre-construction and construction will be unavoidable, though short term (restricted to duration of construction), local and reversible.

Construction Phase

Visual impacts during the the construction will be caused by the presene of people, cars as well as temporary facilities in the construction corridor. (transportation means, camps, storages for the construction materials and residues, etc)

This impact will be temporary and will be finished upon completion of construciotn works. Due to the construction works the interefering factors will be moving along side the activities.

Operation Phase

- Clean up of the road and adjacent area;
- Preservation/maintenance of roadside vegetation to shield the visual change in the landscape related to the new infrastructure;
- Planting and landscaping of the roadsides where feasible, is generally considered as an efficient way of restoring, sometimes improving aesthetic views of the area and mitigating the impression of the landscape disturbance. At the same time plants along the roadside may act as windbreaks providing protection of farmland in the impact area. Planting with vegetation, preferably local, will also support wildlife by creating habitats.
- Implementation of mitigation measures set for pre-construction/construction stage -during road and infrastructure maintenance.

Mitigation Measures

The visual affect could be mitigated by increased vegetation.

Also designing the retaining walls and artificial structures in a manner that they would fit the landscape.

To arrange the sideway green line and landscape in order to improve visual affect and esthetic view. At the same time the vegetation could serve as windshields to protect the agricultural lands from

natural disaster and will serve as a fauna habitation. It is higly recommended to plant the endemic species.

7.9 The impacts on cultural environment

Impacts

Cosntruction Phases

Initial field study shows that there are no cultural heritage sites along the projected aligment. Therefor impact on cultural environment is not expected.

Operation phase

During operation the impact on the cultural environment is not foreseen.

Mitigation Measures

Construction Phase

according to the required procedures of the active legislation constraction work should be conducted under the supervision of archaeologist.

Impact characterisation – summary table

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Consequence	Probability	Significance
Air quality	C	Exhaust Emissions from construction vehicles and generators	Nearby communities	M	M	L	Low	Short term	Low	Definite	L
	C	Dust from the movement of vehicles, stockpiles, etc.	Nearby communities / Agric. crops	M	M	M	Medium	Short term	Medium	Definite	M
	O	Vehicle Emissions from traffic using the road.	Nearby communities	M	L	M	Medium	Medium	Medium	Definite	M
Climate Change	C	GHG Emissions from road construction.	Global	H	L	L	Low	Short term	Low	Definite	L
	O	GHG Emissions from vehicle emissions.	Global	H	L	L	Low	High	Low	Definite	L
Soils	C	Loss / degradation of topsoil through land clearing, borrow pits, etc.	All work sites	M	M	M	Medium	Short term	Low	Possible	L

	C	Soil erosion on unstable slopes caused by poor construction works.	All work sites	M	L	L	Low	Short term	Low	Possible	L
	C	Soil contamination via spills and leaks of hazardous liquids from construction camps.	All work sites	M	M	M	Medium	Short term	Low	Possible	L
	O	Soil erosion caused by poorly designed erosion protection measures, drainage, etc.	All work sites	L	L	L	Low	Medium term	Low	Possible	L
Hydrology	C	Flooding caused by blocking existing drainage structures.	Nearby communities	M	M	L	Medium	Short term	Low	Possible	L
	O	Flooding caused by poorly designed drainage structures.	Nearby communities	L	M	L	Medium	Medium term	Low	Possible	L
	C	Water contamination from construction camps, etc.	All work sites	M	M	M	Medium	Short term	Low	Possible	L
	C	Excessive water extraction affecting local water supplies.	Water users / Aquatic Life	L	M	M	Medium	Short term	Medium	Possible	M

Natural Hazards	C	Landslides caused by poor construction works on slopes.	All work sites	L	L	L	Low	Short term	Medium	Unlikely	L
	O	Landslides caused by poor design of slope protection works.	All work sites	L	L	L	Low	Long term	Medium	Unlikely	L
Vegetation/ Flora & Fauna	C	Degradation of habitat caused during site clearing.	All work sites	L	M	M	Medium	Medium term	Low	Possible	L
	C	Tree cutting.	All work sites	M	M	M	Medium	Medium term	Low	Definite	L
	O	Blocking migration routes of animals.	All work sites	L	L	L	Low	Long term	Low	Unlikely	L
Infrastructure and Transport	C	Damage to access roads caused by construction vehicles.	Road users	M	L	L	Low	Short term	Low	Possible	L
	C	Traffic delays due to road works.	Nearby communities	M	M	L	Mefium	Short term	Medium	Definite	M
	C	Limited accessibility to properties as road works blocks access.	Nearby communities	M	M	M	Mefium	Short term	Medium	Possible	M
	C	Damage to utilities which may not have been identified.	Nearby communities	M	M	L	Mefium	Short term	Low	Possible	L
	C	Temporary disruption to utilities while they are removed to make	Nearby communities	M	M	L	Mefium	Short term	Low	Definite	L

		way for construction works.									
Land Use	C	Loss of land and property due to the new road.	Land / Property owners	M	H	M	High	Long term	High	Definite	H
	C	Disruption to businesses caused by reduced access to the business.	Nearby communities	M	H	M	High	Short term	Medium	Possible	M
	O	Reduced income for businesses.	Nearby communities	M	H	M	High	Medium term	High	Definite	H
Waste	C	Pollution from hazardous waste from construction camps, etc.	All work sites	M	M	M	Medium	Short term	Low	Possible	L
	C	Pollution from inert waste from construction camps, etc.	All work sites	M	L	L	Low	Short term	Low	Possible	L
OHS	C	Accidents and injuries to workers during the construction phase.	Contractors staff	M	M	M	Medium	Short term	High	Definite	H
Emergencys	C	Fires, explosions, etc, at site.	Contractors staff / Nearby communities	M	M	M	Medium	Short term	Medium	Possible	M
Physical cultural	C	Damage to PCR caused during construction.	PCR site and its users	L	M	M	Medium	Long term	Medium	Possible	M

resources (PCR)	O	Effects to PCR in terms of elevated noise, dust, etc.	PCR site and its users	L	L	L	Low	Long term	Low	Unlikely	L
Noise	C	Elevated noise levels from construction equipment.	Contractors staff / Nearby communities	H	H	M	Medium	Short term	Medium	Definite	M
	O	Elevated noise levels from vehicles using the road.	Nearby communities	H	H	H	High	Long term	High	Definite	H
Vibration	O	Damage to properties from vehicle movement vibration.	Nearby communities	L	H	L	Low	Long term	Low	Unlikely	L

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
Topography	Cut and Fill Requirement	The Contractor shall ensure that: • Deposition areas should be ascertained by the Contractor prior to cutting or excavations. Temporary and permanent storage of materials should be confined to government owned land and in no circumstances should be dumped on agricultural or productive lands (without owner's written permission) or to any watercourse including irrigation channels. Such issues should be agreed with local municipality. • In the event of any spoil or debris from construction works being deposited in any of the aforementioned areas or any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Engineer.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors deposition/ dumping activities. • Approvals for waste disposal sites to be sought from the Concerned Agencies by the Contractor.
	Quarries	Should the Contractor decide to establish his own quarry, he will be responsible for the entire facility with respect to all permitting and environmental requirements. Prior to opening of any quarry or rock crushing facility, the Contractor will require approval from the relevant Concerned Agencies and the Engineer to ensure that land owners are adequately compensated for land use and that the sites are not located in an area likely to cause significant detriment to the local environment. To ensure that this is the case, Contractors should ensure that quarries and crusher plants are: • Located at least 300 meters from urban areas to prevent noise and dust impacts; • Located outside of agricultural land; and where possible located on government owned lands. • Quarry area should be reinstated prior to the completion of the project. • Silt-laden water should be retained in sedimentation ponds to allow silt materials to settle; water-recycling should be considered to minimize turbidity in receiving waters. • A Quarry Site Reinstatement plan should be presented by the Contractor to the Engineer. The Quarry Site Reinstatement Plan must be approved by the Engineer with the concurrence of the RD prior to operating quarry sites by the Contractor.	• Concerned Agencies to approve locations. • Contractor to obtain necessary permits. • Engineer to review permits and approvals prior to the opening of the site. • Contractor to submit Quarry Reinstatement Plan to the Contractor; Engineer to review and approve. • Engineer to inspect the reinstatement work on the quarry area by the Contractor
	Borrow Pits.	The Contractor shall ensure that: • A Material Source Management and Reinstatement Plan or a Borrow Pit Action Plan (BAP) be submitted as part of the SSEMP to the Engineer prior to the start of construction. Such plan should be approved by the Engineer with the concurrence of the RD prior to extraction of any materials from the borrow pit.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities. • Contractor to submit Quarry Reinstatement Plan to the

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
		• Borrow Pit restoration will follow the completion of works in full compliance of all applicable standards and specifications. • Arrangements for opening and using material borrow pits will contain enforceable provisions. • The excavation and restoration of the borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the Engineer, will be required before final acceptance and payment under the terms of contracts. • Additional borrow pits will not be opened without the restoration of those areas no longer in use. • Borrow pits should be reinstated prior to completion of the Project	Contractor; Engineer to review and approve. • Engineer to inspect the reinstatement work on the borrow pit by the Contractor
	Use of other materials	Alluvial materials, which will be excavated upstream from blocked culvert areas may be used as base material. These materials shall be tested by the Contractor and Engineer for their suitability as base materials before using. The Contractor must use such materials first before using any other quarry or borrow pit within 3 km from any such alluvial deposits.	• Engineer to test material before use as base material.
Soil and Ground water Quality	Contamination due to Spills or Hazardous Materials	The Contractor shall ensure that: • All fuel and chemical storage (if any) shall be sited on an impervious base within bund and secured by fencing. The storage area shall be located away from any watercourses or wetlands. The base and bund walls shall be impermeable and of sufficient capacity to contain 110 percent of the volume of tanks. • The construction camp maintenance yard shall be constructed on impervious layer with adequate drainage to collect spills; there shall be no vehicle maintenance activities on open ground. • Filling and refueling shall be strictly controlled and subject to formal procedures. Drip pans shall be placed under all filling and fueling areas. Waste oils shall be stored and disposed of by a licensed contractor. • All valves and trigger guns shall be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. • The contents of any tank or drum shall be clearly marked. Measures shall be taken to ensure that no contaminated discharge seeps into any soils. • No bitumen drums or containers, full or used, shall be stored on open ground. They shall only be stored on impervious layer. • Areas using bitumen shall be constructed on impervious layer to prevent seepage of oils into the soils.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
Surface Water and Hydrology	Drainage and Flooding	During the construction phase the Contractor is required to construct, maintain, remove and reinstate as necessary, temporary drainage works and take all other precautions necessary for the avoidance of damage by flooding and silt washed down from the Works.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
	Construction Camps and Storage Areas	The Contractor shall ensure the following conditions are met: • Wastewater arising on the site shall be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance. • There shall be no direct discharge of sanitary or wash water to surface water. Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies, shall be prohibited. • Liquid material storage containment areas shall not drain directly to surface water. • Lubricating and fuel oil spills shall be cleaned up immediately and spill clean-up shall be done regularly at the storage area. • Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters. • Discharge of sediment-laden construction water directly into surface watercourses will be prohibited. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge. • Spill clean-up equipment will be maintained on site. The following conditions to avoid adverse impacts from improper fuel and chemical storage are: – Fueling operations shall occur only within containment areas. – All fuel and chemical storage (if any) shall be sited on an impervious base within bund and secured by fencing. The storage area shall be located away from any watercourses or wetlands. The base and bund walls shall be impermeable and of sufficient capacity to contain 110 percent of the volume of tanks. – Filling and refueling shall be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids. – All valves and trigger guns shall be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. – The contents of any tank or drum shall be clearly marked. Measures shall be taken to ensure that no contaminated discharges enter any drain or watercourses.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
		– Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited. – Should any accidental spills occur, immediate clean-up will be undertaken; and all of the cleaned-up materials will be stored in a secured area for disposal to a site authorized for hazardous waste. • If determined warranted by the Engineer, the Contractor shall provide for a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the sites. If so requested, the Contractor shall ensure that all vehicle are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor shall provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site.	
	Bridge Construction	The Contractor shall consult with the local Concerned Agencies to establish the fish spawning period in relation to the bridge construction works. The Contractor shall ensure that all works are undertaken in periods least likely to affect the fish spawning period. In addition, concerning bridge construction works, the Contractor shall: • Divert the water flow near the bridge piers. • Coffer dams, silt fences, sediment barriers or other devices will be provided to prevent migration of silt during construction within streams. • Dewatering and cleaning of cofferdams will be performed to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.	• Contractor to implement mitigation. • Contractor to consult with Concerned Agencies. • Engineer to routinely monitor Contractors activities.
Air Quality	Open burning of waste materials	The Contractor shall ensure no burning of debris or other materials will occur on the Site in accordance with GEO legislations	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.
	Fuel Emissions	Contractor shall ensure that no furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.
	Exhaust emissions from the operation of	The Contractor shall ensure construction equipment shall be maintained to a good standard and fitted with pollution control devices. The equipment (including the pollution control devices) will be checked at regular intervals by the Engineer to ensure they are maintained in good working condition and that the inspection result will be recorded by the Contractor & Engineer as part of environmental monitoring. In addition, the Contractor shall: • Discourage of the idling of engines;	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
	construction machinery	• Prohibit of the use of equipment and machinery that causes excessive pollution (i.e. visible smoke) at project work sites; Ensure material stockpiles being located in sheltered areas and be covered with tarpaulins or other such suitable covering to prevent material becoming airborne.	
	Fugitive emissions from quarries and asphalt plants.	The Contractor shall ensure that conveyor belts at ancillary facilities (e.g. quarries) shall be fitted with wind-boards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimize dust emission. All conveyors carrying materials that have the potential to create dust shall be totally enclosed and fitted with belt cleaners.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
	Dust generated from haul roads, unpaved roads, exposed soils and material stock piles.	The Contractor shall ensure that the following dust suppression measures shall be instituted: • All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins, or other acceptable type cover (which shall be properly secured) to prevent debris and/or materials from falling from or being blown off the vehicle(s); • Areas of reclamation shall be completed, including final compaction, as quickly as possible consistent with good practice to limit the creation of wind-blown dust. • Hard surfaces will be required in areas with regular movements of vehicles; and • Effective use of water sprays will be implemented (e.g., all roads within the construction areas of the Site shall be sprayed at least twice each day, and more if necessary, to control dust to the satisfaction of the Engineer).	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
Noise Generation	Construction Noise and Vibration	The Contractor shall ensure provision of the following: • Source Controls, i.e., requirements that all exhaust systems will be maintained in good working condition; properly designed engine enclosures and intake silencers will be employed; and regular equipment maintenance will be undertaken; • Site Controls, i.e., requirements that stationary equipment will be placed as far from sensitive land uses as practical; selected to minimize objectionable noise impacts; and provided with shielding mechanisms where possible; • Work near Sensitive Receptors shall be limited to short term activities; • Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people would least likely be affected; work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities. Construction activities will	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
		be strictly prohibited between 10 PM and 6 AM in the residential areas. When operating close to sensitive areas such as residential, nursery, or medical facilities, etc., the Contractor's hours of working shall be limited to 8 AM to 6 PM; • Community Awareness, i.e., public notification of construction operations will incorporate noise considerations; methods to handle complaints will be specified. Sensitive receptors will be avoided as possible (i.e., aggregate crushers, operators, etc.). Disposal sites and haul routes will be coordinated with local officials; • Use of low volume charges will reduce the potential for vibration-induced damage to structures; and in the event of damage proven to be due to the contractor's activities, owners of structures will be fully compensated.	
Introduced Geo-Hazards	Slope Stabilization	The Contractor shall be responsible for the following: • Final forming and re-vegetation will be completed by the Contractor as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover. • Trenching will be used where necessary to ensure successful establishment of vegetation. • Seeding with a fast growing crop and native seed mix will occur immediately after fill placement to prevent scour and to encourage stabilization; • Construction in erosion and flood-prone areas will be restricted to the dry season.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
	Erosion	The Contractor will be responsible for ensuring: • Material that is less susceptible to erosion will be selected for placement around bridges and culverts. • Re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local flora; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth, although due to the arid conditions in most of the road, this may only feasible where there is regular rainfall or other natural water supply.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
Bridges and Waterways	Demolition of existing structural components	• Contractor should provide additional measures to catch debris from falling into the river	• Contractor to implement mitigation measures; Engineer to check and ascertain correct results

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
	Construction of superstructure	The Contractor shall ensure provision/or performance of the following: • As much as possible construction should be undertaken during the dry season to minimize the threat to water contamination; • Excavation methodologies should be done to minimize stockpiling near flowing water; • Temporary rock protection should be provided to prevent soil materials to be washed away. • Frequent monitoring of water quality should be done to determine the status of water quality; • When casting structural elements on site, spillage into the water should be prevented by installing proper measures to catch any spill; • Structural elements should be casted far from the river to prevent concrete mix from getting into the water.	• Contractor to implement mitigation measures; Engineer to check and ascertain appropriate results are attained
Processing Plants and Campsites	Water contamination Air Quality and noise issues Contaminated effluents Defacement of the topography Resource Competition with village residents	The Contractor shall ensure provision/performance of the following: • Reinstatement plan should be conceptualized by the Contractor for their proposed site and submitted to the contractor; • Minimization of issues on water contamination, air quality, noise by provision of appropriate measures; • Regular measurement of ambient water, air and noise levels should be done. • Complaints from communities should be properly and promptly responded to;	• Contractor to implement mitigation measures; Engineer to check and ascertain appropriate results are attained

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
Transportation of Construction Materials and Wastes	Droppings of materials & wastes Spills from haul trucks Dust from uncovered trucks	The Contractor shall ensure provision/performance of the following: • Liquids transported to or from the sites should be placed in sealed containment; • Soil, gravel and stone should be covered with tarp or any material that can effectively prevent the dropping; • Drivers should abide by safe driving practices, especially through communities; • Drivers and Contractor's personnel should ensure that materials are being safely loaded, hauled and unloaded. • Emergency spillage and clean-up procedure should be drafted by the Contractor and approved by the Engineer	• Contractor to implement mitigation measures; Engineer to check and ascertain appropriate results are attained
Biological	Loss of flora	The Contractor shall ensure the following conditions are met: • Each tree removed by the Contractor should be replaced by at least two new saplings of the same species or other at suitable locations, or as designated by the tree owner. Tree translocation should be explored and done whenever feasible. Dead saplings should be replaced as soon as possible. No trees should be cut in the area without written permission from the Engineer. • Supplying appropriate and adequate fuel in workers' camps to prevent fuel-wood collection from unauthorized sources.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
	Impacts to Fauna	Work crews should be alerted that faunal species should not be killed and be allowed to escape during work execution. At best, disturbance should be in such a way as to provide enough escape corridor to allow for animals to move on their own. Should animals be unintentionally be trapped in the work area/s, workers should find ways to enable these animals to escape unharmed. Such measures should be shown in Method Statements of the Contractor and verified by supervision staff of the Engineer.	• Contractor to instruct his personnel not to harm wildlife • Engineer to routinely monitor Contractors activities.
Sensitive Areas	Protecting BKNP	The Engineer to ensure there are no detrimental impacts to protected areas, particularly the BKNP, should the Contractor opt to open new borrow pits. The Contractor shall be required to obtain approval from the MoENRP and local concerned agencies.	• Contractor to obtain necessary permits • Engineer to routinely monitor Contractors activities.
Construction and	Waste in Construction	The Contractor will be required to coordinate all construction camp activities with neighbouring land uses. The Contractor shall also be responsible to maintain and clean-up campsites and	• Contractor to implement mitigation.

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
Domestic Waste	Camps and other ancillary facilities	respect the rights of local landowners. If located outside the RoW, written agreements with local landowners for temporary use of the property will be required and sites must be restored to a level acceptable to the owner within predetermined time period.	• Concerned Agencies to approve any waste disposal to the River. • Engineer to routinely monitor Contractors activities.
	Spoil	Under no circumstances shall the Contractor dump excess materials on private lands without permission of the owner and approval from the Engineer. In addition, excess spoil shall not be dumped or pushed into rivers at any location unless in low volumes and agreed upon with the Engineer and with approval from the Concerned Agencies.	• Contractor to implement mitigation. • Concerned Agencies to approve any waste disposal to the River. • Engineer to routinely monitor Contractors activities.
	Inert Solid & Liquid waste	The Contractor shall be responsible for the following: • Provide refuse containers at each worksite; • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal; • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process; and • Collect and transport non-hazardous wastes to all approved disposal sites. The sites for waste disposal shall be agreed with the local municipal authorities and Concerned Agencies. A specialized company may be contracted, if available to ensure collection of domestic and general waste from camps and temporary storage areas and transportation to landfills approved and licensed by the Concerned Agencies.	• Contractor to implement mitigation. • Concerned Agencies to approve any waste disposal site. • Engineer to routinely monitor Contractors activities.
	Asphalt	Waste from the operation of asphalt should be managed properly. Reinstatement of the site will be necessary after the project.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.
	Hazardous Waste	Management, handling & storage protocols for hazardous waste will be outlined in the Contractors Waste Management Plan. Disposal locations of hazardous wastes should be agreed with the Concerned Agencies. The Contractor shall collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at the temporary storage sites	• Contractor to implement mitigation. • Concerned Agencies to approve any waste disposal site.

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
		and further at the locations approved by Concerned Agencies or pass it to the licensed operator having environmental permit on operation of the hazardous wastes.	• Engineer to routinely monitor Contractors activities.
Worker's Safety	Worker Health & Safety	The Contractor shall be responsible for provision of: • Safety Training Program. A Safety Training Program is required and shall consist of an Initial Safety Induction Course. All workmen shall be required to attend a safety induction course within their first week on Site and Periodic Safety Training Courses. • Safety Meetings. Regular safety meetings will be conducted on a monthly basis and shall require attendance by the safety representatives of Subcontractors unless otherwise agreed by the Engineer. • Safety Inspections. The Contractor shall regularly inspect, test and maintain all safety equipment, scaffolds, guardrails, working platforms, hoists, ladders and other means of access, lifting, lighting, signing and guarding equipment. Lights and signs shall be kept clear of obstructions and legible to read. Equipment, which is damaged, dirty, incorrectly positioned or not in working order, shall be repaired or replaced immediately. • Safety Equipment and Clothing. Safety equipment and protective clothing are required to be available on the Site at all material times and measures for the effective enforcement of proper utilization and necessary replacement of such equipment and clothing, and all construction plant and equipment used on or around the Site shall be fitted with appropriate safety devices. • First Aid facilities. A fully equipped first aid base shall be climatically controlled to maintain the temperature of the inside of the building at 20 degrees C. Arrangements for emergency medical services shall be made to the satisfaction of the Engineer. The Contractor shall coordinate with local public health officials and shall reach a documented understanding with regard to the use of hospitals and other community facilities.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
	Sub-contractor's / Suppliers EMP Compliance	All sub-contractors/ suppliers will be supplied with copies of the SSEMP. Provisions will be incorporated into all sub-contracts to ensure the compliance with the SSEMP at all tiers of the sub-contracting. All sub-contractors will be required to appoint a safety representative who shall be available on the Site throughout the operational period of the respective sub-contract unless the Engineers approval to the contrary is given in writing. In the event of the Engineers approval being given, the Engineer, without prejudice to their other duties and responsibilities, shall ensure, as far as is practically possible, that employees of subcontractors of all tiers are conversant with appropriate parts of the SSEMP.	• Contractor to implement mitigation • Contractor to enforce compliance to his Subontractors / Suppliers and shall be overall responsible • Engineer to routinely monitor Contractors and sub-contractors activities.

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
	HIV / AIDS Awareness	The Contractor shall subcontract with an Approved Service Provider to provide an HIV/AIDS Awareness Program to the Contractor's Personnel and the Local Community as soon as practicable after the Contractor's Personnel arrive at the Site; but in any case within two weeks after the Contractor's Personnel arrive at Site and to repeat the HIV/AIDS Awareness Program at intervals not exceeding four months. All workers should be provided with HIV/AIDS paraphernalia and should have access to such at all times.	• Contractor to implement mitigation. • Service Provider to implement training. • Engineer to review program.
Community Safety	Traffic Safety	It is important that truck drivers and equipment operators understand the importance of maintaining road safety especially at road junction points. Village access likewise should be accorded due focus for the safety of the general population, especially children, and farm animals. Proper coordination with the village should be done to effect road safety. Checking of safety aspects should be done continuously with safety reminder meetings and done regularly. Safety traffic signs and warning lights should be installed at appropriate locations; and flagmen should be assigned at critical spots. Monitoring of this aspect can be conducted jointly by the Contractors' management and the Construction Supervision personnel. Truck drivers and equipment operators must be made to understand the importance of maintaining road safety especially at road junction points and along village roads for the safety of the general population, especially children, and farm animals. Proper coordination with the village leaders should be done to effect road safety. Checking of safety aspects should be done continuously with safety reminder meetings conducted regularly. This can be a joint activity of the Contractors' management and the Construction Supervision personnel.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
	Road closures, existing bridge closure, diversions and blocking of access routes	The Contractor shall ensure that: • He shall be responsible for provision of all road diversion signs and ensure that diversion roads do not impact negatively upon private lands. • Any diversions shall be agreed upon by the Engineer. • The Contractor shall be responsible for ensuring that all access routes are kept open during Project works for at least 50% of the day during construction works and 100% of the time after construction works are completed for the day. Any temporary existing bridge closure should be communicated to affected people ahead of time	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities. • Contractor to provide plan for any existing bridge closure

EMP: Construction Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
	Electrical Systems	During construction the Contractor shall ensure that all power lines be kept operational, this may include the provision of temporary transmission lines while existing poles and lines are moved.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
Cultural, Historical Monuments and Archaeo-logical Sites	Impacts to Historical and archaeological areas	To avoid potential adverse impacts to cultural, historic and archaeological resources, the Contractor shall: • Instruct his personnel to work with care near cultural monuments • Adhere to accepted international practice and all applicable historic and cultural preservation requirements of the Government of Georgia, including all appropriate local government entities, and • In the event of unanticipated discoveries of cultural or historic artifacts (movable or immovable) in the course of the work, the Contractor shall take all necessary measures to protect the findings and shall notify the Engineer and the Concerned Agencies. If continuation of the work would endanger the finding, project work shall be suspended until a solution for preservation of the artifacts is agreed upon.	• Contractor to implement mitigation • Engineer to routinely monitor Contractors activities.
Impact to Households	Impairment of access Livelihood Impact Hampered Mobility	During construction, access should be maintained by providing temporary detour, by-pass or diversion paths for vehicles and people in the area. This should be with proper notification and consultation with the local population	• Contractor to implement mitigation measures; Engineer to check and ascertain appropriate results are attained
	Health and Nuisance	• Suppression of dust by regular spraying of soil at the site will be necessary. • Noise should be minimized by equipping equipment with mufflers and proper maintenance. • Usage of equipment should be scheduled in order to minimize noises.	
	Potential Employment difficulty	Contractor should be encouraged to hire local labour, including women in the villages/	

EMP Operational and Maintenance Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
Soils	Erosion	Contracts stipulated that the Contractor shall be liable for a one year defects liability period. During this year the Concerned Agencies should undertake regular observational monitoring of the Project Road to ensure that engineering works and vegetation growth have prevented erosion impacts. If the Concerned Agencies discover any potential issues they shall report their findings to the RD who shall then make the Contractor responsible for final improvements. Final payments cannot be made until outstanding issues are resolved	• Concerned Agencies to monitor vegetation growth and erosion impacts during defects liability period.
Hydrology	Impacts to hydrology and water quality as a result of construction activities	Contracts stipulated that the Contractor shall be liable for a one year defects liability period. During this year, the local Concerned Agencies should undertake regular water quality monitoring and routine observational monitoring of construction areas close to the rivers and its tributaries, to ensure that the road works are not having any continuous impacts upon the hydrological conditions of the region. If the Concerned Agencies discover any potential issues they shall report their findings to the RD who shall then make the Contractor responsible for remedial measures prior to final improvements. Final payments cannot be made until all outstanding issues are resolved.	• Concerned Agencies to monitor water quality during defects liability period against baseline data prior to construction.
Air Quality	Air quality impacts from Vehicle movements	Potential impacts due to the use of the new bridges and rehabilitated rural roads are the purview of RD.	• RD to monitor air emissions during the operational phase of the Project against baseline data prior to construction or air quality standards
Noise	Noise from Vehicles	When noise becomes excessive, signs can be used to notify drivers to maintain vehicles. However, when it becomes intolerable, noise barrier wall can be constructed	• RD to monitor noise during the operational phase of the Project against baseline data prior to construction or noise standards
Geo-hazards	Continuous presence of Geo-hazards	For general safety, geo-hazards should be continuously monitored and measures should be performed to prevent any untoward incident.	• RD to monitor geo-hazard during the operational phase and provide measures to avoid occurrences of fatal incident

EMP Operational and Maintenance Phase Mitigation			
Subject	**Potential Impact / Issue**	**Mitigation Measure**	**Responsibilities**
Biological	Impacts to fauna	Motorist should be notified by road signs of their possible presence and prohibit harming them	• RD to install signs where wildlife may be expected and prohibit harming them
	Protecting BKNP	Motorist should be notified by road signs of their proximity to BKNP	• RD to install signs to notify motorist of their proximity to the BKNP
	Traffic Safety	Traffic regulations should be enforced at all times Traffic safety measures should be performed Regular maintenance should be done	• Police should enforce traffic regulations • RD to install road safety signs and maintain the road

8. Anexses

8.1. Annex –Georgian Red List species (2006) wich may exist along project area

#	ლათინურიდასახელება / Latin name	ინგლისურიდასახელება/ English name	ქართულიდასახელება Georgian name	ეროვნულისტატუსი / National status	Zestafoni section	Samtredia section	Type of occurrence
		Mammals	**ძუძუმწოვრები**				
1	*Rhinolophus euryale*	Mediterranean Horseshoe Bat	სამხრეთულიცხვირნალა	VU	?		H
2	*Rhinolophus mehelyi*	Mehely's Horseshoe Bat	მეჰელისცხვირნალა	VU	?		H
3	*Barbastella barbastellus*	Western Barbastelle	ევროპულუიმაჩქათელა	VU	?	?	H
4	*Sciurus anomalus*	Persian Squirrel	კავკასიურიციყვი	VU	Y	?	H
5	*Lynx lynx*	Lynx	ფოცხვერი	CR	Y		V
6	*Lutra lutra*	Otter	წავი	VU		Y	H
7	*Ursus arctos*	Brown Bear	მურიდათთვი	EN	Y		V
		Birds	**ფრინველები**				
9	*Anser erythropus*	Lesser White-fronted Goose	პატარაღერღეტი	EN		?	RV
10	*Tadorna ferruginea*	Rudy Duck	წითელიიხვი	VU		Y	V
11	*Aquila clanga*	Greater Spotted Eagle	მყივანიარწივი	VU	Y	Y	M
14	*Tyto alba*	Barn Owl	ბუხრიწა	EN	?	?	H
		Reptiles	**ქვეწარმავლები**				
16	*Testudo graeca ssp. nikolskii*	Common tortoise	ხმელთაშუაზღვისკუ	VU	?	?	H
		Fish	**თევზები**				
17	*Huso huso*	Beluga/ Giant Sturgeon	სვია	EN		Y	M
18	*Acipenser sturio*	Atlantic Sturgeon	ატლანტიურიზუთხი	CR		Y	RV
19	*Acipenser nudiventris*	Fringebarbel sturgeon	ჯარღალა/ფორეჯი	EN		Y	RV
20	*Acipenser stellatus*	Starred Sturgeon	ტარაღანა	EN		Y	M
21	*Acipenser gueldenstaedti*	Colchic Sturgeon	რუსულიზუთხი	EN		Y	M
22	*Acipenser persicus*	Persian Sturgeon	სპარსულიზუთხი	EN		Y	M
23	*Salmo fario*	Brook Trout	მდინარისკალმახი	VU	Y		H
24	*Capoeta (Varicorhinus) sieboldii*	Colchic Khramulya	კოლხურიხრამული	VU	Y	Y	H
		Invertebrates	**უხერხემლოები**				
		Insects	**მწერები**				
26	*Eudia pavonia*	Small Night Peacock Butterfly	ღამისმცირეფარშევანგთვალა	VU	?		H
27	*Manduca atropos*	Death's Head Sphinx	სფინქსიმკვდართავა	EN		?	H
29	*Callimorpha dominula*	Tiger Moth	დათუნელაჰერა	VU	Y	Y	H

#	ლათინურიდასახელება / Latin name	ინგლისურიდასახელება/ English name	ქართულიდასახელება Georgian name	ეროვნულისტატუსი / National status	Zestafoni section	Samtredia section	Type of occurrence
30	*Parnassius apollo*	Apollo	აპოლონი	VU		?	H
31	*Polyommatus daphnis*	Meleager's Blue	ცისფერამელიაგრი	VU	?		H
32	*Xylocopa violacea*	Violet Carpenter bee	იისფერიქსილოკოპა	VU	Y	Y	H
34	*Calopteryx mingrelica*	Banded Agrion	სამეგრელოსტურფა	VU	?	Y	H

8.2. Annex - The bats within the study area (according to A. Bukhnikashvili, 2004)

№	სახეობალათინურად	სახეობაინგლისურად	სახეობაქართულად	ზესტაფონი	ქუთაისი	სამტრედია	მთელიდერეფანი	ბუნებისდაცვისმსოფლიოკავშირი
1.	*Rhinolophus ferrumequinum*	Greater Horseshoe Bat	დიდიცხვირნალა	+	+		+	LC
2.	*Rhinolophus hipposideros*	Lesser Horseshoe Bat	მცირეცხვირნალა	+	+		+	LC
3.	*Rhinolophus euryale*	Mediterranean Horseshoe Bat	სამხრეთულიცხვირნალა		+			**VU**
4.	*Rhinolophus mehelyi*	Mehely's Horseshoe Bat	მეჰელისცხვირნალა		+			**VU**
5.	*Myotis blythii*	Lesser Mouse-eared Bat	ყურწვეტამღამიობი		+		+	LC
6.	*Myotis nattereri*	Natterer's Bat	ნატერერისმღამიობი		+		+	LC
7.	*Myotis mystacinus*	Whiskered Bat	ულვაშამღამიობი	+	+		+	LC
8.	*Eptesicus serotinus*	Serotine Bat	მეგვიანეღამურა	+	+		+	LC
9.	*Nyctalus leisleri*	Lesser Noctule Bat	მცირემეღამურა		+		+	NT

10.	*Nyctalus noctula*	Common Noctule Bat	მეღამურა		+	?	+	LC
11.	*Pipistrellus kuhlii*	Kuhli's Pipistrelle	კულისღამორი	+		+	+	LC
12.	*Pipistrellus nathusii*	Nathusius's Pipistrelle	ტყისღამორი		+		+	LC
13.	*Pipistrellus pipistrellus*	Common Pipistrelle	ჯუჯაღამორი	+	+	?	+	LC
14.	*Barbastella barbastellus*	Western Barbastelle	ევროპულიმაჩქათელა	?	?		□	**VU**
15.	*Plecotus auritus*	Brown Big-eared Bat	რუხიყურა		+		+	LC
16.	*Vespertilio murinus*	Parti-coloured Bat.	ჩვეულიბრივიღამურა	+			+	LC

8.3. Annex - Mammals recorded within thestudy area

№	სამეცნიეროდასახელება	ინგლისურიდასახელება	ქართულიდასახელება	ეროვნულიწითელიწუსხა	საერთაშორისოწითელიწუსხა
1.	*Erinaceus concolor* *Martin.*	Southern Whitebreasted Hedgehog	ზღარბი		LC
2.	*Suncus etruscus* Savi.	Pygmy Whitetoothed Shrew	ფუღუ		LC
3.	*Rhinolophus hipposideros* Bechstein.	Lesser Horseshoe Bat	მცირეცხვირნალა		LC
4.	*Pipistrellus pipistrellus* Schreber.	Common Pipistrelle	ჯუჯაღამორი		LC

5.	*Eptesicus serotinus* Schreber.	Serotine	ჩვეულებრივიმეგვიანე		LC
6.	*Vespertilio murinus* Linnaeus.	Particoloured Bat	ჩვეულებრივიღამურა		LC
7.	*Dryomys nitedula* Pallas.	Forest Dormouse	ტყისძილგუდა		LC
8.	*Arvicola terrestris* Linnaeus.	Eurasian Water Vole	წყლისმემინდვრია		LC
9.	*Microtus arvalis* Pallas.	Common Vole	ჩვეულებრივიმემინდვრია		LC
10.	*Terricola nasarovi* Shidlovsky.	Nazarov's Bushos Vle	მცირეკავკასიურიმემინდვრია		LC
11.	*Sylvaemus uralensis* Pallas.	Little mouse	მცირეტყისთაგვი		NE
12.	*Mus musculus* Linnaeus.	House Mouse	სახლისთაგვი		LC
13.	*Lutra lutra* Linnaeus.	Eurasian Otter, Common Otter	წავი	VU	NT
14.	*Mustela nivalis* Linnaeus.	Least Weasel	დედოფალა		LC
15.	*Felis silvestris* Shreber.	Wild Cat	ტყისკატა		LC

16.	*Canis aureus* Linnaeus.	Golden Jackal	ტურა		LC
17.	*Vulpes vulpes* Linnaeus.	Red Fox	მელა		LC
18.	*Canis lupus*	Wolf	მგელი		LC
19.	*Sus scrofa* Linnaeus.	Eurasian Wild Boar	გარეულიღორი		LC
20.	*Martes martes*	European Pine	ტყისკვერნა		LC

8.4. Annex - birds within the study area

№	სამეცნიეროდასახელება	ინგლისურიდასახელება	ქართულიდასახელება	ეროვნულიწითელიწუსხა	სეზონი	IUCN
1.	*Motacilla alba*	White Wagtail	თეთრიბოლოქანქარა		YR-R, M	LC
2.	*Apus apus*	Common Swift	ნამგალა		BB, M	LC
3.	*Merops apiaster*	European Bee-eater	ოქროსფერიკვირიონი		BB, M	LC
4.	*Corvus cornix*	Hooded Crow	რუხიყვავი		YR-R	LC
5.	*Garrulus glandarius*	Eurasian Jay	ჩხიკვი		YR-R	LC
6.	*Turdus merula*	Eurasian Blackbird	შაშვი		YR-R	LC
7.	*Delichon urbicum*	Hause-Martin	ქალაქისმერცხალი		BB, M	LC
8.	*Sturnus vulgaris*	Common Starling	შოშია		YR-R, M	LC
10.	*Columba livia*	Rock Dove	გარეულიმტრედი		YR-R	LC

11.	*Columba oenas*	Stock Dove	გულიო (ანგვიძინი)		YR-R	LC
12.	*Columba palumbus*	Wood-Pigeon	ქედანი		YR-R	LC
13.	*Hirundo rustica*	Barn Swallow	სოფლისმერცხალი		BB, M	LC
15.	*Oriolus oriolus*	Golden Oriole	მოლაღური		BB, M	LC
16.	*Turdus viscivorus*	Mistle Thrush	ჩხართვი		YR-R, M	LC
17.	*Erithacus rubecula*	European Robin	გულწითელა		YR-R	LC
18.	*Fringilla coelebs*	Chaffinch	*სკვინჩა*		YR-R, M	LC
19.	*Cuculus canorus*	Common Cuckoo	გუგული		BB, M	LC
20.	*Phoenicurus phoenicurus*	Common Redstart	ჩვეულებრივიბოლოცეცხლა		BB, M	LC
21.	*Passer domesticus*	Hause Sparrow	სახლისბეღურა		YR-R	LC
22.	*Carduelis carduelis*	European Goldfinch	ჩიტბატონა		YR-R, M	LC
23.	*Carduelis chloris*	Greenfinch	მწვანულა		YR-R, M	LC
25.	*Parus major*	Great Tit	დიდიწივწივა (წიწკანა)		YR-R	LC
26.	*Lanius collurio*	Red-backed Shrike	ჩვეულებრივიღაჟო		BB, M	LC
38.	*Turdus philomelos*	Song Thrush	წრიპა		YR-R, M	LC
30.	*Aegithalos caudatus*	Long-tailed Tit	თოხიტარა		YR-R, M	LC
36.	*Falco tinnunculus*	Common Kestrel	ჩვეულებრივიკირკიტა		YR-R, M	LC
37.	*Buteo buteo*	Common Buzzard	ჩვეულებრივიკაკაჩა		YR-R, M	LC
38.	*Phalacrocorax carbo*	Great Cormorant	დიდიჩვამა		YR-R, M	LC
39.	*Ardea cinerea*	Grey Heron	რუხიყანჩა		YR-R	LC

41.	*Egretta garzetta*	Little Egret	მცირეთეთრიყანჩა		YR-R	LC
42.	*Nycticorax nycticorax*	Night-Heron	*ღამისყანჩა*		BB, M	LC
44.	*Tadorna ferruginea*	Ruddy Shelduck	*წითელიიხვი*		YR-R	LC
45.	*Anas platyrhynchos*	Mallard	გარეულიიხვი		YR-R, M	LC
46.	*Milvus migrans*	Black Kite	ძერა		YR-R, M	LC
47.	*Accipiter nisus*	Sparrowhawk	მიმინო		YR-R, M	LC
48.	*Accipiter gentilis*	Goshawk	ქორი		YR-R, M	LC
51.	*Charadrius dubius*	Little Ringed Plover	მცირეწინტალა		YR-R, M	LC
52.	*Larus ridibundus*	Black-headed Gull	ტბისთოლია		YR-R, M	LC
55.	*Upupa epops*	Common Hoopoe	ოფოფი		BB, M	LC
57.	*Corvus frugilegus*	Rook	ჭილყვავი		YR-R, M	LC
60.	*Luscinia megarhynchos*	Luscinia megarhynchos	ჩვეულებრივიბულბული		BB, M	LC

8.5. Annex - Reptiles within the study area

№	სამეცნიეროდასახელება	ინგლისურიდასახელება	ქართველიდასახლება	ეროვნულიწითელიწუსხა	საერთაშორისოწითელიწუსხა
1.	*Testudo graeca* Linnaeus	Mediterranean turtle	ხმელთაშუაზღვისკუ	VU	VU
2	*Emys orbicularis*	European Pond Turtle	ჭაობისკუ	LC	NT
3.	*Natrix natrix* Linnaeus.	Ring snake	ჩვეულებრივიანკარა	LC	LR/LC

4.	*Natrix tessellata* Laurenti.	Dice snake	წყლისანკარა	LC	LC
5.	*Coronella austriaca* Laurenti.	Smooth snake	სპილენძა	LC	LC
6.	*Xerotyphlops vermicularis*Strauch.	Blind Snakes	გველბრუცა	DD	LC
7.	*Darevskia derjugini*	Artwin Lizard	ართვინისხვლიკი	LC	LC
8.	*Anguis fragilis*	Caucasian Slow Worm	ბოხმეჭა	LC	LC

8.6. Annex - Amphibians withi the study area

№	Latin name	English name	Georgian name	GeorgianRed List	IUCN status
1.	*Hyla arborea*Linnaeus	European Tree Frog	ჩვეულებრივივასაკა	LC	LC
2.	*Pelophylax ridibundus* Pallas.	Lake frog	ტბორისბაყაყი	LC	LC
3.	*Rana macrocnemis camerani*Boulenger.	Near Eastern brone frog	მცირეაზიულიბაყაყი	LC	LC

8.7. Annex- Insects within the study area

№	Lathin name	Georgian Name	IUCN Red list	National red list
1.	*Libellula depressa*	ნემსიყლაპია	NE	NE
2.	*Pieris napi*	თალგამურასთეთრულა	NE	NE
3.	*Pieris rapae*	თეთრულა	NE	NE
4.	*Plebeius argus*	ცისფერაარგუსი	NE	NE

5.	*Nimphalis antiopa*	მეგლოვია	NE	NE
6.	*Lampyris noctiluca*	ჩვეულებრივიციცინათელა	NE	NE
7.	*Geotrupes spiniger*	ფუნაგორია	NE	NE
8.	*Purpuricenus budensis*	ხარაბუზა	NE	NE
9.	*Polyommatus amandus*	ცისფრულა	NE	NE
10.	*Polyommatus corydonius*	ცისფრულა	NE	NE
11.	*Polyommatus thersites*	ცისფრულა	NE	NE
12.	*Cercopis intermedia*	დუჟიანისებრნი	NE	NE
13.	*Vanessa atalanta*	ადმირალი	NE	NE
14.	*Vanessa cardui*	ნარშავისფრთაკუთხა	NE	NE
15.	*Ischnura elegans*	ნემსიყლაპია	NE	NE
16.	*Panorpa connexa*	ბუზმორიელი	NE	NE
17.	*Apis melifera*	ფუტკარი	NE	NE
18.	*Bombus lapidarius*	ბაზი	NE	NE
19.	*Aphis urticata*	ჭინჭრისბუგრი	NE	NE
20.	*Pieris brassicae*	კომბოსტოსთეთრულა	NE	NE
21.	*Pyrrhocoris apterus*	ჯარისკაცაბაღლინჯო	NE	NE
22.	*Lymantria dispar*	არაფარდიპარკხვევია	NE	NE
23.	*Gryllus campestris*	ჭრიჭინა	NE	NE
24.	*Decticus verrucivorus*	რუხიკუტკალია	NE	NE
25.	*Tettigonia viridissima*	მწვანეკუტკალია	NE	NE

8.8. Annex - Spiders within the study area

№	სამეცნიეროდასახელება	ინგლისურიდასახელება	ქართულიდასახელება	ეროვნულიწითელიწუსხა	საერთაშორისოწითელიწუსხა
1.	*Misumena vatia*	goldenrod crab spider	ობობა	NE	NE
2.	*Pisaura mirabilis*	Nursery web spider	ობობა	NE	NE
3.	*Alopecosa schmidti*	Wolf spiders	ობობა	NE	NE
4.	*Micrommata virescens*	green huntsman spider	ობობა	NE	NE
5.	*Agelena labyrynthica*	Eurasian grass spiders	ობობა	NE	NE
6.	*Phialeus chrysops*	jumping spiders	ობობა	NE	NE
7.	*Argiope lobata*	silver-faced	ობობა	NE	NE
8.	*Menemerus semilimbatus*	jumping spiders	ობობა	NE	NE
9.	*Pardosa hortensis*	Wolf spiders	ობობა	NE	NE
10.	*Larinioides cornutus*	furrow orb spider	ობობა	NE	NE

8.9. Annex–Nematodes within the study area

№	სამეცნიეროდასახელება	ინგლისურიდასახელება	ქართულიდასახელება	ეროვნულიწითელიწუსხა	საერთაშორისოწითელიწუსხა
1.	*Aporcelaimellus amylovorus*	-	-	NE	NE
2.	*Pungentus silvestris*	-	-	NE	NE
3.	*Enchodelus microdorus*	-	-	NE	NE
4.	*Bursilla monhystera*	-	-	NE	NE
5.	*Xiphinema brevicolle*	-	-	NE	NE

7.	*Tylencholaimus stecki*	-	-	NE	NE
8.	*Tylencholaimellus eskei*	-	-	NE	NE
9.	*Dorylaimellus hopedorus*	-	-	NE	NE

8.10. Annex - Worms within the study Area

№	სამეცნიეროდასახელება	ინგლისურიდასახელება	ქართულიდასახელება	ეროვნულიწითელიწუსხა	საერთაშორისოწითელიწუსხა
1.	*Pristina aequiseta*	-	-	NE	NE
2.	*Spirosperma ferox*	-	-	NE	NE
3.	*Limnodrilus claparedeanus*	-	-	NE	NE
4.	*Potamotrix bedoti*	-	-	NE	NE
5.	*Enchitraeus albidus*	-	-	NE	NE
6.	*Lumbriculus variegates*	-	-	NE	NE
7.	*Lumbricus terrestris*	-	-	NE	NE
8.	*Dendrobaena* hortensis	-	-	NE	NE
9.	*Dendrodriloides grandis*	-	-	NE	NE
10.	*Eiseniella tetraedra*	-	-	NE	NE

8.11. Annex - Armored ticks within study area

№	Scientific name	Enl=glish name	Gergian Name	National red list	International Red list
1.	*Sphaerozetes piriformis*	-	-	NE	NE
2.	*Latilamellobates naltschiki*	-	-	NE	NE

3.	*Chamobates cuspidatus*	-	-	NE	NE
4.	*Minunthozetes semirufus*	-	-	NE	NE
5.	*Liebstadia similis*	-	-	NE	NE
6.	*Scheloribates laevigatus*	-	-	NE	NE
7.	*Oribatula tibialis*	-	-	NE	NE
8.	*Simkinia tianschanica*	-	-	NE	NE
9.	*Zygoribatula exilis.*	-	-	NE	NE

8.12. Annex–Protected species according Bon convention

№	Lathin name	Georgian name	English name
1.	*Anas platyrhynchos*	გარეულიიხვი	Mallard
5.	*Nycticorax nycticorax*	ღამისყანჩა	Nigth Heron
8.	*Ardea cinerea*	რუხიყანჩა	Grey Heron
15.	*Milvus migrans*	ძერა	Black Kite
16.	*Buteo buteo*	ჩვ.კაკაჩა	Common Buzzard
19.	Accipiter *nisus*	მიმინო	Sparrowhaw
20.	*Accipiter gemtilis*	ქორი	Goshawk
22.	*Falco tinnunculus*	ჩვ.კირკიტა	Common Kestrel
24.	*Charadrius dubius*	პატარაწინტალა	Little Ringed Plover

8.13. Annex - Protected species according Bern convention Mamals

№	Lathin name	Georgian name	English name
1.	*Pipistrellus pipistrelus*	ჯუჯაღამორი	Common Pipistrelle
2.	*Sciurus anomalus*	კავკასიურიციყვი	Caucasian Squirrel
3.	*Dryomys nitedula*	ტყისძილგუდა	Forest Dormouse
4.	*Martes martes*	ტყისკვერნა	Common Marten
5.	*Mustela nivalis*	დედოფალა	Weasel
6.	*Lutra lutra*	წავი	Common Otter
7.	*Canis lupus*	მგელი	Wolf
8.	*Felis sylvestris*	ტყისკატა	Wild Cat

Birds

№	Lathin name	Georgian name	English name
1.	*Anas platyrhynchos*	გარეულიიხვი	Mallard
3.	*Nycticorax nycticorax*	ღამისყანჩა	Black-crownedNight Heron
4.	*Ardea cinerea*	რუხიყანჩა	Grey Heron
11.	*Milvus migrans*	ძერა	Black Kite
13.	*Buteo buteo*	ჩვ. კაკაჩა	Common Buzzard
14.	*Accipiter nisus*	მიმინო	EurasianSparrowhawk
15.	*Accipiter gentilis*	ქორი	Goshawk

18.	*Falco tinnunculus*	ჩვ. კირკიტა	Common Kestrel
20.	*Charadrius dubius*	მცირეწინტალა	Little Ringed Plover
26.	*Cuculus canorus*	გუგული	Cuckoo
30.	*Apus apus*	ნამგალა	Common Swift
33.	*Upupa epops*	ოფოფი	Eurasian Hoopoe
41.	*Hirundo rustica*	სოფლისმერცხალი	Swallow
42.	*Delichon urbica*	ქალაქისმერცხალი	House Martin
44.	*Motacilla alba*	თეთრიბოლოქანქალა	Pied Wagtail
48.	*Erithacus rubecula*	გულწითელა	European Robin
50.	*Phoenicurus phoenicurus*	ჩვ. ბოლოცეცხლა	Common Redstart
53.	*Turdus merula*	შავიშაშვი	Common Blackbird
54.	*Turdus philomelos*	წრიპა	Song Thrush
55.	*Turdus viscivorus*	ჩხართვი	Mistle Thrush
63.	*Aegithalos caudatus*	თოხიტარა	Long-tailed Tit
65.	*Parus major*	დიდიწივწივა	Great Tit
67.	*Lanius collurio*	ღაჟო	Red-backed Shrike
69.	*Oriolus oriolus*	მოლაღური	Eurasian Golden Oriole
70.	*Fringilla coelebs*	სკვინჩა	Common Chaffinch
71.	*Carduelis carduelis*	ჩიტბატონა (ნარჩიტა)	European Goldfinch
72.	*Carduelis chloris*	მწვანულა	European Greenfinch

Reptilies

№	Lathin name	Georgian name	English name
1.	*Anguis fragilis*	ბოხმეჭა	Slow Worm
2.	*Darevskia derjugini*	ართვინულიხვლიკი	Derjugin's Lizard
3.	*Natrix natrix*	ჩვ. ანკარა	Ring Snake
4.	*Natrix tesselata*	წყლისანკარა	Dice Snake
5.	*Coronela austriaca*	სპილენძა	Smooth Snake

Amphibias

№	Lathin name	Georgian name	English name
1.	*Hyla arborea*	ჩვ. ვასაკა	Common Tree Frog
2.	*Pelophylax ridibundus*	ტბორისბაყაყი	Lake Frog
3.	*Rana macrocnemis*	მცირეაზიურიბაყაყი	Longlegged Wood Frog